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UNITED STATES AIR FORCE

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Wright-Patterson Air Force Base, Ohio

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IDENTIFICATION OF AN ADAPTABLE COMPUTER
PROGRAM DESIGN FOR ANALYZING A
MODULAR ORGANIZATIONAL
ASSESSMENT INSTRUMENT

James B. Bushman, Captain, USAF

LSSR 50-81

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The purpose of this study was to identify an adaptable computer program design for analyzing the data collected by the Organizational Assessment Package (OAP) which would be responsive to the needs of management consultants within the Air Force. The system described provides consultants with a means by which potential problem areas within Air Force organizations can be identified, thus increasing the consultant's efficiency during the diagnostic phase. The system is flexible in that it will accept survey data from a wide range of survey structures. This feature provides consultants with a means by which the analysis of an organization can be tailored to the specific needs and problems of the organization. The development and implementation of this system will provide a means for the management consultants to better serve commanders throughout the Air Force and improve the overall effectiveness of the Air Force.

IDENTIFICATION OF AN ADAPTABLE COMPUTER

PROGRAM DESIGN FOR ANALYZING A

MODULAR ORGANIZATIONAL

ASSESSMENT INSTRUMENT

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirement for the

Degree of Master of Science in Systems Management

By

James B. Bushman, BS
Captain, USAF

September 1981

This thesis, written by

        Captain James B. Bushman

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      MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

DATE: 30 September 1981

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           COMMITTEE CHAIRMAN

_____
             READER

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ACKNOWLEDGEMENTS

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Chapter 1

INTRODUCTION

OVERVIEW

Background

The Organizational Assessment Package (OAP) is a
survey instrument package that was designed to support the
mission objectives of the Air Force Leadership and Manage-
ment Development Center (LMDC), Maxwell AFB, Alabama
(Hendrix & Halverson, 1979; p. 5). One of the primary mis-
sion objectives of LMDC is to provide consultative services
to Air Force commanders. This consultative role involves
identification of organizational problems and recommendations
for resolving the problems identified.

The OAP was "designed to measure the basic compo-
nents of the Three Component Organizational Effectiveness
Model" (Hendrix & Halverson, 1979; p. 6). The model (see
Figure 1) describes the effectiveness of an organization as
a function of managerial style, the situational environment,
and the selected criteria.

The OAP is a modular survey instrument. The three
components of the organizational effectiveness model are
measured by different modules (or inventories) within the
OAP (Hendrix, 1979; p. 6). The managerial style component

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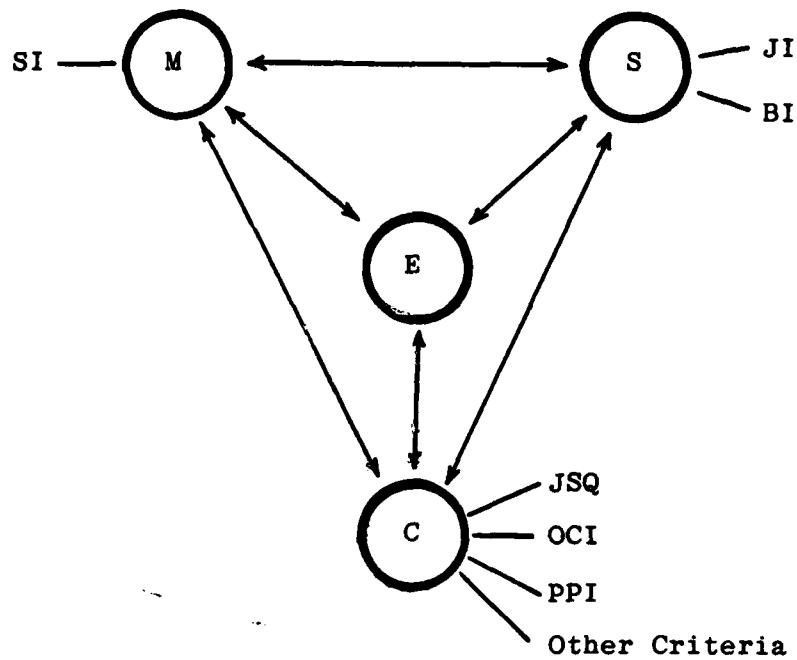
Legend:

    M -- Managerial Style

        SI -- Supervisory Inventory

    S -- Situational Environment

        JI -- Job Inventory

        BI -- Background Inventory

    E -- Effectiveness

    C -- Criterion

        JSQ -- Job Satisfaction Questionnaire

        OCI -- Organizational Climate Inventory

        PPI -- Perceived Productivity Inventory

Figure 1

Three Component Organizational Effectiveness Model

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of the model is measured by the Supervisory Inventory (SI). The situational environment component of the model is measured by two modules--the Job Inventory (JI) and the Background Inventory (BI). Finally, the criteria selected for measuring organizational effectiveness included satisfaction with job, organizational climate, and perceived productivity. These criteria are measured by three separate modules--the Job Satisfaction Questionnaire (JSQ), the Organizational Climate Inventory (OCI), and the Perceived Productivity Inventory (PPI). Each module within the OAP was designed to be used independently, or as a part of the total package (Hendrix, 1979; p. 16). This modular concept provides a flexible instrument package which can be used in total or in part.

Statement of the Problem

The OAP is the basic tool used by LMDC consultant teams in identifying the strengths and weaknesses within organizational work groups. Currently, the identification of the strengths and weaknesses is performed by manually analyzing basic statistical data (means, standard deviations, and frequency distributions) provided by computer for each item and factor measured by the OAP. The consultant teams are then required to review all of the data to determine the strengths and weaknesses of the organization being evaluated. A need exists for the development of an automated OAP

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analysis system which will identify the strengths and weaknesses of the organizational work groups. In addition, the system must be able to accommodate modifications to the OAP without destroying the overall output framework of the system.

Objectives of the Research

The overall objective of the research was to identify an adaptable computer program design for analyzing the data collected by the OAP which would be responsive to the needs of the LMDC consultants in evaluating the effectiveness of an organization. In addition, the computer program must be adaptable in that it will retain the flexibility and modularity concepts designed into the OAP. This objective was accomplished by the following set of subobjectives:

1. Review of previous computer-based survey guided development efforts.

2. Understand the current system for analyzing the data collected by the OAP.

3. Identify the requirements for the proposed OAP analysis system.

4. Define the program development specifications for the proposed system.

5. Define the system design specifications for the proposed system.

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Due to the time constraints involved, no attempt was made to actually code and implement the proposed OAP analysis system. Recommendations pertaining to the coding and implementation of the system, however, are given in Chapter 5.

METHODOLOGY

The body of the system development effort was divided into the following five phases:

1. Literature search

2. Review of current analysis system

3. Requirements analysis

4. Development specification

5. System design specification

Literature Search

A literature search was conducted at the outset of the development of the proposed OAP analysis system. The objective of the search was to identify previous computer-based survey guided development efforts which might have some application to the proposed system. The results of the search are presented in Chapter 2. The search concentrated on military and military-related efforts; in particular, the U.S. Navy Human Resource Management Program and the U.S. Army Organization Effectiveness Program were studied.

Review of Current Analysis
System

An extensive review of the current system for
analyzing the OAP was also conducted and the results are
included in Chapter 2. This review provided a bench mark
or reference point from which the proposed system was
designed. The review was conducted by interviewing the
various personnel involved with the current system. In
addition to providing an understanding of how the current
system operated, the review provided insight into the
strengths and weaknesses of the current system.

Requirements Analysis

During the requirements analysis phase, the require-
ments for the proposed OAP analysis system were identified.
These requirements are found in Chapter 3. The requirements
were obtained from discussions with LMDC. In addition,
Lt Colonel William H. Hendrix of the Department of Organiza-
tion Sciences, AFIT, was also interviewed for suggested
requirements. Lt Colonel Hendrix assisted in the develop-
ment of the OAP (Hendrix & Halverson, 1979).

Development Specification

Once the requirements for the proposed system were
defined, the development specification phase of the develop-
ment refined the requirements and described them in terms
of the inputs, processes, and outputs required by the system.

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The major processes were described in terms of Data Flow
Diagrams (DFDs). A DFD is a "network representing the sys-
tem in terms of its component processes, and declares all
the interfaces among the components" (DeMarco, 1979; p. 417).

System Design Specification

The final phase of the development effort was the
system design specification. During this phase, the inputs,
processes, and outputs defined in the previous phase were
refined. The inputs and outputs were defined in terms of
physical file structures, card layouts, and printer layouts.

Chapter 2

LITERATURE REVIEW

The literature review which follows contains six
sections. The first section presents a definition of
survey-guided development. The second section will describe
the U.S. Army's approach to survey-guided development--the
Army Organization Effectiveness Program. The third section
will describe a system which is currently being developed
for the Army--the Organizational Effectiveness Management
Information System. The fourth section will describe the
U.S. Navy's approach to survey-guided development--the Navy
Human Resource Management Program. The fifth section will
describe a system developed by the Institute for Social
Research (ISR) at the University of Michigan to assist con-
sultants during the diagnosis phase of a survey-guided
development effort--CANOPUS (Computerized Analysis of
Organizational Problems in User Systems). The final section
will describe the U.S. Air Force's approach to survey-guided
development.

SURVEY GUIDED DEVELOPMENT

Survey Guided Development (SGD) is an organization
development process in which organization members
themselves diagnose their own organization, plan

actions, implement changes and evaluate results
[Mietus & Lucken-Newton, Note 1; p. 1].

"The ultimate goal of SGD is to facilitate inter-
ventions or changes in organizational functioning which will
lead to increased organizational effectiveness" (Pecorella
et al., Note 2; p. 1-5). The major steps of a SGD effort
are (Pecorella, Note 2):

1. Identification of a valid model of organiza-
tional functioning.

2. Identification of an ideal state of organiza-
tional functioning.

3. Collection of information indicating the actual
state of the organizational functioning using a standardized
survey.

4. Identification of discrepancies between the
ideal state of the organization and the actual state.

5. Initiation of action steps to reduce the dis-
crepancies by the individuals of the organization.

6. Reevaluation of the organizational functioning
using the standardized survey.

As seen above, SGD relies on a standardized survey to
evaluate the performance of the organization. A standard-
ized survey consists of three basic characteristics
(Pecorella et al., Note 2):

1. The survey consists of predetermined questions
and is identical for all respondents.

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2. The survey is relevant to a large population.
This characteristic allows the survey to be used to estab-
lish norms for the various survey items.

3. The survey must have as its theoretical basis
a valid model of organizational functioning.

The role of the consultant in the SGD process is to
act as a "transducer . . . that is, as a link between a
body of knowledge and a client system in potential need of
its selective application" (Bowers & Franklin, 1975; p. 113).
The body of knowledge which the consultant brings to the
SGD process is "scientific information regarding organiza-
tional functioning and change process" (Pecorella et al.,
Note 2; p. 1-8). This body of knowledge is then used by the
organizational members to diagnose the problems of the
organization and plan action steps to resolve the problems.

Dengler (1980) describes the SGD process as follows:

> In this technique [SGD], the membership of the par-
> ticipating organization is surveyed to determine its
> attitudes on institutional policies and procedures. The
> survey data are then collated to highlight significant
> trends or sub-group deviations from normative response
> values and presented to the organization's membership
> in a process known as "feedback". This initiates a
> dialogue during which the rank and file attempt to
> interpret questionnaire responses and diagnose potential
> cause and effect relationships which may have influenced
> the results [Dengler, 1980; pp. 15-16].

U.S. ARMY ORGANIZATION EFFECTIVENESS PROGRAM

The U.S. Army has conducted organization effective-
ness (organization development) activities since September

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1975 (Adams, 1977; p. 2). The Army defines the Organization Effectiveness (OE) program as follows:

> [OE is] a process designed to strengthen the chain of command, increase individual and unit effectiveness, create an organizational commitment to which personnel are actively involved in planned actions to improve the unit's performance in meeting its mission of being combat ready and effective at all times [Adams, 1977; p. 1].

The ultimate goal of the Army OE program is to:

> . . . design and implement techniques which will enhance the Army's effectiveness. A primary objective is to identify and optimize those organizational factors in the Army work environment which are related to soldier job satisfaction, motivation, and performance [Cohen & Turney, 1976; p. 1].

The Army OE program provides for the assignment of two military career officers as Organization Effectiveness Staff Officers (OESOs) within each of the Army's division-sized units (Adams, 1977; p. 3). The OESOs act as internal consultants and work with the various "commanders to implement organization effectiveness interventions which are designed to seek solutions to the particular problems of the unit involved" (Adams, 1977; p. 3). The OESO provides the work group members with a structure within which they can identify and solve their problems.

OE Process

Figure 2 describes the general model of the OE process. The model consists of eight major phases: scouting, entry, data collection, data feedback, diagnosis, action
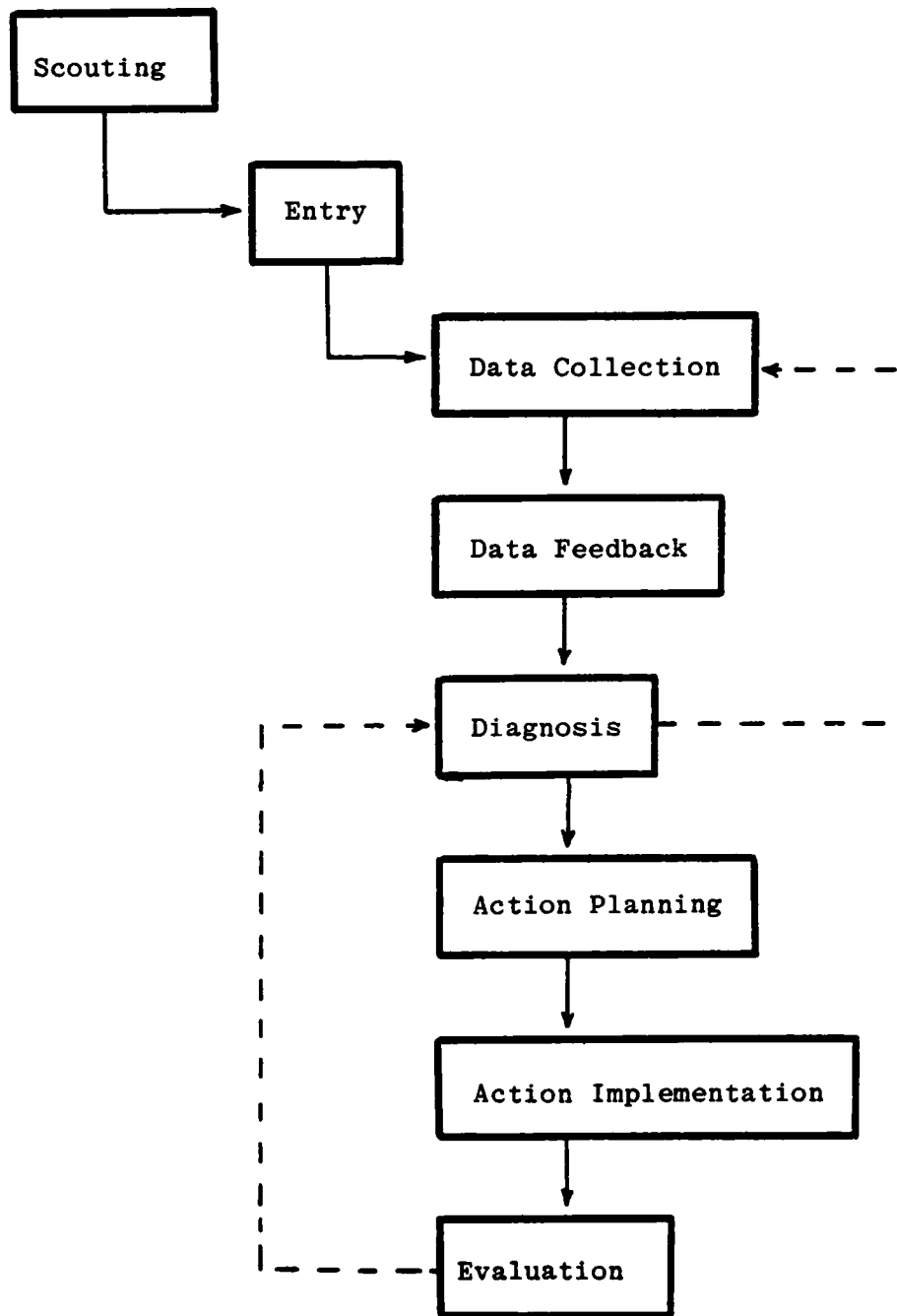
Figure 2

General Model of OE Process

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planning, action implementation and evaluation (Adams, 1977; p. 3).

Scouting. The initial phase of the OE process is prediagnostic scouting. During the scouting phase, the OESO develops an "initial fix on the perceived significant characteristics and problems of the prospective client system" (Adams, 1977; p. 14). During this phase, the OESO "exposes his assumptions, biases, and values to the potential client" who provides the OESO with feedback as to how the biases and values fit into the client's system (Adams, 1977; p. 14). This process helps to build a "collaborative interventionist-client relationship" from the start (Adams, 1977; p. 14).

Entry. The entry phase consists of three process activities. The first activity is "to build a collaborative and open interventionist-client relationship" (Adams, 1977; p. 15). The second activity is to establish a "clear understanding of the expectations of both parties" (Adams, 1977; p. 15). Thirdly, the OESO must demonstrate a behavior which will help establish his credibility as a consultant to the client (Adams, 1977; p. 15).

Data collection. The data collection phase, unlike the scouting performed by the OESO, involves the client to a great extent (Adams, 1977; p. 16). The client participates in the selection of the data collection method and in the

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actual collection of the data. The OESO has several surveys
available from which the client may select. Three of the
most common surveys used are the Work Environment Question-
naire (WEQ), the General Organization Questionnaire (GOQ),
and the Organization Survey II (OSII).

The WEQ measures the attitudes and perceptions of
supervisors and subordinates concerning "their job duties,
training, performance standards and consequences, and . . .
their organizational supervision, work group, job importance,
and feedback" (Cohen & Turney, 1976; p. vi).

The GOQ is "a standardized machine scored question-
naire" modeled after the Survey of Organizations developed
by the Institute of Social Research at the University of
Michigan (Mietus & Lucken-Newton, Note 1; p. 20). The GOQ
measures 21 indices of organizational behavior. Five major
dimensions of organizational behavior are measured: unit
climate, supervisory leadership, co-worker interaction, work
group processes, and effects on personnel.

The OSII is a "modification of the GOQ for use in
organizations having large numbers of civilians" (Mietus &
Lucken-Newton, Note 1; p. 20).

Data feedback. Once the survey data has been collected,
the survey results are compiled via data processing to be
used in the next phase of the OE process--data feedback.
The data feedback phase "provides the client with data about
the client system which is useful in determining the

relative strengths of the system and areas where improvement
is most needed" (Adams, 1977; p. 18). The survey results
are placed on feedback profile forms by the OESO (Mietus &
Lucken-Newton, Note 1; p. 24).

The feedback profile forms (see Figure 3) list the
survey questions in logical groupings. For each question,
the average response is given in graphical form and the fre-
quencies of response are given in numerical form. The forms
can also indicate the relationship of the work group's
average responses to a standard of comparison (Mietus &
Lucken-Newton, Note 1; p. 24). The standards of comparison
may be one of two types:

1. Comparison of the average responses of the unit
with the average responses of the overall organization.

2. Comparison of the average responses of the unit
with the average responses of many similar organizations
(Mietus & Lucken-Newton, Note 1; p. 25).
The feedback profile forms:

> . . . help group members understand where their work
> group lies in relation to some standard of comparison
> and to understand which areas their group's functioning
> are strongest and weakest. The frequency of response
> data show the extent to which the group is in agreement
> about an area of functioning [Mietus & Lucken-Newton,
> Note 1; p. 25].

Diagnosis. During the diagnosis phase, the OESO and client
system members jointly evaluate the feedback data to "explore
organizational problems and strengths" (Adams, 1977; p. 19).

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II. SUPERVISORY LEADERSHIP

1. SUPPORT

	Strongly disagree	Somewhat disagree	Undecided	Somewhat agree	Strongly agree
		FREQUENCIES			
28. My supervisor lets me know when I have done my job well.	0	2	1	0	2
29. When appropriate, my supervisor supports my decisions.	2	0	1	0	2
30. It is easy for me to get in to see my supervisor.	1	0	0	2	2

2. GOAL EMPHASIS

	Strongly disagree	Somewhat disagree	Undecided	Somewhat agree	Strongly agree
31. I know what my work group is trying to accomplish.	1	0	0	2	2
32. My supervisor emphasizes mission accomplishment.	1	1	1	0	2

Note: Solid line = data from work group; broken line = standard of comparison.

Figure 3

Example of a Feedback Profile

The OESO does not give the work group leader a detailed technical analysis of the work group's survey results; instead, the leader, the immediate subordinates, and the OESO analyze the data together to decide what it means (Mietus & Lucken-Newton, Note 1; p. 1). "Ownership and commitment on the part of the client members are enhanced by their specific contribution to problem diagnosis" (Adams, 1977; p. 19). If additional information is required to complete an accurate diagnosis, the data collection phase may be returned to at the end of this phase.

Action planning. During the action planning phase, the OESO functions only as a process helper and instructor (Adams, 1977; p. 20). The objective of the OE program is to develop problem solving skills within the client system. The OESO acts as a "catalyst to insure that the process interaction analysis takes place" (Adams, 1977; p. 20).

Action implementation. The action implementation phase consists of the implementation of the specific action plans developed in the previous phase.

Evaluation. The last phase of the model is the evaluation phase. During this phase, the client evaluates the effectiveness of the plans to determine if the desired changes have occurred. "The results of the evaluation serve as a basis for further diagnosis and action planning" (Adams,

1977; p. 21). As the unit cycles through the model, the OESO's involvement becomes less and less as the unit develops their own internal problem solving skills.

ORGANIZATIONAL EFFECTIVENESS MANAGEMENT INFORMATION SYSTEM

The success of the Army's OE program is dependent upon the skills of the OESO in identifying problems within a unit and determining the appropriate intervention technique to be used. To assist the OESO in performing his/her duties as a consultant, the Army has recently awarded Arthur Young & Co. a contract to develop an Organizational Effectiveness Management Information System (OEMIS).

> The primary purpose of the OEMIS is to provide the OESO with relevant historical information about other OE operations to assist in the conduct of a current OE operation. That is, information about similar OE operations in sufficient detail to permit the OESO to employ previously successful implementations, or avoid those which were unsuccessful. In addition, the OEMIS is to provide survey processing service, network and resource information, and appropriate information to other constituencies including: OE Program Manager, MACOM OE Officers, OEC&S [Organizational Effectiveness Center and School], and researchers [Arthur Young & Co., Note 3; p. I-8].

The project (as of the date of this report) is currently in the requirements definition phase. The requirements for OEMIS as stipulated in the contract are as follows:

> 1. Procedures for accepting a broad array of organizational diagnostic data.
> 2. Data base construction to portray the situation, problem type, nature of intervention applied, and intervention outcome for a particular OE operation.

3. Procedures capable of accepting and analyzing data generated as a function of OE follow-up and evaluation activities.

4. Data management procedures capable of updating the data base(s).

5. An interactive system in which . . . the OESO would receive a straightforward analysis of the data he/she submitted, along with an indication of what interventions have been applied in previous similar situations with a similar assessment pattern and what outcome resulted.

6. Service for several other user types including managers, policy makers, and researchers who would use the aggregated data to the appropriate degree [Arthur Young & Co., Note 3; p. I-7].

The OEMIS would be used by the OESO during each phase of the OE process (Arthur Young & Co., Note 3). Figure 4 graphically describes how the OEMIS blends into the OE process. The OESO would generate queries into the OEMIS from the scouting phase through the follow-up phase. The queries would describe the characteristics of the particular OE operation in such a way that the OEMIS would provide the OESO with information relating to comparable cases. As the OESO proceeded from the scouting phase, the queries would "be refined to obtain increasingly relevant case information" (Arthur Young & Co., Note 3; p. I-15).

During the diagnosis and feedback phases, the survey results would be compared to similar OE cases in which similar survey results were obtained (Arthur Young & Co., Note 3; p. I-15). These case files would be provided to the OESO. In addition, the OEMIS would provide the OESO with a survey processing capability which would include diagnostics and

OEMIS

Data Base Management System

Data Reduction and Analysis

Report Writer

Historically Prescriptive Case Files

Bibliography

Network Information

Workshop/Seminar Descriptions

OE Operation

Scouting → Entry → Data Collection → Diagnosis/Feedback → Planning → Implementation → Follow-up → Evaluation → Termination

Initial Description

Most/Least Successful Comparable Cases

User Objectives, Problem Description

More Comparable Cases

Survey Data, Refined Information

Feedback Package

More Comparable Cases

Outcomes, Implementations Planned

More Comparable Cases

Refined/Outcomes/Implementations

More Comparable Cases

Refined/Outcomes/Implementations

More Comparable Cases

Printout of Case File

Figure 4

Use of OEMIS in the OE Process

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graphical outputs for use during the feedback process
(Arthur Young & Co., Note 3; p. I-16).

At any time during the OE process, the OESO could
also obtain a bibliography of the most recent journal arti-
cles, books, etc., relating to the particular OE operation
(Arthur Young & Co., Note 3; p. I-18).

At the end of the process, the OESO would assess the
effect of the operation on the particular problem and enter
this information into the OEMIS (Arthur Young & Co., Note 3;
p. I-15). Other OESOs could then retrieve this information
for their use in a similar OE operation.

U.S. NAVY HUMAN RESOURCE MANAGEMENT PROGRAM

In November of 1970, Admiral Elmo R. Zumwalt, then
Chief of Naval Operations, recognized the importance of the
human asset to the Navy and directed a pilot program be
established to adapt "some of the contributions of the
behavioral sciences to the effective management of these
vital assets" (Dengler, 1980; p. 6). The result of this
pilot project was the Navy's Human Resource Management (HRM)
Program.

Command Development

The objective of the HRM program was to develop a
systematic approach to improving the effectiveness of naval
organizations. This process is normally referred to as
"organizational development"; however, the Navy modified this

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term and referred to the process as "command development"
(Dengler, 1980; p. 6). The command development process is
basically a survey-guided development process. The command
development process consists of the following seven steps
(Dengler, 1980; p. 8):

1. Introductory seminar

2. Data collection phase using a standardized
survey

3. Data analysis phase using manual and automated
procedures

4. Data feedback phase

5. Data interpretation phase

6. Action planning period

7. Evaluation phase

Human Resource Management
Centers and Detachments

To coordinate and control the HRM program, four
Human Resource Management Centers (HRMCs) were established
(Dengler, 1980; p. 9). In addition, Human Resource Manage-
ment Detachments (HRMDs) were established in "virtually all
significant naval complexes and fleet operating bases"
(Dengler, 1980; p. 9).

The HRMCs and HRMDs are manned by officer and
enlisted Human Resource Management Specialists (HRMSs). The
HRMSs are trained in the basic social science theories and
techniques. They are organized into teams of six to ten and

their function is to introduce the HRM Program to client commands, administer surveys, conduct interviews, analyze survey data, present initial feedback data to unit commanders, and provide consultative support to baval organizations on a case by case basis.

Human Resource Management Cycle

In 1974, the command development process was refined into a regularly scheduled Human Resource Management Cycle (Dengler, 1980; p. 8). The HRM Cycle is approximately eighteen months in length and is mandatory for nearly all naval organizations. The actual structure of the HRM Cycle may vary from organization to organization; however, the following basic elements are included in each cycle (Pecorella et al., Note 2; p. 1-15):

1. An initial meeting between the consultants and the commander

2. Survey administration

3. A meeting between the consultants and the commander to feed back the results of the survey

4. Human Resource Management Availability (HRAV) week

5. Six-month follow-up visit

The first four elements are normally conducted within an eight week period. The bulk of the data feedback procedure, workshops, seminars, and action plan development occur during the HRAV week (Dengler, 1980; p. 8).

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The actual structure of the activities during the HRAV week will vary from installation to installation depending upon the time and resource constraints (Pecorella et al., Note 2; p. 1-15). The activities focus on the development at two levels: system level and work group level. To accomplish the work group level development, the HRMSs usually rely on the use of internal personnel. These personnel are trained by the HRMSs during the HRAV week and are then required to guide the work group level development during the six-month period following the HRAV week.

HRM Survey

The survey used by the HRM program during the data collection phase is the HRM Survey (Dengler, 1980; p. 10). The HRM Survey has its theoretical basis in the Survey of Organizations developed by the Institute for Social Research, University of Michigan. The HRM Survey measures four basic dimensions of organizational functioning: supervisory leadership, peer leadership, command climate, and work group processes. The survey contains approximately 100 standard attitudinal items and room for an additional forty supplemental questions. The responses to the HRM Survey are recorded on optical scan response sheets to alleviate the automated processing of the survey results. Two separate HRM Surveys exist--one for shore activities and one for seagoing units.

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HRM Survey Feedback Package

The feedback package developed by the Human Resource Management Support System presents an extensive picture of the status of the command at various levels (Gross, 1977). The feedback package contains the following information (NPRDC, Note 4):

1. Analysis Suggestions--describes various ways in which the feedback package may be analyzed by the using command.

2. Command Graph Summary--horizontal bar graph indicating the mean scores for each index measured by the HRM Survey.

3. Command Summary/Normative Graph--indicates the percentile scores using normative data for each index measured by the survey.

4. Most/Least Positive Questions--indicate potential strengths and weaknesses.

5. Overall Command Response Frequencies--response frequencies for all questions within the survey.

6. Demographic Summaries--graphically describes the mean scores for each index for a variety of demographic categories. The summaries also indicate the command mean for each index for comparison purposes.

COMPUTERIZED ANALYSIS OF ORGANIZATIONAL PROBLEMS
IN USER SYSTEMS (CANOPUS)

The diagnosis phase of survey-guided development is often presumed to be the most important and the most difficult part of the consultant's job (Bowers et al., 1977; p. 3). Bowers (1974) presents an excellent description of the problem:

> Diagnosis requires a comprehensive analysis of the current state of the system, an analysis which precedes, and in part determines, a treatment from a possible array of treatments. It must be differential, it must be oriented primarily toward the client system's well-being, and it ought not be a simple benchmark, a map of pitfalls for the change agent or consultant, nor a simple earmarking of the style differences among existing consultants . . . . The diagnostician and his consultant counterpart have the responsibility for bringing into the organization and its operating situation an adequately interpreted, reliable, valid, body of data which in relation to known principles of management differentially assess the current states of organizational functioning. It is this professional, differential, analytic procedure which constitutes a genuine diagnosis [Bowers, 1974; p. 31].

The type of diagnosis that Bowers discusses is seldom found. Reviews of literature and formal experience "suggest that the field is characterized by ad hoc problem solving and by efforts to simply justify whatever it is that the consultant knows how to do" (Davenport & Bowers, 1979; p. 130).

The Institute for Social Research at the University of Michigan recognized the problem associated with the diagnosis phase and developed CANOPUS (Computerized Analysis of Organizational Problems in User Systems) as an automated tool to be used by consultants during a survey-guided

development effort. The unique features of the system are outlined below (Bowers, 1974; p. 3):

1. It is almost entirely automated.

2. It prioritizes problems in terms of their relationship to performance criteria as well as in terms of the level of goodness or badness.

3. It assesses the causes of problems.

4. It recommends training or intervention techniques to resolve problems.

5. It presents a summary of the condition of the organization and treatment steps for managers and consultants using automated text-writing procedures.

The CANOPUS system may be used with the ISR's Survey of Organization or the HRM Survey or any other derivative survey instrument (Bowers, 1974; p. 33).

The functional components of the CANOPUS procedure are presented in Figure 5. The procedure consists of two major functions: descriptive function and analytic function. The descriptive function describes the current state of the organizational functioning. The analytic function determines the reasons for the current state of the organization and recommends action steps to improve the level of organizational functioning (Bowers, 1974; p. 36). The various components of the CANOPUS procedure are described briefly below.
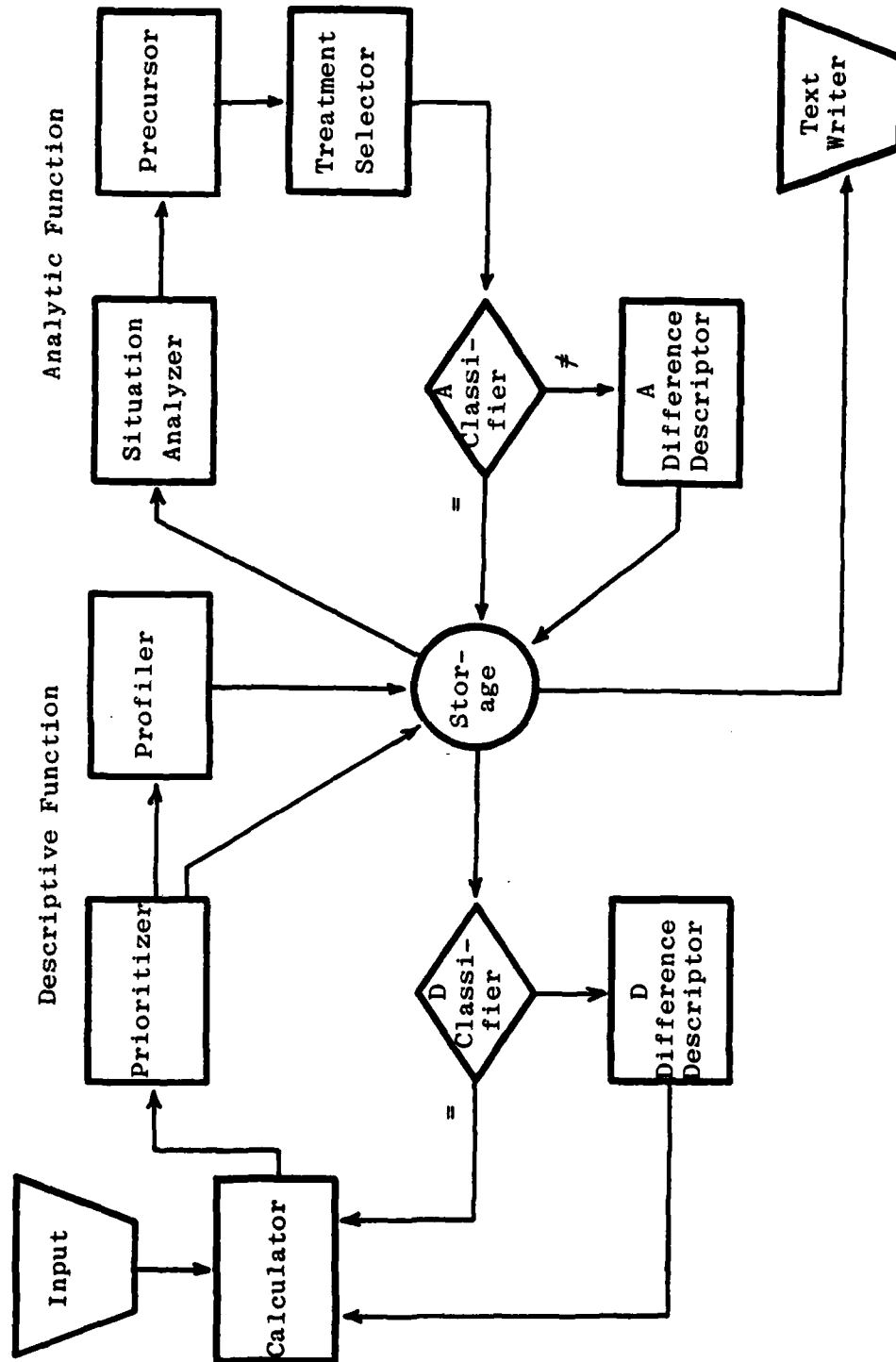
Figure 5

CANOPUS Functional Components

Input

The input into the CANOPUS system consists of records containing the mean item and index scores for a particular work group over all individuals within the work group.

Descriptive Function

The Calculator component converts the mean item and index scores for the work group to percentile scores using normative data as the standard of comparison. The Prioritizer component will then weight each of the measures according to their relationship to outcome variables and prioritize each percentile score.

The Profiler component determines the "type" of the work group in question. "A limited number of relatively 'pure' types of groups exist . . . and these types respond differentially to various action or development techniques" (Bowers, 1974; p. 38).

The D-Classifier component aggregates work groups by organizational level. If all of the work groups within a given level are of the same type, the work groups are aggregated by D-Classifier and processed by the Calculator and Prioritizer components. If the work groups are not of the same type, the D-Difference Descriptor component identifies those work groups within the level that are of the same type and aggregates them.

Analytic Function

CANOPUS identifies four possible causes of organizational problems: constraining situations, information deficiencies, skill deficiencies, and values conflicts (Bowers, 1974; p. 39). The Situation Analyzer component determines the extent to which constraining situations contribute to the problem. The Precursor component determines the extent to which information deficiencies, skill deficiencies, and values conflicts contribute to the problem.

Once the possible causes for the work group's problems have been identified, the Treatment Selector Component identifies possible intervention techniques which have the highest probability of success given the work group's status, type, and causal pattern.

In order to identify causal patterns and treatments across level of the organization, the A-Classifier and A-Difference Descriptor components identify those work groups which have similar causal patterns and treatments identified (similar to the D-Classifier and D-Difference Descriptor components).

Output

The Text Writer component writes a narrative statement about each work group and the system as a whole. The statement includes a descriptive statement concerning the status of the work group, as well as an analytic statement describing the causal patterns and recommended treatments.

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U.S. AIR FORCE ORGANIZATIONAL
EFFECTIVENESS PROGRAM

The Air Force Leadership and Management Development Center (LMDC) is tasked with the responsibility of conducting the survey-guided development efforts within Air Force organizations. The mission of LMDC includes:

> (a) providing consultative services to Air Force commanders, (b) providing leadership and management training to Air Force personnel in their work environment, and (c) performing research in support of (a) and (b) [Hendrix & Halverson, 1979; p. 5].

System Operation

The survey-guided development effort is initiated by the requesting organization (Wilkerson, Note 5). The commander of the organization, upon identification of a possible problem with the organizational functioning, requests LMDC's assistance in performing an evaluation of his/her organization. Upon receiving the invitation, LMDC management consultant teams are dispatched to the organization.

Once at the organization, the consultant teams begin the process of data collection. The data are collected by the use of the Organizational Assessment Package (OAP), a standardized survey instrument. The OAP is administered to a stratified random sample of the organization. The sample consists of from fifty to seventy percent of the organization's population. As described in the Background section

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of Chapter 1, the OAP was designed to evaluate the Three Component Organizational Effectiveness Model (see Figure 1, Chapter 1).

Once the data have been collected on the organization, the LMDC consultants return to LMDC and begin the data analysis phase. The data are arranged by work groups and analyses of each work group are prepared (Green, Note 6). In addition, analyses are prepared for aggregations of work groups up to, and including, the overall organization. This provides the consultants with information concerning the status of individual work groups, as well as the whole organization.

The analyses are formatted into a report entitled the OAP Analysis Worksheet (Austin, Note 7). The report describes the level of organization/work group functioning in terms of factors measured by the OAP and items within the OAP. The factor and item scores are also compared against two standards of comparison--the overall Air Force mean score and the similar work group mean score.

In addition to the OAP Analysis Worksheet, the consultants use SPSS (Statistical Package for the Social Sciences) to gain further insight into the organizational functioning (Austin, Note 7). These "special cuts" (as they are called) are used to evaluate aspects of the organizational functioning which are not indicated by the OAP Analysis Worksheet. Some of these aspects are:

1.   Evaluation of a particular factor or variable within a work group by a demographic variable (for example, male and female)

2.   Prioritized listing of work groups by any variable or factor

3.   Prioritized listing of the factors or variables for a given work group

Once the data have been analyzed, feedback packages are prepared for the organization and the LMDC consultants return to the organization for the "tailored visit" (Wilkerson, Note 5).   The tailored visit accomplishes the feedback process.   The process takes approximately two weeks. The data are fed back to the organization starting with the top level of the organization and work down.   The process is then repeated from the bottom up.

The feedback process is followed by an action planning phase where the organization members prepare management action plans to resolve identified problems (Wilkerson, Note 5).   The success of the action plans are then evaluated with a follow-up visit six to nine months later.   At that time, the OAP is readministered to the organization and a pre-post survey analysis is conducted to identify the changes in the organizational functioning.

Computer Analysis System

An important part of the review of the Air Force organizational effectiveness program was to review the

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current computer analysis system. This review provided a reference point from which the proposed system was designed. The system used by LMDC is referred to as the Organizational Assessment Package System, which refers to the OAP survey and the associated computer program to analyze the survey (LMDC, Note 8). The objectives of the OAP System are:

> . . . to (1) create an input, analysis, and output capability to process optical scan sheet responses generated by LMDC survey efforts; (2) develop a flexible inquiry/retrieval program to output values from the cumulative data base to support special analyses; and (3) support management consultation efforts of LMDC traveling teams with Air Force organizations worldwide [LMDC, Note 8; p. 2-1].

The major inputs, processes, and outputs of the system are briefly described in the following sections. For a more detailed description of the system operation, the reader is referred to the Users Manual for the Organizational Assessment Package (LMDC, Note 8).

Inputs. The primary inputs into the OAP system are the OAP survey responses. The survey responses are recorded on optical scan sheets (AU Form 855, OAP Response Sheet).

In addition to the survey responses, two major data bases are used by the system. The Air Force Data Base maintains cumulative statistics for each work group (and aggregate work group). The Elementary Master Records Data Base contains elementary master records for all valid responses over a three year period. The elementary master records

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contain the variable responses and factor scores for each respondent.

Processes. The optical scan sheets for all respondents are read using the IBM 3881 Optical Mark Reader. The responses are then formatted into elementary master records. The elementary master records are used to generate work group and aggregate work group records which contain the mean variable responses and factor scores for each work group/ aggregate work group.

The elementary master, work group, and aggregate work group records are then used to generate the various reports. Once the reports have been generated, the records are used to update the appropriate data bases.

Outputs. Four major outputs are produced by the system: OAP Analysis Worksheet (previously described), OAP Demographic Analysis, Survey Work Group Code Distribution Report, and LMDC OAP Evaluation Report.

The OAP Demographic Analysis provides a demographic breakdown of the respondents for all work groups and aggregate work groups.

The Survey Work Group Code Distribution Report provides a list of all the work groups evaluated by the system in hierarchal structure.

The LMDC OAP Evaluation Report provides information concerning pre-survey and post-survey changes in work groups. This report is used during the follow-up phase of the survey-guided development effort.

Chapter 3

COMPUTER PROGRAM DEVELOPMENT SPECIFICATION

The Organizational Assessment Package (OAP) Analysis System is one of three systems within the proposed OAP Management Information System (MIS). The other components are the OAP Data Base Management System (DBMS) and the OAP Data Base Analysis System (DBAS). The three components and their interactions are shown in Figure 6.

The primary objective of the OAP Analysis System is to provide a tool which can be used by management consultants in the evaluation of an organization. The basis for the evaluation are data collected by the OAP (Hendrix & Halverson, 1979). The OAP Analysis System requires as input two data files. The first file is the OAP Structure Data Base which describes the format of all OAP versions. The second file is the OAP Data Base System which consists of a collection of smaller data bases used by the system during the analysis.

In addition to the data files, the OAP Analysis System requires inputs from the organization being evaluated and from management consultants. The organization provides OAP survey responses to the system. These responses are recorded on optical scan sheets. The management consultants provide three inputs: Analysis Identification Cards, Work
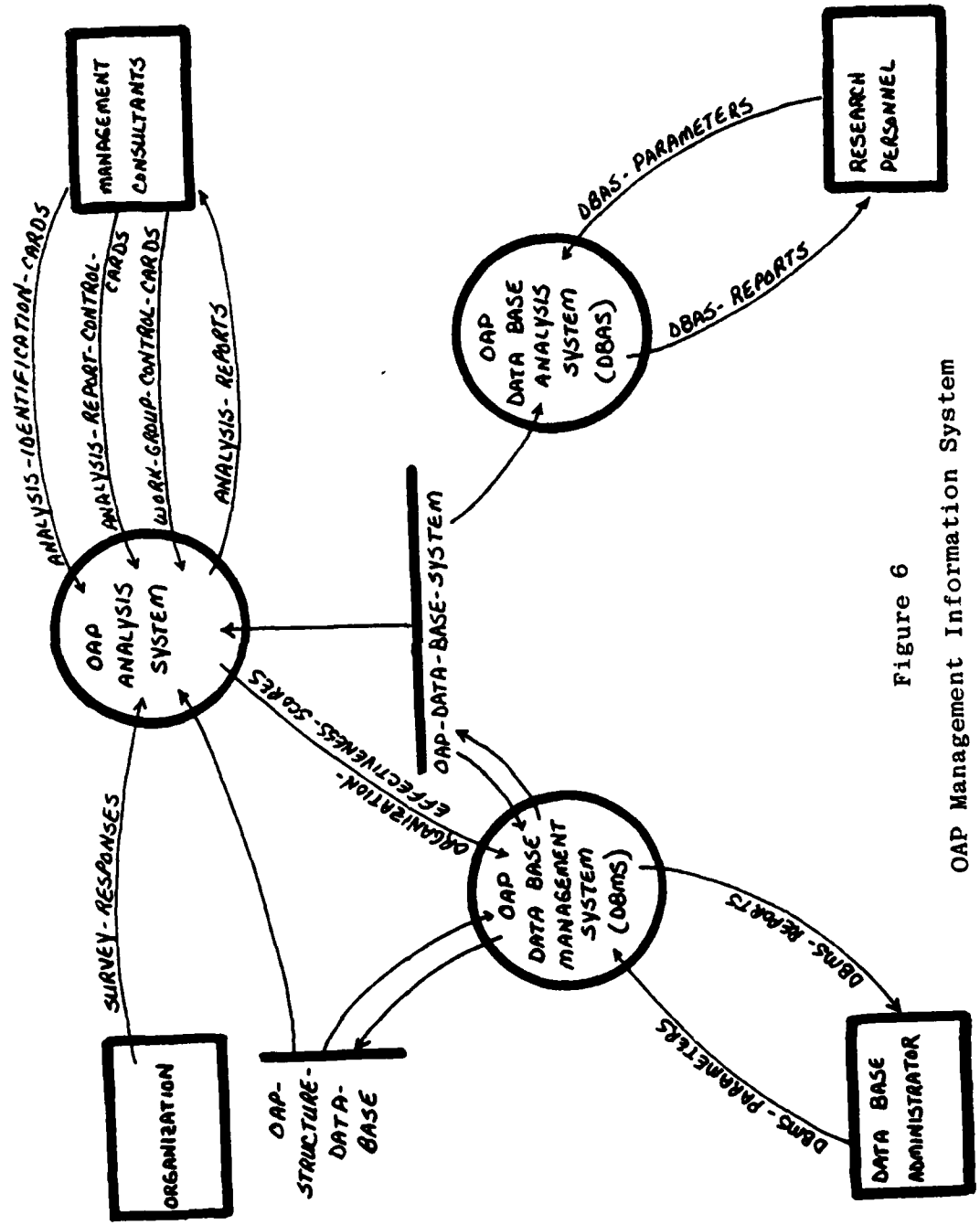
Figure 6

OAP Management Information System

Group Control Cards, and Analysis Report Control Cards. The Analysis Identification Cards describe the organization being evaluated and the OAP survey. The Work Group Control Cards specify the supplemental work groups to be used by the system during the analysis. The Analysis Report Control Cards describe the analysis reports to be produced by the system and their formats.

The primary objective of the OAP DBMS is to maintain the two data files used by the OAP MIS--the OAP Structure Data Base and the OAP Data Base System. The OAP DBMS requires inputs from the Data Base Administrator (individual responsible for maintaining the data files) in the form of update parameters. These parameters control the updates to the data files. The output of the system consists of various status reports of the data files.

The primary objective of the OAP DBAS is to provide research personnel with the capability of performing analyses using the historical data bases. The OAP DBAS requires inputs from research personnel specifying the types of analyses to be performed and the variables to be used in the analyses. The output of the system consists of various analytical analyses.

The objective of this chapter is to describe in detail the requirements and specifications for the OAP Analysis System component. The detailed requirements for the OAP DBMS and OAP DBAS will not be developed at this time, but will be

left for future research projects. The objective will be
accomplished by first briefly describing the requirements
of the OAP Analysis System. This will be followed by a
detailed description of the specifications in terms of
inputs, processes, and outputs needed to satisfy the require-
ments.

REQUIREMENTS

The specifications and requirements for the OAP
Analysis System were determined primarily from discussions
with the Leadership and Management Development Center (LMDC),
Maxwell AFB, Alabama (the primary users of the OAP).
Lt Colonel William H. Hendrix (original developer of the
OAP) of the Department of Organization Sciences at the Air
Force Institute of Technology (AFIT) was also interviewed
for suggested requirements. The Department of Organization
Sciences also uses the OAP in some of its research projects.
A thorough review of the existing analysis system used by
LMDC was also accomplished for identification of additional
requirements. A review of previous computer-based survey-
guided development efforts was also conducted to provide
additional input into the requirements. Finally, the theo-
retical basis of the OAP (the Three Component Organizational
Effectiveness Model) developed by Hendrix & Halverson (1979)
was also reviewed to evaluate its requirements.

The following list summarizes the requirements identified for the OAP Analysis System:

1. The system must be able to identify potential strengths and weaknesses at all levels within an organization.

2. The basic unit of analysis should be the organizational work group. A work group is defined as "any group of individuals performing work under a work group supervisor/ manager" (Hendrix & Halverson, 1979; p. 9). A work group may be either an elementary work group which is the lowest level of work group or an aggregate work group which consists of more than one elementary work group.

3. The system must be flexible in that it will accommodate a wide variation in the actual structure of the OAP without requiring internal changes to the computer programs.

4. All reports that are generated by the system must be statistically sound.

5. The system must be able to produce a demographic analysis for each work group within the organization. The demographic analysis should contain a description of each value of each demographic variable, as well as the frequency of response.

6. The system must evaluate the effectiveness of the organization in terms of the Three Component Organizational Effectiveness Model (Hendrix & Halverson, 1979).

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7. The system must be able to perform a comparison of the organization's effectiveness scores obtained from the analysis with the overall Air Force average and similar work group average scores.

8. The system must be able to perform a comparison of a given work group across demographic lines.

9. The system must be able to prepare a summary of all of the work groups evaluated during the analysis.

10. The system must be able to manually consolidate work groups into aggregate work groups in order to accommodate anomalies within the organization's physical structure.

11. The system must be able to produce a standardized feedback package which can be used to "feed" the results of the analysis back to the organization.

12. The system must cumulate all data produced by the analysis into a master historical data base.

SYSTEM INPUTS

The major inputs to the OAP Analysis System consist of the following:

1. Survey Responses
2. Analysis Identification Cards
3. Work Group Control Cards
4. Analysis Report Control Cards
5. OAP Structure Data Base
6. OAP Data Base System

Survey Responses

The Survey Responses contain the answers to the OAP for each individual surveyed. The responses are recorded on optical scan sheets. Each response sheet has a five digit precoded sequence number on it. The survey responses contain the following information for each respondent:

1. Supervisor's work group code--corresponds to the work group code of the supervisor's immediate subordinates, if the respondent is a supervisor.

2. Work group code--unique code representing the specific work group the respondent belongs to.

3. AFSC of the respondent.

4. Variable responses--limited to 225 responses. Several scales are available on the response sheet:

a. The first 200 responses contain seven response categories. These responses may be attitudinal or demographic variables. All attitudinal variables are measured on a 7-point Likert scale.

b. The next fifteen responses contain ten response categories. These responses are reserved for demographic variables only.

c. The last ten responses contain multi-digit response categories. These responses are also reserved for demographic variables. One response contains four digits, four responses contain three digits, and five responses contain two digits.

d. All variable responses, with the exception of the multi-digit demographic responses, have special response fields for "not applicable" and "don't know" responses.

The work group code defined above is an integral element of the OAP Analysis System and, as such, requires a more detailed description of how it is structured. The work group code is a unique 7-digit alphanumeric code representing a specific work group function. This concept of the code representing a specific work group function, rather than a specific work group, allows the work group code to be used to identify a standard of comparison for all similar work groups (that is, work groups with the same function).

The work group code also distinguishes between elementary work groups and aggregate work groups. An aggregate work group has a "zero" in the last digit of the work group code; an elementary work group has a "non-zero" in the last digit of the work group code.

The work group code is structured such that elementary work groups can easily be aggregated in a "natural" hierarchal fashion. This concept can best be described with an illustration. Figure 7 illustrates a linking-pin diagram of a simple organization. The organization has three hierarchal level and consists of thirteen elementary work groups (the base of each triangle represents an elementary work
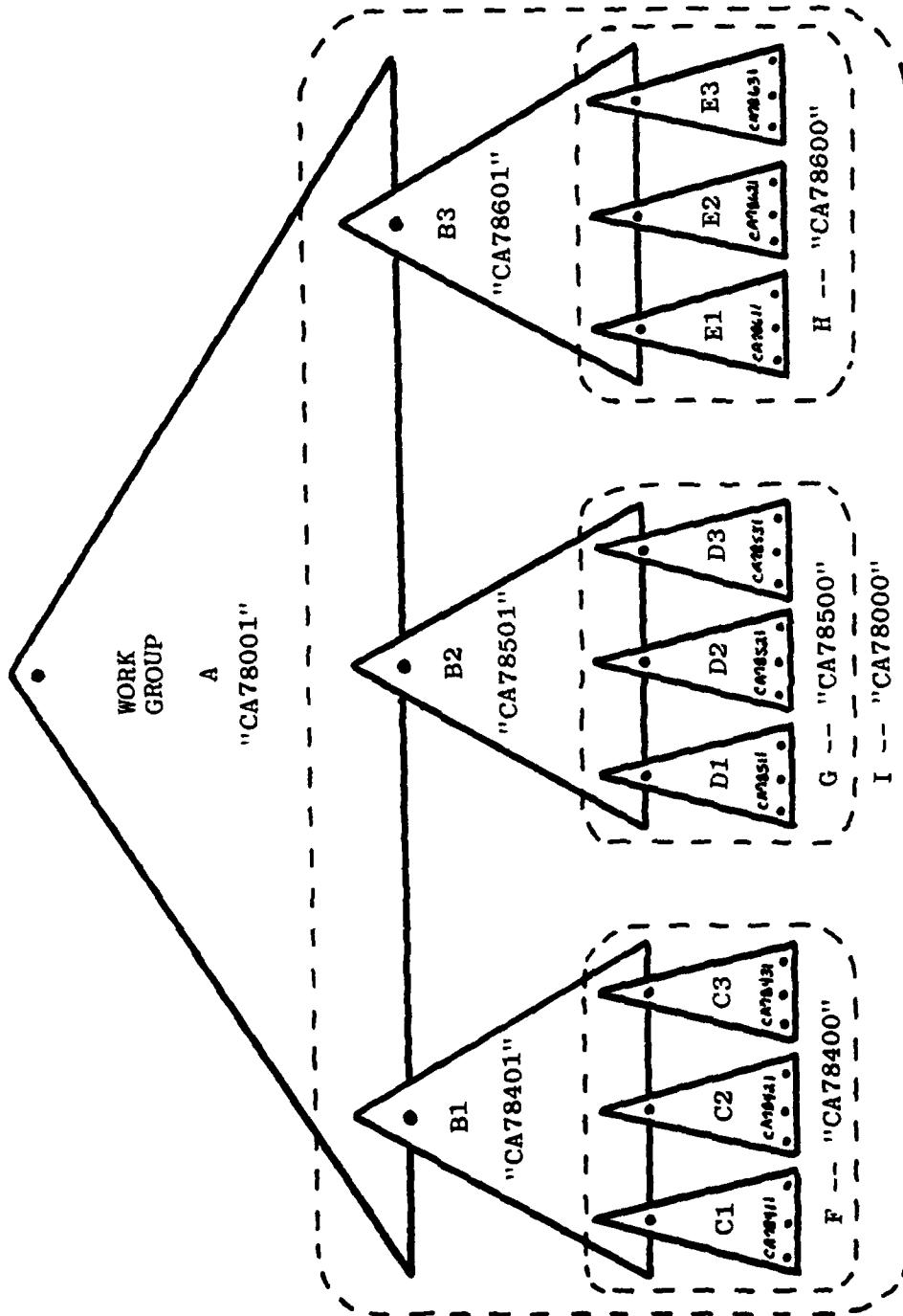
Figure 7

Hierarchal Structure of Work Group Code

group). E? 'h elementary work group has been assigned a work group code (the seven digit number within each triangle).

The "natural" hierarchal grouping is described as follows. For any particular elementary work group, the aggregate work group at that level for that work group consists of the particular work group plus all elementary work groups below it in the hierarchal structure. For example, the aggregate work group for B2 consists of four elementary work groups (B2, D1, D2, and D3). The aggregate work group for A consists of all elementary work groups in the diagram.

There are four aggregate work groups in the diagram-- F, G, H, and I. Aggregate work group F consists of B1, C1, C2, and C3. Aggregate work group G consists of B2, D1, D2, and D3. Aggregate work group H consists of B3, E1, E2, and E3. Aggregate work group I has already been defined.

The work group code is structured to accomplish this "natural" hierarchal grouping. Aggregate work group F consists of all elementary work groups that have a work group code that begins with the digits "CA784". The corresponding work group code for aggregate work group F is "CA78400". Aggregate work group I consists of all elementary work groups that begin with "CA78" and the corresponding work group code is "CA78000".

Although the above example was rather simple, it illustrated the hierarchal structure of the work group codes. The hierarchal structure of the work group code was not

intended to fit every organization within the Air Force. Due to the large number of organizations and the complexity involved, the structure is almost certain to not fit every organization. When the hierarchal structure of the code fails to adequately fit a given organization, consolidated work groups (to be described later) may be created to handle the situation.

As a final note on the work group code, a special work group code has been defined to indicate the overall organization (regardless of type and function). This work group code consists of all zeroes ("0000000"). When this work group code is used as a standard of comparison, the comparison is being made to the Air Force average.

Analysis Identification Cards

The Analysis Identification Cards describe the organization being evaluated and the OAP version used during the analysis. The following information is included on the card:

1. Date of analysis

2. OAP survey version

3. Base code of the base (organization) being evaluated

4. Major Command code

5. Supplemental variables included on the OAP

Supplemental questions are added to the OAP, at times, to tailor the survey to a given organization's needs. A maximum of twenty supplemental questions may be added and only attitudinal questions may be added. For each supplemental variable added, the following information must be provided:

1. Attitudinal variable number

2. Relative position of the question in the OAP

Work Group Control Cards

The Work Group Control Cards specify supplemental work groups which are to be used in the analysis in addition to the standard elementary and aggregate work groups. Two types of supplemental work groups may be created--consolidated work groups and "dummy" work groups.

Consolidated work group cards. The Consolidated Work Group Cards are used to specify work groups which are to be consolidated into an aggregate work group. Consolidated work groups are created when the "normal" hierarchal structure of the work group code is not adequate. For each consolidated work group being created, the following items are to be specified:

1. Consolidated work group name and code--the code must not be a valid work group code.

2. A list of all work groups (by work group code) that are to be included in the consolidated work group. Only elementary work groups may be specified.

Dummy work group cards. The Dummy Work Group Cards are used to create "dummy" work groups. A dummy work group is a work group which consists of a subset of the individuals from a particular base work group. The subsets are created using the values of up to five specified demographic variables. Dummy work groups may be used to perform a comparison of a work group across demographic lines. For each dummy work group created, the following items must be specified:

1. Dummy work group name and code--the code must not be a valid work group code.

2. Work group code for the base work group.

3. For each demographic variable used to create the dummy work group, the following must be specified:

a. Demographic variable number

b. Value or range of values for the demographic variable

The dummy work group will be created to contain all individuals that satisfy all of the demographic variables.

Dummy work groups may be specified as members of a consolidated work group using the Consolidated Work Group Cards described in the previous section.

Analysis Report Control Cards

The Analysis Report Control Cards describe the analysis reports and their formats to be prepared by the OAP Analysis System. These cards consist of the following option cards:

1. OAP Comparison Analysis Report Option Card

2. OAP Demographic Analysis Report Option Card

3. OAP Organization Summary Option Card

4. OAP Detailed Summary Option Card

5. Potential Strengths and Weaknesses Report Option Card

6. Work Group Distribution Report Option Card.

OAP comparison analysis report option card. The OAP Comparison Analysis Report Option Card specifies whether or not the OAP Comparison Report is to be produced. If the report is to be produced, the card also specifies the level of organization at which the report is to be prepared. Three organizational levels are available: organization level, all work groups level, and selected work group level. At the organization level, the report will be prepared for only the overall organization. At the all work groups level, the report will be prepared for all aggregate work groups. At the selected work group level, the report will be prepared for only those aggregate work groups specified. A maximum of twenty aggregate work groups may be specified.

OAP demographic analysis report option card. The OAP Demographic Analysis Report Option Card specifies whether or not the OAP Demographic Analysis Report is to be produced. If the report is to be produced, the card also specifies the frequency limits and the level of analysis. The frequency limits specify the minimum size (sample size) for a work group to be included in the report. As in the previous option card, three levels of analysis are available. At the organization level, the report will be prepared for only the overall organization. At the all work groups level, the report will be prepared for all work groups. At the selected work group level, the report will be prepared for only those work groups specified. Elementary or aggregate work groups may be specified. A maximum of twenty work groups may be specified.

OAP organization summary option card. The OAP Organization Summary Option Card specifies whether or not the OAP Organization Summary is to be produced.

OAP detailed summary option card. The OAP Detailed Summary Option Card specifies whether or not the OAP Detailed Summary is to be prepared. If the report is to be prepared, the card also specifies the level of analysis and frequency limits. The level of analysis option is the same as stated in the OAP Demographic Analysis Report Option Card.

Potential strengths and weaknesses report option card. The Potential Strengths and Weaknesses Report Option Card specifies whether or not the Potential Strengths and Weaknesses Report is to be produced. If the report is to be produced, the level of analysis and frequency limits must be specified as in the OAP Demographic Analysis Report Option Card.

In addition, if the report is to be prepared, the format of the report and the criteria must be specified. Two formats are available: factor format and variable format. The format determines which score will be used to determine the potential strengths and weaknesses. Three criteria are available for identification of potential strengths and weaknesses: standard deviation criteria, cut-off score criteria, and top-ten bottom-ten criteria.

Under the standard deviation criteria, a mean score and a number of standard deviations (between 1 and 3) are specified. All scores above the specified number of standard deviation from the mean score are identified as potential strengths and all scores below the specified number of standard deviations are identified as potential weaknesses. The specified mean score may be either the Air Force average score, similar work group average score, or the organization average score.

Under the cut-off score criteria, a strength cut-off score and a weakness cut-off score are specified. All scores above the strength cut-off score are identified as potential

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strengths and all scores below the weakness cut-off score are identified as potential weaknesses.

Under the top-ten bottom-ten criteria, the top ten scores are identified as potential strengths and the bottom ten scores are identified as potential weaknesses.

Work group distribution report option card. The Work Group Distribution Report Option Card specifies whether or not the Work Group Distribution Report is to be prepared.

OAP Structure Data Base

The OAP Structure Data Base describes the format for all versions of the OAP. The particular version of the OAP used during the analysis is specified on the Analysis Identification Card (described earlier).

OAP physical structure. Before describing the requirements for the data base, a description of the physical structure of the OAP will be given. The OAP is a standardized survey instrument. Two types of variables are measured by the OAP: attitudinal variables and demographic variables. The physical structure of the OAP consists of the following sections:

1. Demographic Section I
2. Attitudinal Section
3. Demographic Section II
4. Demographic Section III

The OAP must always have the Attitudinal Section. It is in this section that the inventories designed to

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measure the Three Component Organizational Effectiveness Model are located. The demographic sections are optional; however, in order for the OAP to adequately serve as a tool for evaluating the effectiveness of an organization, some questions relating to the demographics of the organization will normally be specified.

Demographic Section I and the Attitudinal Section, together, may not be larger than 200 questions (the limit is due to the response sheet capacity). Demographic Section I may not contain more than twenty questions. If supplemental variables are added to a version of the OAP, they are physically located in the Attitudinal Section. Demographic Section I contains questions with a maximum of seven response categories. All of the questions in the Attitudinal Section must be structured on a 7-point Likert scale.

Demographic Section II contains a maximum of fifteen questions. All of the questions have a maximum of ten response categories.

Demographic Section III contains a maximum of ten demographic questions. The responses categories in this section all contain multi-digit numeric responses. This section consists of three sub-sections:

1. 4-digit response sub-section

2. 3-digit response sub-section

3. 2-digit response sub-section

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The 4-digit response sub-section contains room for only <u>one</u> question. The 3-digit response sub-section contains room for four questions. The 2-digit response sub-section contains room for five questions.

An optical scan response sheet is currently being designed to satisfy these physical requirements for the OAP structure (Ovalle, Note 9). The proposed design layout for the optical scan form is shown in Figures 8 and 9.

Data base requirements. The OAP Structure Data Base consists of five major components (see Figure 10):

1. Demographic Variable File

2. Attitudinal Variable File

3. Factor File

4. Inventory File

5. Survey Version File

The Demographic Variable File describes the demographic variables used by all OAP versions. For each demographic variable, the following information must be provided:

1. Demographic variable number--unique number associated with each demographic variable.

2. Demographic variable name--abbreviated version of the demographic variable question.

3. Minimum valid value of the demographic variable.

4. Maximum valid value of the demographic variable.

Figure 8

OAP Optical Scan Form (Side 1)

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Figure 9

OAP Optical Scan Form (Side 2)

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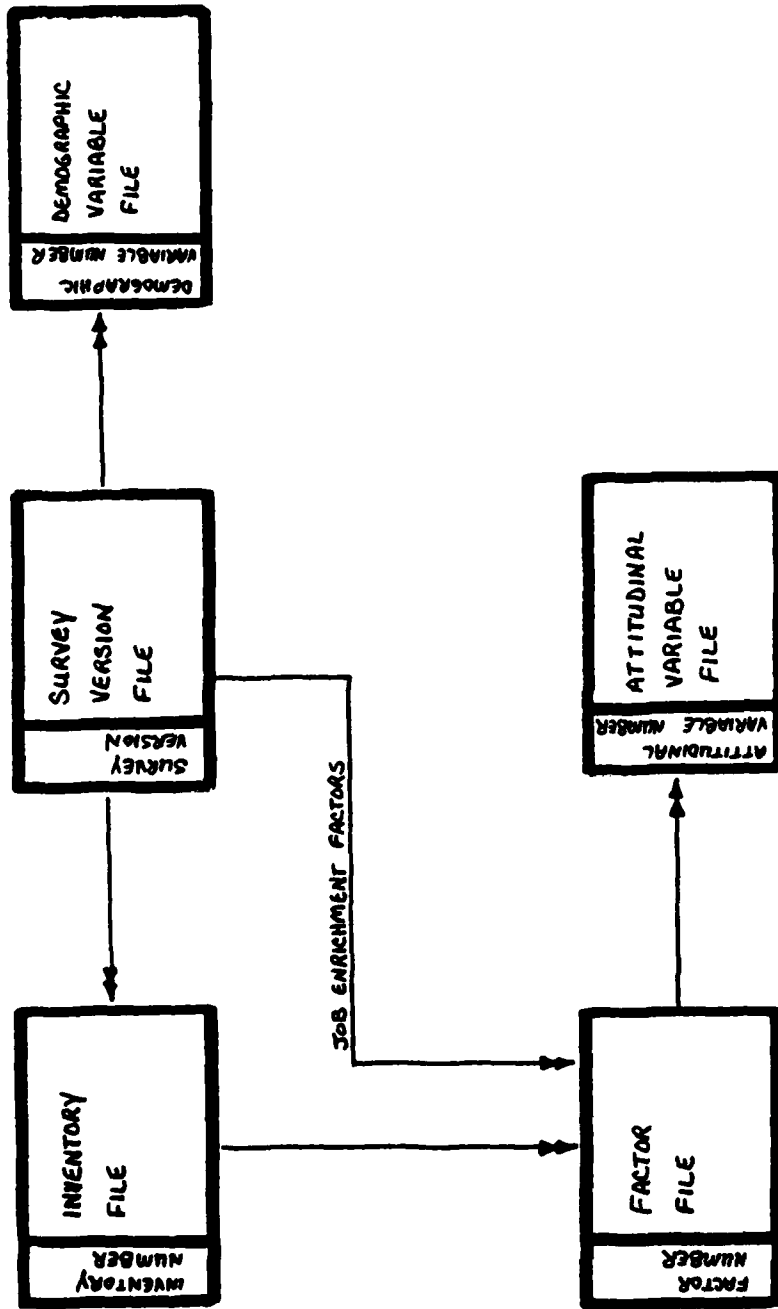
Figure 10

OAP Structure Data Base

5. For each demographic variable in Demographic Sections I and II of the OAP, an abbreviated description of each valid value of the demographic variable.

The Attitudinal Variable File describes the attitudinal variables used by all OAP versions (this includes supplemental variables). For each attitudinal variable, the following information must be provided:

1. Attitudinal variable number--unique number associated with each attitudinal variable.

2. Attitudinal variable name--abbreviated version of the attitudinal variable question.

3. An indicator of whether or not the attitudinal variable is negatively stated. The attitudinal variables are all measured on a 7-point Likert scale. Normally, a response of seven indicates the best situation; however, if the variable were negatively stated, a response of seven would indicate the worst situation. This information is required when the factor scores are computed (refer to System Processes section).

The Factor File describes the analytical factors measured by all versions of the OAP. For each analytical factor measured, the following information is required:

1. Factor number--unique number associated with each factor.

2. Factor name.

3. A list of all attitudinal variables (maximum of twenty) that measure the factor.

In addition to the above analytical factors, the Factor File also describes supplemental job enrichment factors that may be included in an OAP version. These factors include the five core job dimensions (skill variety, task identity, task significance, job feedback, and task autonomy) defined by Hackman & Oldham (1975) plus a sixth factor-- need for enrichment--defined by Hendrix & Halverson (1979). For each of the job enrichment factors, the attitudinal variables (maximum of 20) that measure the job enrichment factors must be specified. The five core dimensions are used to compute the Motivation Potential Score (MPS) defined by Hackman & Oldham (1975). The Factor File must also define the MPS factor; however, since the MPS is computed from the core dimensions, the list of attitudinal variables that determine the MPS will be "empty".

The Inventory File describes the inventories used by all versions of the OAP. For each inventory, the following information must be specified:

1. Inventory number--unique number associated with each inventory.

2. Inventory name.

3. A list of all factors (maximum of twenty) measured by the inventory, excluding job enrichment factors, by factor number.

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The Survey Version File describes the inventories, attitudinal and demographic variables, job enrichment factors, and inventory and factor subjective weights associated with a given OAP survey version. For each survey version, the following information must be specified:

1. Survey version number--unique number associated with each OAP version.

2. For each inventory within the version (maximum of ten inventories:

    a. Inventory number.

    b. Inventory weight--a subjective weight to be associated with the inventory score for this inventory when computing the overall effectiveness score (refer to the System Processes section).

3. For each factor measured by the OAP version (maximum of 100):

    a. Factor number.

    b. Factor weight--a subjective weight to be associated with the factor score for this factor when computing the inventory score (refer to the System Processes section).

4. A list of all variables (attitudinal and demographic) measured by the OAP version by relative position within the OAP (leaving "holes" for relative positions not used).

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5. If job enrichment factors are measured by the OAP version, the factor numbers associated with the following job enrichment factors must be specified:

    a. Skill variety

    b. Task identity

    c. Task significance

    d. Job feedback

    e. Task autonomy

    f. Need for enrichment

    g. Motivation potential score

OAP Data Base System

The OAP Data Base System consists of four separate data bases used by the OAP Analysis System:

1. Analysis Code Data Base

2. OAP Historical Response Data Base

3. OAP Historical Organization Scores Data Base

4. OAP Work Group Standards Data Base

Analysis code data base. The Analysis Code Data Base describes the various codes used throughout the OAP Analysis System. This data base consists of three files:

1. Base Code File

2. Major Command Code File

3. Work Group Code File

The Base Code File describes all valid base codes used by the OAP Analysis System. The Major Command Code

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File describes the major command codes used by the system. Finally, the Work Group Code File describes the valid work group codes used by the system.

OAP historical response data base. The OAP Historical Response Data Base contains the responses and analysis scores for all individuals analyzed by the OAP Analysis System. From an operational point view, however, the data base may contain only recent responses depending upon the capacity of the data base medium and management policy.

For each respondent, the OAP Historical Response Data Base contains the following information:

1. Individual's survey responses (see Survey Responses section for detailed description)

2. Date of survey

3. Base code

4. Major command code

5. OAP survey version

6. Individual's factor scores

7. Individual's inventory scores

8. Individual's overall effectiveness score.

The formulas used to compute the factor scores, inventory scores, and the overall effectiveness score are described later in the System Processes section of this chapter.

OAP historical organization scores data base. The OAP Historical Organization Scores Data Base contains the

organizational effectiveness scores for all organizations analyzed by the OAP Analysis System. This data base is required in order to be able to perform a pre-survey versus post-survey analysis (to be accomplished by the OAP DBAS). This data base consists of the following information for each organization evaluated:

1. Date of analysis

2. Base code

3. Major command code

4. OAP survey version

5. Sample size of the organization

6. Work group scores for each work group evaluated

The work group scores consist of the following information:

1. Work group code

2. Work group sample size

3. For each attitudinal variable:

   a. Variable score sample mean

   b. Variable score sample standard deviation

   c. A count of the number of individuals in the work group that provided valid response

4. For each factor (including job enrichment factors, if any):

   a. Factor score sample mean

   b. Factor score sample standard deviation

c. A count of the number of individuals in the work group that had a valid factor score computed

5. For each inventory:

a. Inventory score sample mean

b. Inventory score sample standard deviation

c. A count of the number of individuals in the work group that had a valid inventory score computed

6. Overall effectiveness score sample mean

7. Overall effectiveness score sample standard deviation

8. A count of the number of individuals in the work group that had a valid overall effectiveness score computed

OAP work group standards data base. The OAP Work Group Standards Data Base contains the average (standard) scores for each work group that has been analyzed by the OAP Analysis System with the exception of consolidated and dummy work groups. No attempt is made to maintain standards for these supplemental work groups.

All work groups with the same function (work group code) are averaged to arrive at a standard of comparison for the work group.

The data base includes standards for all levels of work groups (elementary and aggregate) up to and including the overall organization aggregate work group. The average

of the analysis scores for all organizational level aggregate work groups yields the Air Force average (or standard).

For each work group analyzed by the system, the OAP Work Group Standards Data Base will contain the following information:

1. For each attitudinal variable that has been contained in any OAP version, the following information is included:

    a. Variable number

    b. Variable score sample mean ($\overline{V}$)

    c. Variable score sample standard deviation (S_V)

    d. A count of the number of individuals in the work group that provided valid response (N_V)

2. For each factor that has been measured by any of the OAP versions (including job enrichment factors), the following information is included:

    a. Factor number

    b. Factor score sample mean ($\overline{F}$)

    c. Factor score sample standard deviation (S_F)

    d. A count of the number of individuals in the work group that had a valid factor score computed (N_F)

3. For each inventory that has been contained in any OAP version, the following is included:

    a. Inventory number

    b. Inventory score sample mean ($\overline{I}$)

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c. Inventory score sample standard deviation (S_I)

d. A count of the number of individuals in the work group that had a valid inventory score computed (N_I)

4. Overall effectiveness score sample mean $(\overline{O})$

5. Overall effectiveness score sample standard deviation (S_O)

6. A count of the number of individuals in the work group that had a valid overall effectiveness score computed (N_O)

The following formulas are used to compute the above variables:

$$(1) \quad V = \frac{\Sigma(IVR_j)}{N_V}$$

$$(2) \quad S_V = \sqrt{\frac{SSV - N_V \times \overline{V}^2}{(N_V-1)}}$$

$$(3) \quad SSV = \Sigma(IVR_j)^2$$

The above summations are from $j = 1$ to N_V.

$$(4) \quad \overline{F} = \frac{\Sigma(IFS_j)}{N_F}$$

$$(5) \quad S_F = \sqrt{\frac{SSF - N_F \times \overline{F}^2}{(N_F-1)}}$$

$$(6) \quad SSF = \Sigma(IFS_j)^2$$

The above summations are from $j = 1$ to N_F.

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$$(7) \quad \overline{I} = \frac{\Sigma(IIS_j)}{N_I}$$

$$(8) \quad S_I = \sqrt{\frac{SSI - N_I \times \overline{I}^2}{(N_I - 1)}}$$

$$(9) \quad SSI = \Sigma(IIS_j)^2$$

The above summations are from $j = 1$ to N_I.

$$(10) \quad \overline{O} = \frac{\Sigma(IOES_j)}{N_0}$$

$$(11) \quad S_0 = \sqrt{\frac{SSO - N_0 \times \overline{O}^2}{(N_0 - 1)}}$$

$$(12) \quad SSO = \Sigma(IOES_j)^2$$

The above summations are from $j = 1$ to N_0,

where: IVR_j refers to the individual variable response for the jth individual in the work group.

IFS_j refers to the individual factor score for the jth individual in the work group.

IIS_j refers to the individual inventory score for the jth individual in the work group.

$IOES_j$ refers to the individual overall effectiveness score for the jth individual in the work group.

SYSTEM PROCESSES

The various processes identified for the OAP Analysis System are shown in Figures 11 through 14. Three major processes (see Figure 11) were identified:

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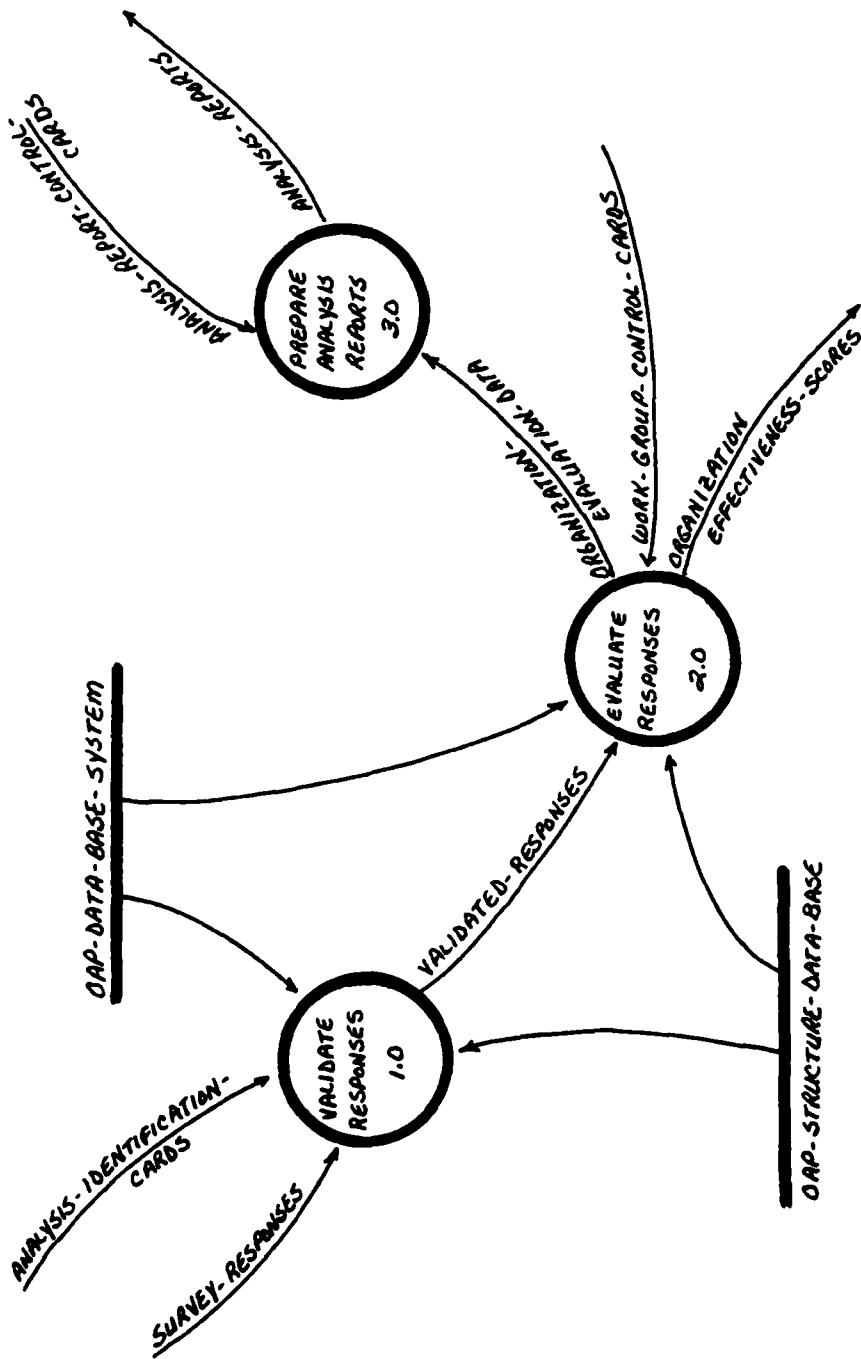
Figure 11

OAP Analysis System
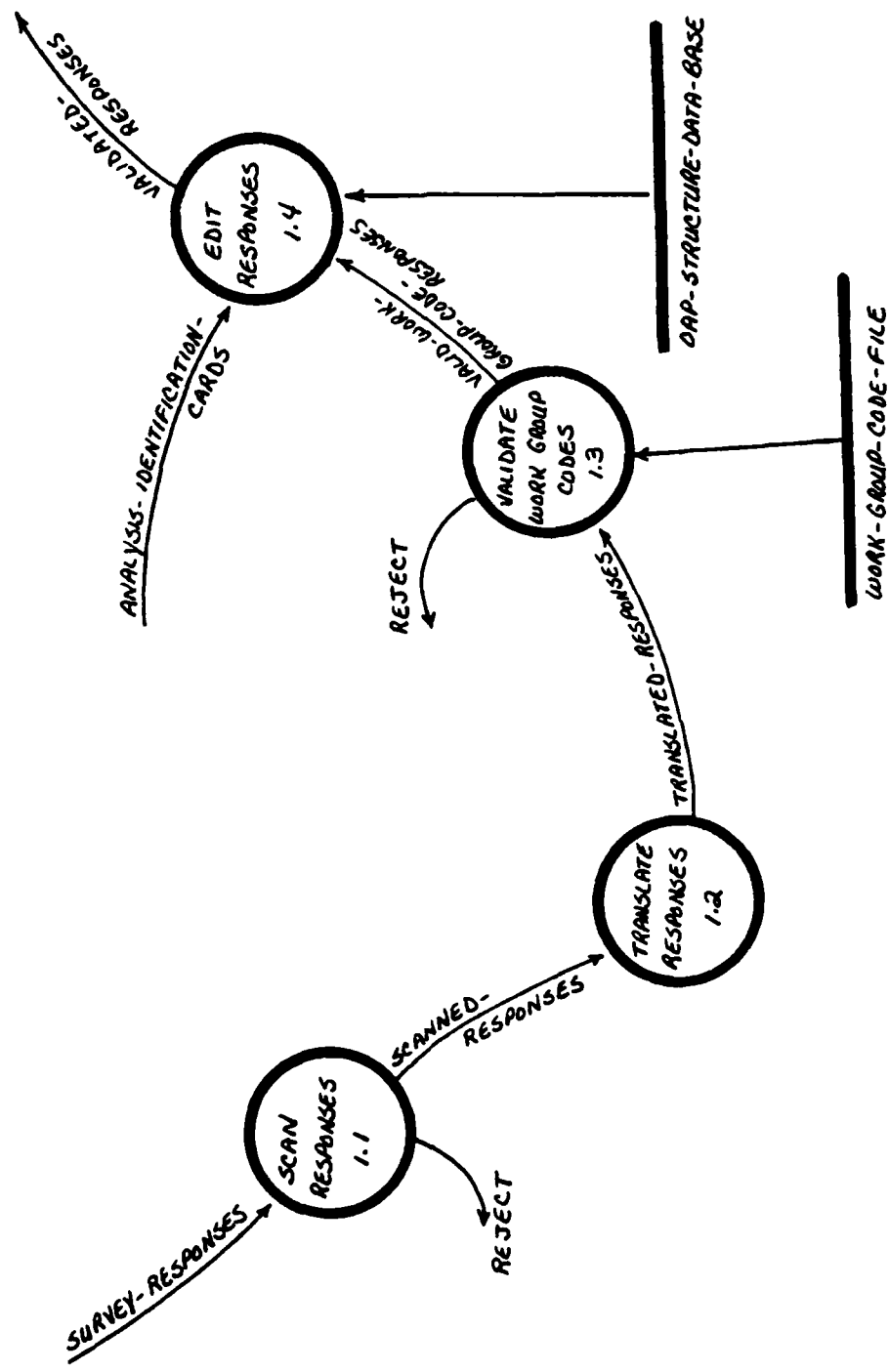
Figure 12

Validate Responses Process

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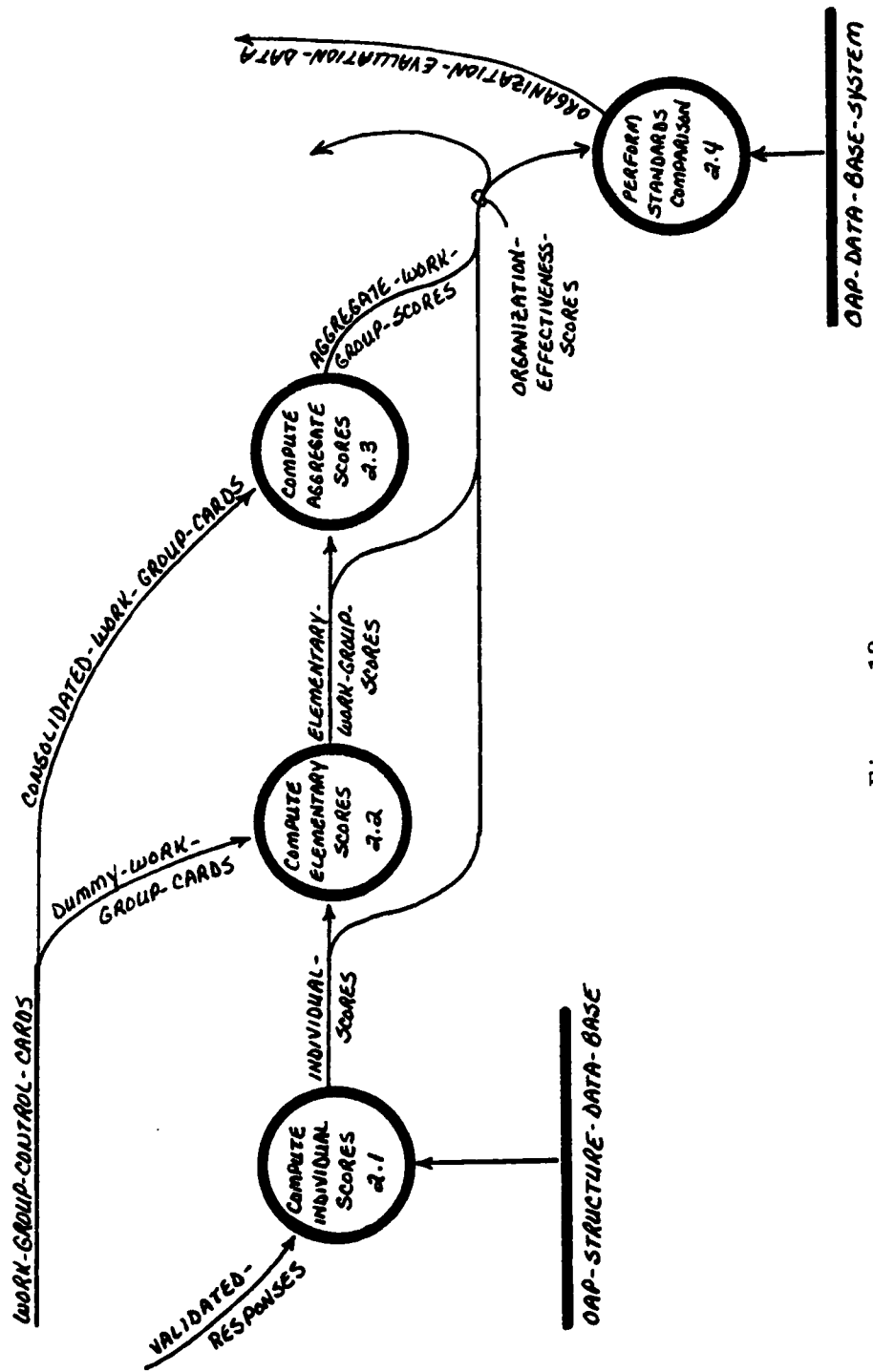
Figure 13

Evaluate Responses Process

71
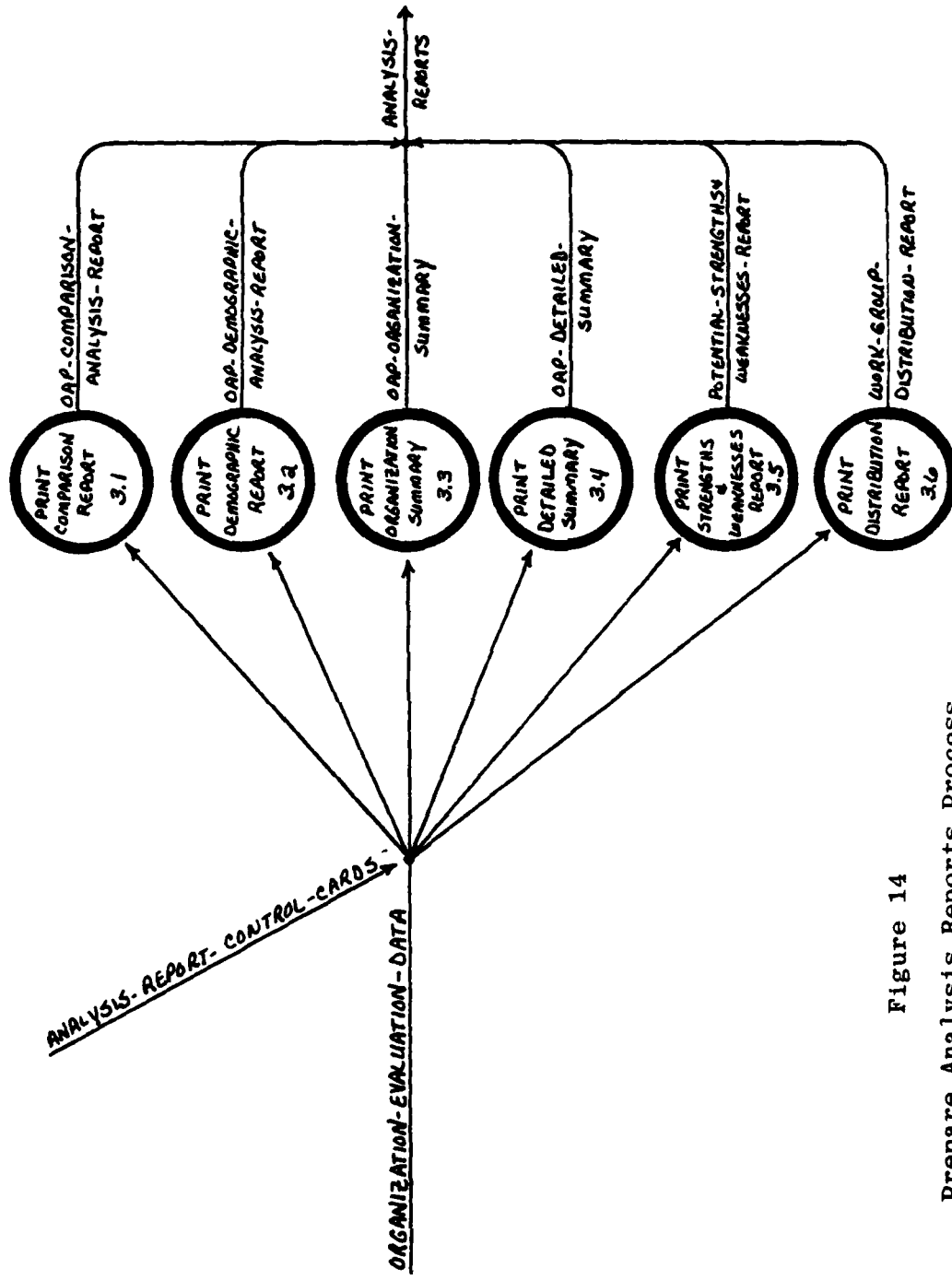
Figure 14

Prepare Analysis Reports Process

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1. Validate responses

2. Evaluate responses

3. Prepare analysis reports

Validate Responses

The "Validate Responses" process of the OAP Analysis System converts the survey responses on the optical scan sheets into a format acceptable to the computer programs. The process also verifies that all of the fields on the response sheets contain valid entries. This process was further divided into four sub-processes (see Figure 12):

1. Scan responses

2. Translate responses

3. Validate work group codes

4. Edit responses

Scan responses. The "Scan Responses" process consists of reading the optical scan sheets containing the survey responses using an optical mark reader. During this process, scan sheets which are unreadable by the hardware are rejected. In addition, scan sheets with incomplete work work group codes are also rejected. Rejected responses may be manually corrected by the user before proceeding to the next process.

The output from this process consists of scanned responses which contain the same information as found in the survey responses (see Survey Responses section).

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Translate responses. The "Translate Responses" process consists of translating the raw responses recorded by the optical mark reader into a format that is acceptable to the host computer for the OAP Analysis System. Depending upon the type of optical mark reader used, this process may not be required.

The output of this process consists of the translated responses and contain the same information as the survey responses.

Validate work group codes. The "Validate Work Group Codes" process consists of checking all input work group codes on the input survey responses to ensure that they have been previously defined in the Work Group Code File. Survey responses which contain invalid work group codes are rejected. Rejected responses may be manually corrected by the user before proceeding to the next process.

The output of the process consists of only those responses with valid work group codes. A listing of rejected responses due to invalid work group codes is also produced.

Edit responses. The "Edit Responses" process consists of ensuring that valid responses have been recorded for each question within the OAP. Invalid or missing responses are converted to a special response category and will have a value of zero.

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The output of this process consists of all validated responses.

Evaluate Responses

The second major process within the OAP Analysis System is the "Evaluate Responses" process. This process consists of evaluating all work groups within the organization. The work groups are evaluated in terms of four scores--variable scores, factor scores, inventory scores, and overall effectiveness scores. This process was further divided into four sub-processes (see Figure 13):

1. Compute individual scores

2. Compute elementary scores

3. Compute aggregate scores

4. Perform standards comparison

Compute individual scores. The "Compute Individual Scores" process computes the individual factor scores, inventory scores, and overall effectiveness scores for each validated response. The factor scores are computed as the mean of the variable responses for the highly loaded variables. The inventory scores are computed as the weighted average of the factor scores. The overall effectiveness score is computed as the weighted average of the inventory scores. The formulas used to compute these scores are described below:

$$(1) \quad IFS_i = \frac{\Sigma(IVR_j)}{NVF_i}$$

The above summation is from $j = 1$ to NVF_i.

$$(2) \quad IIS_i = \frac{\Sigma[(IFS_j) \times (SFW_j)]}{\Sigma(SFW_j)}$$

The above summations are from $j = 1$ to NFI_i.

$$(3) \quad IOES = \frac{\Sigma[(IIS_j) \times (SIW_j)]}{\Sigma(SIW_j)}$$

The above summations are from $j = 1$ to NI,

where: IFS_i refers to the individual factor score (excluding MPS) for the ith factor.

IVR_j refers to the individual variable response for the jth variable. If a variable is negatively stated, substitute "$8 - IVR_j$" for "IVR_j" in equation (1) to account for the reversed scoring.

NVF_i refers to the number of variables that determine the ith factor.

IIS_i refers to the individual inventory score for the ith inventory.

SFW_j refers to the subjective factor weight for the jth factor.

NFI_i refers to the number of factors measured by the ith inventory.

IOES refers to the individual overall effectiveness score.

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SIW_j refers to the subjective inventory weight for the jth inventory.

NI refers to the number of inventories in the version of the OAP used by the analysis.

In the event that a respondent does not provide a valid response to a particular attitudinal variable, the variable will be eliminated from the corresponding factor score computation. The factor score will be computed as the mean of the remaining highly loaded variables. Because of the high intercorrelation between the variables, this procedure should not provide biased results.

If the respondent, however, does not provide valid responses for at least two of the attitudinal variables that determine a particular factor, the factor score will not be computed. The factor score will be set equal to zero to indicate that a valid score was not computed.

If a particular factor score is not computed, the corresponding inventory score and the overall effectiveness score for the individual cannot be computed. The scores will be set equal to zero to indicate that a valid score was not computed.

This process will also compute the individual MPS using the following formula:

$$(4) \quad MPS = \frac{(SV + TI + TS)}{3} \times TA \times JF$$

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              IDENTIFICATION OF AN ADAPTABLE COMPUTER PROGRAM DESIGN FOR ANAL--ETC(U)
              SEP 81 J B BUSHMAN
UNCLASSIFIED AFIT-LSSR-50-81   NL

2 3

‖ 1.0

2 8 2.5
3 2 2.2
3 6
4 0 2.0

‖ 1.1

‖ 1.8

‖ 1.25 1.4 1.6
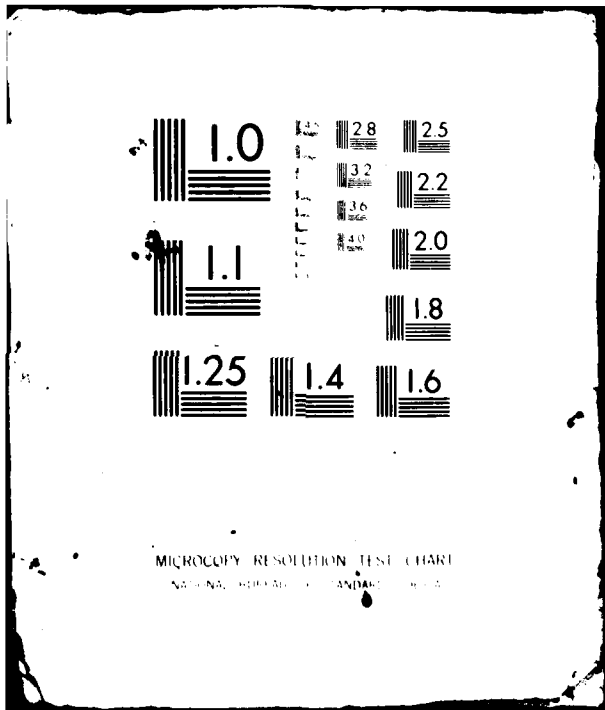
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS

where: SV refers to the individual skill variety factor score.

TI refers to the individual task identity factor score.

TS refers to the individual task significance factor score.

TA refers to the individual task autonomy factor score.

JF refers to the individual job feedback factor score.

The skill variety, task identity, task significance, task autonomy, and job feedback factor scores are computed using equation (1). If any of these job enrichment factor scores are unable to be computed, the MPS will be set equal to zero to indicate that a valid MPS could not be computed.

The output from this process is the individual effectiveness scores which consists of the following information for each individual:

1. Individual's survey responses

2. For each factor measured by the OAP (including job enrichment factors):

   a. Factor number

   b. Individual factor score

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3. For each inventory within the OAP:

    a. Inventory number

    b. Individual inventory score

4. Individual overall effectiveness score

Compute elementary scores. The "Compute Elementary Scores" process computes the effectiveness scores for all elementary and dummy work groups included in the analysis. The following information is computed and outputed from this process for each elementary and dummy work group:

1. Work group code

2. Work group sample size

3. For each attitudinal variable in the OAP:

    a. Attitudinal variable number

    b. Variable score sample mean ($\bar{V}_E$)

    c. Variable score sample standard deviation (S_{VE})

    d. A count of the number of individuals in the work group that provided valid response (N_{VE})

4. For each factor measured by the OAP (including job enrichment factors)

    a. Factor number

    b. Factor score sample mean ($\bar{F}_E$)

    c. Factor score sample standard deviation (S_{FE})

    d. A count of the number of individuals in the work group that had a valid factor score computed (N_{FE})

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5. For each inventory within the OAP:

    a. Inventory number

    b. Inventory score sample mean $(\overline{I}_E)$

    c. Inventory score sample standard deviation (S_{IE})

    d. A count of the number of individuals in the work group that had a valid inventory score computed (N_{IE})

6. Overall effectiveness score sample mean $(\overline{O}_E)$

7. Overall effectiveness score sample standard deviation (S_{OE})

8. A count of the number of individuals in the work group that had a valid overall effectiveness score computed (N_{OE})

The following formulas are used to compute the above variables:

$$(5) \quad \overline{V}_E = \frac{\Sigma(IVR_j)}{N_{VE}}$$

$$(6) \quad S_{VE} = \sqrt{\frac{SSV_E - N_{VE} \times \overline{V}_E^2}{(N_{VE}-1)}}$$

$$(7) \quad SSV_E = \Sigma(IVR_j)^2$$

The above summations are from $j = 1$ to N_{VE}.

$$(8) \quad \overline{F}_E = \frac{\Sigma(IFS_j)}{N_{FE}}$$

$$(9) \quad S_{FE} = \sqrt{\frac{SSF_E - N_{FE} \times \overline{F}_E^2}{(N_{FE}-1)}}$$

(10) $\quad SSF_E = \Sigma(IFS_j)^2$

The above summations are from $j = 1$ to N_{FE}.

(11) $\quad \bar{I}_E = \dfrac{\Sigma(IIS_j)}{N_{IE}}$

(12) $\quad S_{IE} = \sqrt{\dfrac{SSI_E - N_{IE} \times \bar{I}_E^2}{(N_{IE}-1)}}$

(13) $\quad SSI_E = \Sigma(IIS_j)^2$

The above summations are from $j = 1$ to N_{IE}.

(14) $\quad \bar{O}_E = \dfrac{\Sigma(IOES_j)}{N_{OE}}$

(15) $\quad S_{OE} = \sqrt{\dfrac{SSO_E - N_{OE} \times \bar{O}_E^2}{(N_{OE}-1)}}$

(16) $\quad SSO_E = \Sigma(IOES_j)^2$

The above summations are from $j = 1$ to N_{OE},

where: $\quad IVR_j$ refers to the individual variable response for the jth individual in the work group.

IFS_j refers to the individual factor score for the jth individual in the work group.

IIS_j refers to the individual inventory score for the jth individual in the work group.

$IOES_j$ refers to the individual overall effectiveness score for the jth individual in the work group.

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Compute aggregate scores. The "Compute Aggregate Scores"
process computes the effectiveness scores for all aggregate
and consolidated work groups included in the analysis. The
following information is computed and outputed from the
process for each aggregate and consolidated work group:

1. Work group code

2. Work group sample size

3. For each attitudinal variable in the OAP:

    a. Variable number

    b. Variable score sample mean ($\overline{V}_A$)

    c. Variable score sample standard deviation
(S_{VA})

    d. A count of the number of individuals in the
work group that provided valid response (N_{VA})

4. For each factor measured by the OAP (including
job enrichment factors):

    a. Factor number

    b. Factor score sample mean ($\overline{F}_A$)

    c. Factor score sample standard deviation (S_{FA})

    d. A count of the number of individuals in the
work group that had a valid factor score computed (N_{FA})

5. For each inventory within the OAP:

    a. Inventory number

    b. Inventory score sample mean ($\overline{I}_A$)

    c. Inventory score sample standard deviation
(S_{IA})

d. A count of the number of individuals in the work group that had a valid inventory score computed (N_{IA})

6. Overall effectiveness score sample mean ($\overline{O}_A$)

7. Overall effectiveness score sample standard deviation (S_{OA})

8. A count of the number of individuals in the work group that had a valid overall effectiveness score computed (N_{OA})

9. A count of the number of elementary or dummy work groups within the aggregate or consolidated work group (N_{WG})

The following formulas are used to compute the above variables:

$$(17) \quad \overline{V}_A = \frac{\Sigma [\overline{V}_{E_i} \times N_{VE_i}]}{N_{VA}}$$

$$(18) \quad S_{VA} = \sqrt{\frac{SSV_A - N_{VA} \times \overline{V}_A^2}{(N_{VA}-1)}}$$

$$(19) \quad SSV_A = \Sigma [(S_{VE_i}^2) \times (N_{VE_i}-1) + (\overline{V}_{E_i}^2) \times (N_{VE_i})]$$

$$(20) \quad N_{VA} = \Sigma (N_{VE_i})$$

$$(21) \quad \overline{F}_A = \frac{\Sigma [\overline{F}_{E_i} \times N_{FE_i}]}{N_{FA}}$$

$$(22) \quad S_{FA} = \sqrt{\frac{SSF_A - N_{FA} \times \overline{F}_A^2}{(N_{FA}-1)}}$$

$$(23) \quad SSF_A = \Sigma [(S_{FE_i}^2) \times (N_{FE_i}-1) + (\overline{F}_{E_i}^2) \times (N_{FE_i})]$$

$$(24) \quad N_{FA} = \Sigma(N_{FE_i})$$

$$(25) \quad \overline{I}_A = \frac{\Sigma[\overline{I}_{E_i} \times N_{IE_i}]}{N_{IA}}$$

$$(26) \quad S_{IA} = \sqrt{\frac{SSI_A - N_{IA} \times \overline{I}_A^2}{(N_{IA}-1)}}$$

$$(27) \quad SSI_A = \Sigma[(S_{IE_i}^2) \times (N_{IE_i}-1) + (\overline{I}_{E_i}^2) \times (N_{IE_i})]$$

$$(28) \quad N_{IA} = \Sigma(N_{IE_i})$$

$$(29) \quad \overline{O}_A = \frac{\Sigma[\overline{O}_{E_i} \times N_{OE_i}]}{N_{OA}}$$

$$(30) \quad S_{OA} = \sqrt{\frac{SSO_A - N_{OA} \times \overline{O}_A^2}{(N_{OA}-1)}}$$

$$(31) \quad SSO_A = \Sigma[(S_{OE_i}^2) \times (N_{OE_i}-1) + (\overline{O}_{E_i}^2) \times (N_{OE_i})]$$

$$(32) \quad N_{OA} = \Sigma(N_{OE_i})$$

All of the above summations are from $i = 1$ to N_{WG},

where: $\overline{V}_{E_i}$ refers to the variable score sample mean for the ith elementary work group within the aggregate work group.

N_{VE_i} refers to the number of individuals in the ith elementary work group of the aggregate work group that provided valid responses to the variable.

S_{VE_i} refers to the variable score sample standard deviation for the ith elementary work group within

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the aggregate work group.

$\overline{F}_{E_i}$ refers to the factor score sample mean for the ith elementary work group within the aggregate work group.

N_{FE_i} refers to the number of individuals in the ith elementary work group of the aggregate work group that had a valid factor score computed.

S_{FE_i} refers to the factor score sample standard deviation for the ith elementary work group within the aggregate work group.

$\overline{I}_{E_i}$ refers to the inventory score sample mean for the ith elementary work group within the aggregate work group.

N_{IE_i} refers to the number of individuals in the ith elementary work group of the aggregate work group that had a valid inventory score computed.

S_{IE_i} refers to the inventory score sample standard deviation for the ith elementary work group within the aggregate work group.

$\overline{O}_{E_i}$ refers to the overall effectiveness score sample mean for the ith elementary work group within the aggregate work group.

N_{OE_i} refers to the number of individuals in the ith elementary work group of the aggregate work group that had a valid overall effectiveness score computed.

S_{OE_i} refers to the overall effectiveness score sample standard deviation for the ith elementary work group within the aggregate work group.

Perform standards comparison. The "Perform Standards Comparison" process computes the differences between the effectiveness scores for all work groups and the three standards of comparison--Air Force average, similar work group average, and organization average. A student's t-test will be used to test the null hypothesis that the scores are equal to the standards at the 95 percent confidence level. If the test indicates no significant difference exists, the difference between the score and the standard will be indicated as zero. However, if the test indicates that there is a significant difference between the score and the standard, the actual difference will be computed.

The consolidated and dummy work group scores will not be compared against the similar work group standards, since no standards are maintained for these supplemental work groups. The scores for the supplemental work groups are considered to be the similar work group standard; consequently, the difference between the supplemental work group scores and the similar work group standard will always be

zero. The differences between the supplemental work group scores and the Air Force and organization average will be computed the same as the other work groups.

The input to this process (organization effectiveness scores) consists of the outputs from the three previous processes (Calculate Individual Scores, Calculate Elementary Scores, and Calculate Aggregate Scores). This input is also input into the OAP DBMS and used to update the data bases.

The output of the process consists of the following information for each work group evaluated by the system:

1. Work group code

2. Work group sample size

3. For each attitudinal variable in the OAP:

    a. Variable number

    b. Variable score sample mean

    c. Variable score sample standard deviation

    d. A count of the number of individuals in the work group that provided valid response

4. For each factor measured by the OAP (including job enrichment factors):

    a. Factor number

    b. Factor score sample mean

    c. Factor score sample standard deviation

    d. A count of the number of individuals in the work group that had a valid factor score computed

5. For each inventory within the OAP:

a. Inventory number

b. Inventory score sample mean

c. Inventory score sample standard deviation

d. A count of the number of individuals in the work group that had a valid inventory score computed

6. Overall effectiveness score sample mean

7. Overall effectiveness score sample standard deviation

8. A count of the number of individuals in the work group that had a valid overall effectiveness score computed

9. The difference between each mean score computed (variable, factor, inventory, and overall effectiveness) and the three standards of comparison (Air Force, similar work group, and organization), if there is a significant difference at the 95 percent confidence level.

In addition to the above, the individual scores output from the Compute Individual Scores process are also included in the output from this process. This information is required to compute frequency distributions in later processes.

Prepare Analysis Reports

The "Prepare Analysis Reports" process uses the organization evaluation data output from the previous process to prepare the various analysis reports. The reports to be prepared are specified by the management consultants in the Analysis Report Control Cards. These cards also

specify the level of the organization at which the reports are to be prepared.

This process was divided into six sub-processes (see Figure 14):

1. Print comparison report

2. Print demographic report

3. Print organization summary

4. Print detailed summary

5. Print strengths and weaknesses report

6. Print distribution report

Print comparison report. The "Print Comparison Report" process prints the OAP Comparison Analysis Report. The work groups which are included in the report are determined by the level of analysis specified on the OAP Comparison Analysis Report Option Card.

Print demographic report. The "Print Demographic Report" process prints the OAP Demographic Analysis Report for each work group specified by the level of analysis on the OAP Demographic Analysis Report Option Card. The work groups must also satisfy the frequency limits specified on the option card.

Print organization summary. The "Print Organization Summary" process prints the OAP Organization Summary.

Print detailed summary. The "Print Detailed Summary" process prints the OAP Detailed Summary for each work group specified by the level of analysis specified on the OAP Detailed Summary Option Card. The work groups must also satisfy the frequency limits specified on the option card.

Print strengths and weaknesses report. The "Print Strengths and Weaknesses Report" process identifies the potential strengths and weaknesses for all work groups specified by the level of analysis option on the Potential Strengths and Weaknesses Report Option Card. The criteria specified on the option card will be used to identify the potential strengths and weaknesses. The process will then produce the Potential Strengths and Weaknesses Report. The work groups in the report must also satisfy the frequency limits specified on the option card.

Print distribution report. The "Print Distribution Report" process produces the Work Group Distribution Report.

SYSTEM OUTPUTS

The outputs of the OAP Analysis System are utilized by management consultants in evaluating the organization. The various reports which may be produced are:

1. OAP Comparison Analysis Report
2. OAP Demographic Analysis Report
3. OAP Organization Summary

4. OAP Detailed Summary

5. Potential Strengths and Weaknesses Report

6. Work Group Distribution Report

OAP Comparison Analysis Report

The OAP Comparison Analysis Report performs a comparison of a particular parent work group with the set of work groups that it is comprised of. The parent work group must always be an aggregate or consolidated work group. The set of work groups consists of the highest hierarchal level of work groups that the parent is comprised of.

An illustration will help clarify what this report accomplishes. Figure 15 illustrates a sample organization. If the parent work group were aggregate work group I, the report would perform a comparison of aggregate work groups F, G, and H and elementary work group A with aggregate work group I. If the parent work group were aggregate work group G, the report would perform a comparison of elementary work groups B2, D1, D2, and D3 with G.

This report is especially suited to performing comparisons within a work group along demographic lines. For example, if it were desired to evaluate the differences between officers and enlisteds in work group "E1" (assume only officers and enlisteds are in the work group), two dummy work groups could be created--one containing all officer members of "E1" (called "E1O") and one containing all enlisted members of "E1" (called "E1E"). A consolidated

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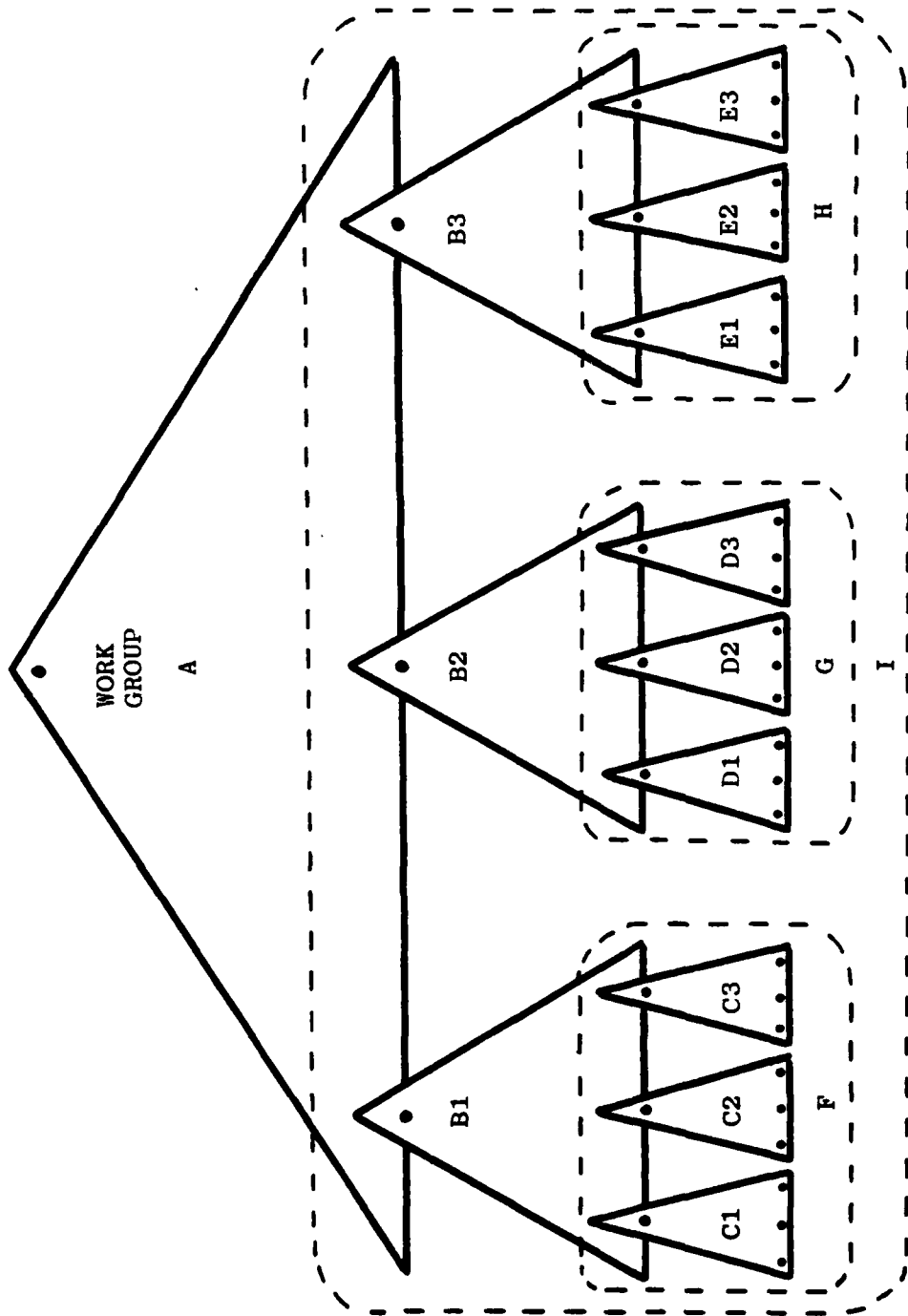
Figure 15

Comparison Analysis Report Example

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work group could then be created (called "CWG") to consist of the two dummy work groups. If the comparison report were prepared for the consolidated work group "CWG", it would compare the two dummy work groups--"E1O" and "E1E"--with "CWG" (which is the original work group "E1").

The contents of the report are as follows:

1. Name of the parent work group

2. Sample size of the parent work group

3. For each subordinate work group:

   a. Name of the work group

   b. Sample size of the work group

4. Overall effectiveness score sample mean for the parent work group

5. For each inventory within the OAP:

   a. Inventory name

   b. Inventory score sample mean for the parent work group

6. For each factor measured by the OAP (including job enrichment factors):

   a. Factor name

   b. Factor number

   c. Factor score sample mean for the parent work group

7. For each attitudinal variable within the OAP:

   a. Variable name

   b. Variable number

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c. Variable score sample mean for the parent work group

8. For every mean score computed for the parent work group (overall effectiveness, inventory, factor, and variable), the difference between the mean score and the corresponding mean scores for the subordinate work groups at the 95 percent confidence level.

OAP Demographic Analysis Report

The OAP Demographic Analysis Report describes the demographic characteristics of a particular work group. The contents of the report are as follows:

1. Name of the work group

2. Sample size of the work group

3. For each demographic variable within the OAP:

   a. Variable name

   b. Frequency distribution

The frequency distribution for each demographic variable includes:

1. Description of each value of the demographic variable (only for demographic variables in Demographic Sections I and II of the OAP)

2. Value of the variable

3. Absolute frequency of each value

4. Relative frequency (percentage) for each value

5. Adjusted frequency (eliminating "not applicable", "don't know", invalid, and missing responses)

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6. Cumulative adjusted relative frequency

OAP Organization Summary

The OAP Organization Summary provides a brief summary of an organization's effectiveness in terms of its overall effectiveness score sample mean and inventory score sample means. The contents of the report are as follows:

1. Name of the organization

2. Sample size of the organization

3. Overall effectiveness score sample mean for the organization, sample standard deviation, and 95 percent confidence interval

4. For each inventory within the OAP:

   a. Inventory name

   b. Inventory score sample mean for the organization

   c. Ninety-five percent confidence interval for the inventory score sample mean

   d. Inventory score sample standard deviation

5. For each elementary work group within the organization:

   a. Work group name

   b. Work group sample size

   c. Inventory score sample means for all inventories within the OAP

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d. Overall effectiveness score sample mean (These work groups are listed in ascending order by the work group's overall effectiveness score sample mean.)

OAP Detailed Summary

The OAP Detailed Summary provides a detailed description of a work group's effectiveness in terms of its overall effectiveness score sample mean, inventory score sample means, factor score sample means, and variable score sample means. The contents of the report are as follows:

1. Work group name

2. Work group sample size

3. Overall effectiveness score sample mean

4. Overall effectiveness score sample standard deviation

5. For each inventory within the OAP:

   a. Inventory name

   b. Inventory score sample mean

   c. Inventory score sample standard deviation

6. For each factor measured by the OAP (including job enrichment factors):

   a. Factor name

   b. Factor score sample mean

   c. Factor score sample standard deviation

7. For each attitudinal variable within the OAP:

   a. Variable name

   b. Variable score sample mean

c. Variable score sample standard deviation

d. Frequency distribution of the variable responses

8. For every mean score computed, the difference between the mean score and the Air Force, similar work group, and organization mean scores at the 95 percent confidence level.

Potential Strengths and Weaknesses Report

The Potential Strengths and Weaknesses Report describes the potential strengths and weaknesses of a particular work group. Two formats of the report are available. Only one of the formats may be selected. These formats are:

1. Factor format

2. Variable format

The factor format report describes the potential strengths and weaknesses of the work group in terms of factor scores. The variable format of the report describes the potential strengths and weaknesses in terms of variable scores. The contents of both formats of the report are as follows:

1. Work group name

2. Description of the criteria used to identify the potential strengths and weaknesses

3. List of the identified potential strengths in descending order by score sample mean

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4. List of the identified potential weaknesses in ascending order by score sample mean

Each potential strength and weakness is identified by name, number, and score sample mean.

Work Group Distribution Report

The Work Group Distribution Report contains a list of all of the work groups analyzed during a particular evaluation of an organization. The report includes the following items:

1. Name of the organization

2. For every work group that was evaluated (includes consolidated and dummy work groups):

   a. Work group name

   b. Work group code

   c. Work group sample size

Chapter 4

SYSTEM DESIGN SPECIFICATION

The objective of this chapter is to refine the
requirement specifications for the OAP Analysis System
described in the previous chapter. This will be accomplished
by presenting a system level design of the inputs, processes,
and outputs of the OAP Analysis System.

The data files used by the system and the inter-
mediate data files generated by the system are described in
terms of the logical file structure. The card inputs are
described in terms of card layouts. The analysis reports
which are outputed from the system are described in terms of
printer layouts. Finally, the processes involved in the
system are refined to reflect the system level design.

SYSTEM INPUTS

As described in the previous chapter, the major
inputs to the OAP Analysis System consist of:

1. Survey Responses

2. Analysis Identification Cards

3. Work Group Control Cards

4. Analysis Report Control Cards

5. OAP Structure Data Base

6. OAP Data Base System

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Survey Responses

The format of the survey responses is determined by the format of the optical scan response sheet currently being developed (Ovalle, Note 9). No further description of the format of the survey responses is required.

Analysis Identification Cards

The Analysis Identification Cards consist of three types of cards (see Figure 16):

1. Identification Card
2. Supplemental Variable Cards (optional)
3. End Card

Identification card. The Identification Card describes the organization being evaluated and the OAP survey version used during the analysis. The format of the card is as follows:

CC	Content
1-5	"IDENT"
10-15	Date of analysis (DDMMYY)
20-22	OAP Survey Version
25-27	Base Code of the base (organization being evaluated)
30-31	Major Command Code

Supplemental variable cards. The Supplemental Variable Cards describe the supplemental variables used with the particular OAP version during the analysis. These cards are
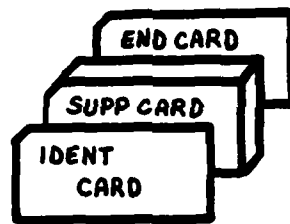
Figure 16

Analysis Identification Cards

optional; however, if supplemental variables were used with the survey, these cards are required. One Supplemental Variable Card is required for each supplemental variable (maximum of twenty) used with the survey. The format for the card is as follows:

CC	Content
1-4	"SUPP"
10-12	Attitudinal variable number associated with the supplemental variable
15-17	Relative position of the supplemental variable within the OAP survey version

End card. The End Card specifies the end of the Analysis Identification Cards. The format of the card is as follows:

CC	Content
1-3	"END"

Work Group Control Cards

The Work Group Control Cards consist of two optional sets of cards: Consolidated Work Group Cards and Dummy Work Group Cards.

Consolidated work group cards. The Consolidated Work Group Cards consist of three types of cards (see Figure 17):

1. Consolidated Work Group Identification Card
2. Work Group Cards
3. End Card

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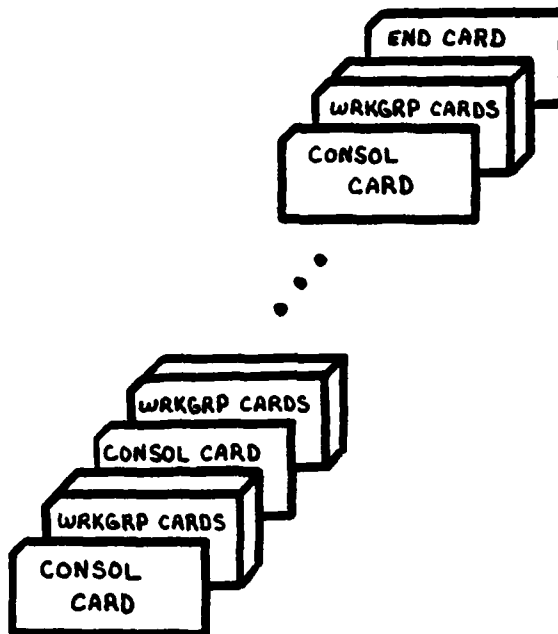
Figure 17

Consolidated Work Group Cards

The Consolidated Work Group Identification Card
defines the consolidated work group. The format of the card
is as follows:

CC	Contents
1-5	"CONSOL"
10-16	Consolidated work group code
30-69	Consolidated work group name

The Work Group cards define the set of work groups
that are to be consolidated. One Work Group Card is
required for each work group in the set. The format of the
card is as follows:

CC	Contents
1-6	"WRKGRP"
10-16	Work group code

For each consolidated work group being created, there
must be one Consolidated Work Group Identification Card and
a corresponding set of Work Group Cards. The End Card is
used to indicate the end of the Consolidated Work Group
Cards. The format of the card is the same as previously
defined.

Dummy work group cards. The Dummy Work Group Cards consist
of three types of cards (see Figure 18):

1. Dummy Work Group Identification Card

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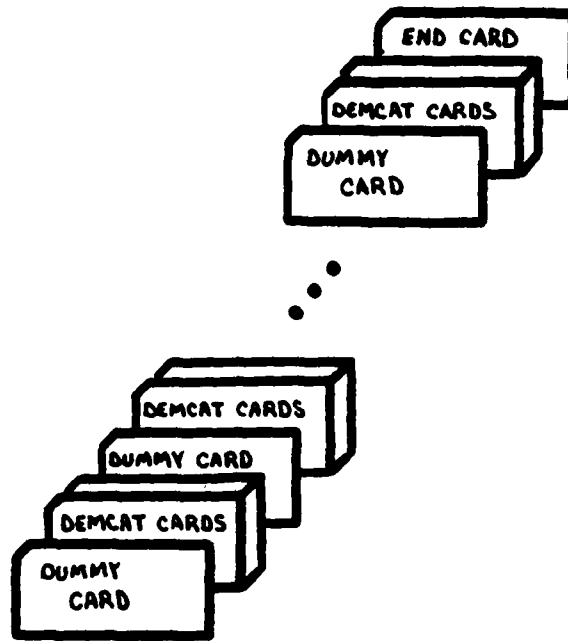
Figure 18

Dummy Work Group Cards

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2. Demographic Category Cards

3. End Card

The Dummy Work Group Identification Card defines
the dummy work group being created. The format of the card
is as follows:

CC	Contents
1-5	"DUMMY"
10-16	Dummy work group code
20-26	Base work group code
30-69	Dummy work group name

The Demographic Category Cards define the demo-
graphic categories which the dummy work group will be com-
prised of. For each demographic category (maximum of five),
one Demographic Category Card is required. The format of
the card is as follows:

CC	Contents
1-6	"DEMCAT"
10-12	Demographic variable number
20-23	Minimum value of the demographic variable (right-justified)
25-28	Maximum value of the demographic variable (right-justified)—if a single value is used to define the category, the maximum value will be equal to the minimum value

For each dummy work group created, there must be one Dummy Work Group Identification Card and a corresponding set of Demographic Category Cards. The End Card indicates the end of the Dummy Work Group Cards.

Analysis Report Control Cards

The Analysis Report Control Cards consists of nine types of cards (see Figure 19):

1. OAP Comparison Analysis Report Option Card
2. OAP Demographic Report Option Card
3. OAP Organization Summary Option Card
4. OAP Detailed Summary Option Card
5. Potential Strengths and Weaknesses Option Card
6. Work Group Distribution Report Option Card
7. Work Group Cards
8. Last Work Group Card
9. End Card

The OAP Comparison Analysis Report Option Card must be specified if the OAP Comparison Analysis Report is to be prepared. The format for the card is as follows:

CC	Contents
1-7	"COMPRPT"
10-10	Level of organization analysis
	"O"--organization level
	"A"--all aggregate/consolidated work groups
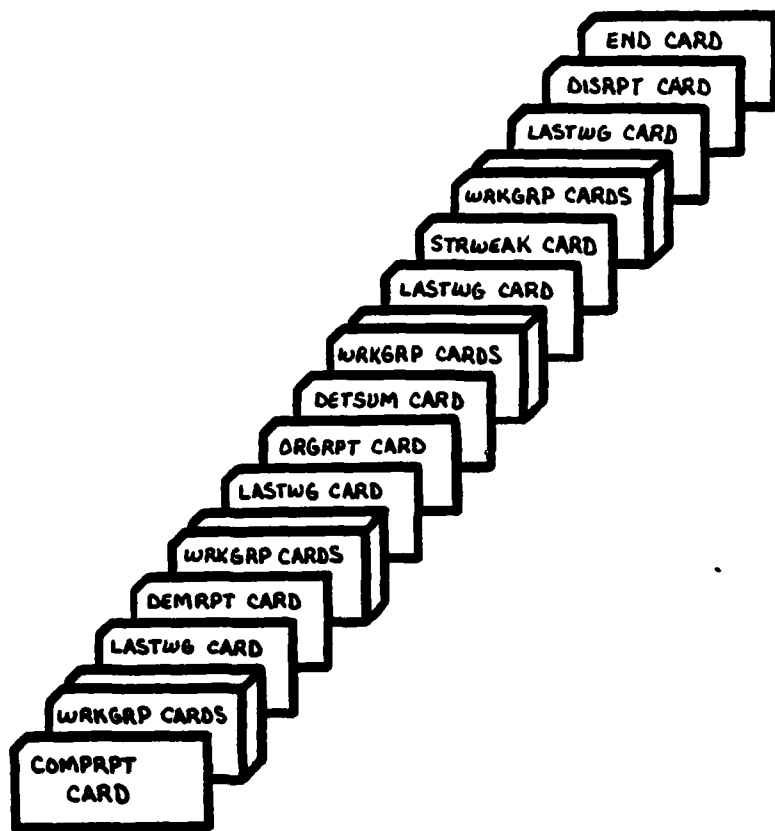
Figure 19

Analysis Report Control Cards

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"S"--selected aggregate/consolidated

work groups

If the OAP Comparison Analysis Report Option Card
specifies the selected aggregate/consolidated work groups
level of analysis, the option card must be immediately
followed by a set of Work Group Cards (same format as pre-
viously defined). One Work Group Card must be specified for
each aggregate/consolidated work group in the set. At the
end of the set of Work Group Cards, the Last Work Group
Card must be specified to indicate the end of the set of
work groups. The format for that card is as follows:

CC	Contents
1-6	"LASTWG"

The OAP Demographic Report Option Card must be
specified if the OAP Demographic Analysis Report is to be
prepared. The format for the card is as follows:

CC	Contents
1-7	"DEMRPT"
10-10	Level of organization analysis
	"O"--organization level
	"A"--all work groups level
	"S"--selected work groups level
20-22	Frequency limits (right justified)

If the OAP Demographic Report Option Card specifies the selected work groups level of analysis, the option card must be immediately followed by a set of Work Groups Cards. One Work Group Card must be specified for each work group included in the set. At the end of the set of Work Group Cards, the Last Work Group Card must be specified to indicate the end of the set of work groups.

The OAP Organization Summary Option Card must be specified if the OAP Organization Summary is to be prepared. The format for the card is as follows:

CC	Contents
1-6	"ORGRPT"

The OAP Detailed Summary Option Card must be specified if the OAP Detailed Summary is to be prepared. The format for the card is as follows:

CC	Contents
1-6	"DETSUM"
10-10	Level of organization analysis
	"O"--organization level
	"A"--all work groups level
	"S"--selected work groups level
20-22	Frequency limits (right-justified)

As with the other option cards, if the specified work groups level is indicated, the option card must be followed by a set of Work Group Cards and the Last Work Group Card. A maximum of twenty work groups may be specified.

The Potential Strengths and Weaknesses Report Option Card must be specified if the Potential Strengths and Weaknesses Report is to be prepared. The format of the card is as follows:

CC	Contents
1-7	"STRWEAK"
10-10	Level of organization analysis
	"O"--organization level
	"A"--all work groups level
	"S"--selected work groups level
20-22	Frequency limits (right-justified)
25-25	Report Format
	"F"--factor format
	"V"--variable format
30-32	Strengths and weaknesses criteria
	"STD"--standard deviation criteria
	"CUT"--cut-off score criteria
	"TOP"--top-ten bottom-ten criteria
35-36	Mean score (for standard deviation criteria)
	"AF"--Air Force mean

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"WG"--similar work group mean

"OR"--organization mean

40-42	Number of standard deviations (for standard deviation criteria)--F3.1
50-53	Strength cut-off score (for cut-off score criteria)--F4.2
55-58	Weakness cut-off score (for cut-off score criteria)--F4.2

As with the other option cards, if the specified work groups level is indicated, the option card must be followed by a set of Work Group Cards and the Last Work Group Card. A maximum of twenty work groups may be specified.

The Work Group Distribution Report Option Card must be specified if the Work Group Distribution Report is to be prepared. The format of the card is as follows:

CC	Contents
1-7	"DISRPT"

An End Card is placed after the last option card (or Last Work Group Card, if a set of work groups are associated with the last option card) to indicate the end of the Analysis Report Control Cards.

OAP Structure Data Base

The OAP Structure Data Base consists of five separate files:

1. Survey Version File

2. Inventory File

3. Factor File

4. Demographic Variable File

5. Attitudinal Variable File

The interrelationships among these files was illustrated in Chapter 3 (see Figure 10).

Survey version file. The logical record format for the Survey Version File is given in Table 1. The file is an indexed sequential file. The file is sorted in ascending survey version number order. The file access key is the survey version number.

The variable list described in Table 1 (positions 562-1236) is a sequential list of all variables (demographic and attitudinal) identified with a particular survey version (supplemental variables are not included). The variables are listed in the order in which they appear on the survey response sheet. Responses which are not used have a zero in the corresponding position in the variable list.

Inventory file. The logical record format for the Inventory File is given in Table 2. The Inventory File is an indexed sequential file. The file is sorted in ascending inventory number order. The file access key is the inventory number.

Table 1

Survey Version File Record

Positions	Data Names	Length	Type	Notes
0001-0011	Survey Version number	11	A/N	
0012-0061	Inventory list occurs 10 times			
	Inventory number	03	N	(1)
	Inventory weight	02	N	9(2), (1)
0062-0561	Factor list occurs 100 times			
	Factor number	03	N	(1)
	Factor weight	02	N	9(2), (1)
0562-1236	Variable list occurs 225 times			
	Variable number	03	N	(1)
1237-1238	Relative position of first attitudinal variable in variable list	02	N	9(2)
1239-1259	Job enrichment factor list occurs 7 times			
	Factor number	03	N	(2)

Notes: (1) Value equals zero if not used.
(2) If no job enrichment factors are measured by the survey version, value equals zero.

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Table 2

Inventory File Record

Positions	Data Names	Length	Type	Notes
001-003	Inventory number	03	N	
004-043	Inventory name	40	A/N	
044-045	Number of factors in list	02	N	9(2), (1)
046-105	Factor list occurs 20 times			
	Factor number	03	N	(2)

Notes: (1) Maximum value equals twenty.
       (2) Value equals zero if not used.

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Factor file. The logical record format for the Factor File is given in Table 3. The Factor File is an indexed sequential file. The file is sorted in ascending factor number order. The file access key is the factor number.

Demographic variable file. Table 4 describes the logical record format for the Demographic Variable File. The file is an indexed sequential file and is sorted in ascending demographic variable number order. The file access key is the demographic variable number.

Attitudinal variable file. Table 5 describes the logical record format for the Attitudinal Variable File. The file is an indexed sequential file and is sorted in ascending attitudinal variable number order. The file access key is the attitudinal variable number.

OAP Data Base System

The OAP Data Base System consists of four smaller data bases:

1. Analysis Code Data Base
2. OAP Historical Response Data Base
3. OAP Historical Organization Scores Data Base
4. OAP Work Group Standards Data Base

Analysis code data base. The Analysis Code Data Base consists of three indexed sequential files: Base Code File, Major Command File, and Work Group Code File.

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Table 3

Factor File Record

Positions	Data Names	Length	Type	Notes
001-003	Factor number	03	N	
004-043	Factor name	40	A/N	
044-045	Number of variables in list	02	N	9(2), (1)
046-105	Attitudinal variable list occurs 20 times			
	Attitudinal variable number	03	N	(2)

Notes: (1) Maximum value equals twenty. Value equals zero if factor is MPS.
(2) Value equals zero if not used.

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Table 4

Demographic Variable File Record

Positions	Data Names	Length	Type	Notes
001-003	Demographic variable number	03	N	
004-043	Demographic variable name	40	A/N	
044-047	Minimum value of variable	04	N	9(4)
048-051	Maximum value of variable	04	N	9(4)
052-451	Value description list occurs 10 times			(1)
	Description of value	40	A/N	(2)

Notes: (1) Value description list is only used for Demographic Section I and II variables.
(2) Value equals blanks if not used.

Table 5

Attitudinal Variable File Record

Positions	Data Names	Length	Type	Notes
01-03	Attitudinal variable number	03	N	
04-43	Attitudinal variable name	40	A/N	
44-44	Negatively stated variable flag	01	A/N	(1)

Notes: (1) Value equals "_" if the variable is negatively stated. Value equals blank if variable is stated normally.

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The logical record format of the Base Code File is described in Table 6. The file is sorted in ascending base code order and the base code is the file access key.

The format of the Major Command Code File is described in Table 7. The file is sorted in ascending major command code order. The major command code is the file access key.

Table 8 describes the format of the Work Group Code File. The file is sorted in ascending work group code order. The work group code is the file access key.

OAP historical response data base. The OAP Historical Response Data Base contains a historical collection of the individual scores for all organizations evaluated by the OAP Analysis System. The data base consists of two types of records: Header Record and Individual Scores Record.

The records in the data base are ordered in ascending data order (analysis date). All individuals for a given base and a given time are grouped together. These scores are preceded by a Header Record.

The format of the Header Record is described in Table 9. The Header Record describes the format of the Individual Scores Record and contains information common to the scores for a given survey administration.

The inventory list (positions 1208-1257 in the Header Record) describes the inventories within the particular OAP version. The factor list (positions 0708-1207)

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Table 6

Base Code File Record

Positions	Data Names	Length	Type
001-003	Base Code	003	N
004-043	Base name	040	A/N

Table 7

Major Command Code File Record

Positions	Data Names	Length	Type
001-002	Major command code	002	N
003-042	Major command name	040	A/N

Table 8

Work Group Code File Record

Positions	Data Names	Length	Type
001-007	Work group code	007	A/N
008-047	Work group name	040	A/N

Table 9

Header Record

Positions	Data Names	Length	Type	Notes
0001-0006	Date of analysis	06	N	YYMMDD
0007-0017	Survey version number	11	A/N	
0018-0020	Base code	03	N	
0021-0022	Major command code	02	N	
0023-0027	Survey sample size	05	N	9(5)
0028-0702	Variable list occurs 225 times			
	Variable number	03	N	(1)
0703-0704	Relative position of first attitudinal variable in variable list	02	N	9(2)
0705-0707	Relative position of first supplemental variable in variable list	03	N	9(3), (2)
0708-1207	Factor list occurs 100 times			
	Factor number	03	N	(1)
	Number of variables	02	N	9(2), (3)
1208-1257	Inventory list occurs 10 times			
	Inventory number	03	N	(1)
	Number of factors	02	N	9(2), (3)
1258-1617	Job enrichment variable list occurs 120 times			
	Relative position of variable in variable list	03	N	9(3), (1)
1618-1647	Job enrichment factor list occurs 6 times			
	Factor number	03	N	(4)
	Number of variables	02	N	9(2), (5)
1648-1650	MPS factor number	03	N	(4)

Notes: (1) Value equals zero if not used.
(2) Value equals zero if no supplemental variables used.

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Table 9 (continued)

Positions	Data Names	Length	Type	Notes

Notes: (3) Maximum value equals twenty. Value equals zero if not used.
(4) Value equals zero if no job enrichment factors measured.
(5) Maximum value equals twenty. Value equals zero if no job enrichment factors measured.

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describes the factors measured by the OAP version. The factors are listed in inventory order. All factors measured by the first inventory in the inventory list are listed first in the factor list. Factors from the second inventory are listed next and so on.

The variable list (positions 0028-0702) describes all of the variables measured by the OAP version (including supplemental variables). The structure of the variable list consists of four sections.

The first section describes the variables in Demographic Section I of the OAP (refer to OAP Physical Structure section in Chapter 3). The variables are listed in the order in which they appear on the survey response sheet.

The second section describes the attitudinal variables that are standard for the particular survey version (in other words, it does not describe supplemental variables). The starting position of this section in the variable list is identified by positions 0703-0704. The variables in this section are listed in factor order. All variables measured by the first factor in the factor list are listed first in this section of the variable list. Variables from the second factor are listed next and so on.

The structure of the inventory list, factor list, and second section of the variable list are structured in the manner described above to permit an easy association between the variables and corresponding factors that they

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measure and between the factors and the corresponding inventories that they are measured in. These associations are needed in preparing the analysis reports.

The third section of the variable list describes the supplemental variables (if any). The starting position of this section in the variable list is identified by positions 0705-0707 in the Header Record. The supplemental variables are listed in the order in which they appear on the survey.

The last section of the variable list describes the variables that correspond to the Demographic Sections II and III in the OAP. This section always begins in the 200th position in the variable list. This is because Demographic Section II of the OAP begins with the 200th response. The variables in this section are listed in the order in which they appear on the survey response sheet. If all of the responses are not used, the corresponding positions in the variable list are left empty (zero).

The job enrichment factor list (positions 1618-1647) describes the factor numbers associated with the six job enrichment factors (if they are measured). The factor numbers are listed in the following sequence: skill variety, task identity, task significance, job feedback, task autonomy, and need for enrichment.

The job enrichment variable list describes the variables associated with the job enrichment factors. As with the variable list, the variables in the job enrichment

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variable list are listed in job enrichment factor order. The variables for the skill variety factor are listed first, task identity factor second, task significance third, and so on. Rather than containing the actual variable number, the job enrichment variable list contains a pointer to the position in the variable list where the variable number is located. This structure was necessary because the variables which measure the job enrichment factors are also used to measure the factors in the factor list; consequently, structuring the list in this manner eliminated the need to carry duplicate scores for the variables in the Individual Scores Record.

The format of the Individual Scores Record is presented in Table 10. The variable responses were broken into five lists because of the variance in the size of the responses. The order of the responses in the lists, however, is the same as presented in the variable list in the Header Record. The factor scores, inventory scores, and job enrichment factor scores are also in the same order as indicated by their corresponding lists in the Header Record.

OAP historical organization scores data base. The OAP Historical Organization Scores Data Base contains a historical collection of the work group scores for all organizations evaluated by the system. The data base is also constructed of two types of records: Header Record and Work Group Scores Record.

Table 10

Individual Scores Record

Positions	Data Names	Length	Type	Notes
001-007	Work group code	7	A/N	
008-014	Supervisor code	7	A/N	(1)
015-019	Sequence number	5	N	
020-024	AFSC	5	N	
025-224	Variable list I occurs 200 times			
	Variable response	1	N	9(1), (2)
225-254	Variable list II occurs 15 times			
	Variable response	2	N	9(2), (3)
255-258	Variable list III	4	N	9(4), (4)
259-270	Variable list IV occurs 4 times			
	Variable response	3	N	9(3), (4)
271-280	Variable list V occurs 5 times			
	Variable response	2	N	9(2), (4)
281-580	Factor list occurs 100 times			
	Factor score	3	N	9V99, (5)
581-610	Inventory list occurs 10 times			
	Inventory score	3	N	9V99, (5)
611-613	Overall effectiveness score	3	N	9V99, (5)
614-631	Job enrichment list occurs 6 times			
	Factor score	3	N	9V99, (5)
632-634	MPS factor score	3	N	9(3), (5)

Notes:
(1) Blank, if respondent is not a supervisor.
(2) Negative, if variable is negatively stated.   Missing value = zero.
    Not applicable = 8.   Don't know = 9.
(3) Missing value = zero.   Not applicable = 11.   Don't know = 12.
(4) Missing value = zero.
(5) Score equals zero, if unable to compute.

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The records in the data base are ordered in ascending date order. All work group scores for a given base at a given time are grouped together. The set of work group scores are preceded by a Header Record.

The format of the Header Record is the same as described in the previous section. The format of the Work Group Scores Record is presented in Table 11.

The Work Group Scores Record contains only the attitudinal variable scores. Information concerning the demographics of the work group must be obtained from the Individual Scores Records for that work group. The variable scores within the Work Group Scores Record are listed in the same relative position as the variable responses are in the variable list I of the Individual Scores Record. The first several variable scores in the variable score list will probably not be used because they correspond to demographic variables (Demographic Section I of the OAP). It was necessary to structure the list in this manner because of the variable number of the demographic variables in Demographic Section I. It is possible that the section may not contain any variables.

The variable NV in the variable score list refers to the number of individuals in the work group that provided a valid response to the corresponding variable. The variables NF, NI, and NO refer to the number of individuals in the work group that had valid factor, inventory, and overall

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Table 11

Work Group Scores Record

Positions	Data Names	Length	Type	Notes
0001-0007	Work group code	7	A/N	
0008-0012	Work group sample size	5	N	9(5)
0013-2212	Variable score list occurs 200 times			
	Variable score sample mean	3	N	S9V99, (1), (2)
	Variable score sample std. dev.	3	N	9V99, (2)
	NV	5	N	9(5), (2)
2213-3312	Factor score list occurs 100 times			
	Factor score sample mean	3	N	9V99, (2)
	Factor score sample std. dev.	3	N	9V99, (2)
	NF	5	N	9(5), (2)
3313-3422	Inventory score list occurs 10 times			
	Inventory score sample mean	3	N	9V99, (2)
	Inventory score sample std. dev.	3	N	9V99, (2)
	NI	5	N	9(5), (2)
3423-3425	Overall effectiveness score sample mean	3	N	9V99
3426-3428	Overall effectiveness score sample std. dev.	3	N	9V99
3429-3433	NO	5	N	9(5)
3434-3499	Job enrichment factor list occurs 6 times			
	Factor score sample mean	3	N	9V99, (3)
	Factor score sample std. dev.	3	N	9V99, (3)
	NF	5	N	9(5), (3)
3500-3502	MPS sample mean	3	N	9(3), (3)
3503-3505	MPS sample standard deviation	3	N	9(3), (3)
3506-3510	NMPS	5	N	9(5), (3)

Notes: (1) Negative mean indicates negatively stated variable.
      (2) Value equals zero if not used.
      (3) Value equals zero if no job enrichment factors measured.

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effectiveness scores computed, respectively. Variable NMPS refers to the number of individuals in the work group that had a valid MPS computed.

OAP work group standards data base. The OAP Work Group Standards Data Base consists of two separate files: Overall Effectiveness/Inventory Standards File and the Factor/ Variable Standards File.

The data base requires separate files because the overall effectiveness score and the inventory scores are computed using subjective weights (unlike the variable and factor scores). The subjective weights are associated with a particular version of the OAP. It was, therefore, necessary to include the survey version number in the record key for these standards so that the standard for a particular inventory score or overall effectiveness score would be computed using only those scores which were computed using the same subjective weights.

The formats of the Overall Effectiveness Standard Record and the Inventory Standard Record are presented in Tables 12 and 13, respectively. In order to make the record keys the same length (to avoid having three separate files), a filler of zeroes was inserted in the record key for the Overall Effectiveness Standard Record (positions 08-10). The zeroes also serve to differentiate between an Overall Effectiveness Standard Record and an Inventory Standard Record.

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Table 12

Overall Effectiveness Standard Record

Positions	Data Names	Length	Type	Notes
01-21	Record key			
01-07	Work group code	07	A/N	
08-10	Filler	03	N	"000"
11-21	Survey version number	11	A/N	
22-24	Overall effectiveness score sample mean	03	N	9V99
25-27	Overall effectiveness score sample	03	N	9V99
28-33	standard deviation N	06	N	9(6), (1)
34-39	Date of last update	06	N	YYMMDD

Notes: (1) N refers to the number of individuals that had a valid overall
effectiveness score computed.

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Table 13

Inventory Standard Record

Positions	Data Names	Length	Type	Notes
01-21	Record key			
01-07	Work group code	07	A/N	
08-10	Inventory number	03	N	
11-21	Survey version number	11	A/N	
22-24	Inventory score sample mean	03	N	9V99
25-27	Inventory score sample standard deviation	03	N	9V99
28-33	N	06	N	9(6), (1)
34-39	Date of last update	06	N	YYMMDD

Notes: (1) N refers to the number of individuals in the work group that had a valid inventory score computed.

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The variable N defined in both records refers to the number of individuals within the data base for a given work group and survey version that had a valid score (overall effectiveness or inventory) computed.

The Overall Effectiveness/Inventory Standards File is an indexed sequential file and is sorted in ascending record key order. The file access key is record key.

The Factor/Variable Standards File is also an indexed sequential file. The formats for the Factor Standard Record and the Variable Standard Record are presented in Tables 14 and 15, respectively. The only difference between the two records is the record type field (position 08). This field is used to differentiate between the two record types.

The Factor/Variable Standards File is sorted in ascending record key order and the record key serves as the file access key.

SYSTEM PROCESSES

The major processes previously defined for the OAP Analysis System are:

1. Validate Responses

2. Evaluate Responses

3. Prepare Analysis Reports

Validate Responses

The "Validate Responses" process was further divided into four sub-processes:

Table 14

Factor Standard Record

Positions	Data Names	Length	Type	Notes
01-11	Record key			
01-07	Work group code	7	A/N	
08-08	Record type	1	A/N	"F"
09-11	Factor number	3	N	
12-14	Factor score sample mean	3	N	9V99, (1)
15-17	Factor score sample standard deviation	3	N	9V99, (1)
18-23	N	6	N	9(6), (2)
24-29	Date of last update	6	N	YYMMDD

Notes: (1) Format is 9(3), if the factor is MPS.
(2) N refers to the number of individuals in the work group that had a valid factor score computed.

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Table 15

Variable Standard Record

Positions	Data Names	Length	Type	Notes
01-11	Record key			
01-07	Work group code	7	A/N	
08-08	Record type	1	A/N	"V"
09-11	Variable number	3	N	
12-14	Variable score sample mean	3	N	9V99
15-17	Variable score sample standard deviation	3	N	9V99
18-23	N	6	N	9(6), (1)
24-29	Date of last update	6	N	YYMMDD

Notes: (1) N refers to the number of individuals in the work group that provided a valid response to the variable.

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1. Scan Responses

2. Translate Responses

3. Validate Work Group Codes

4. Edit Responses

Until more information is available on the type of hardware that will be used to optically read the survey response wheets, nothing more can be said about the function of the "Scan Responses" process. This section, therefore, will concentrate on the remaining three processes.

Translate responses. The input into the "Translate Responses" process is also dependent upon the optical hardware and, therefore, cannot be described at this time. The format of the output of this process, however, is presented in Table 16.

The variable responses were broken up into five sections because of the differing size of response. The responses are listed in the order in which they appear on the survey response sheet. Missing responses in all of the sections will be coded as a zero response by this process.

Variable list I refers to the variables in Demographic Section J and the Attitudinal Section of the OAP. The largest available response category for these variables is seven. The "not applicable" response category will be coded as an eight by the process and the "don't know" category will be coded as a nine.

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Table 16

Translated Response Record

Positions	Data Names	Length	Type	Notes
001-007	Work group code	7	A/N	
008-014	Supervisor code	7	A/N	(1)
015-019	Sequence number	5	N	
020-024	AFSC	5	N	
025-224	Variable list I occurs 200 times			
	Variable response	1	N	9(1), (2)
225-254	Variable list II occurs 15 times			
	Variable response	2	N	9(2), (3)
255-258	Variable list III	4	N	9(4), (4)
259-270	Variable list IV occurs 4 times			
	Variable response	3	N	9(3), (4)
271-280	Variable list V occurs 5 times			
	Variable response	2	N	9(2), (4)

Notes: (1) Blank, if respondent is not a supervisor.
(2) Missing value equals zero. Not applicable value equals 8. Don't know value equals 9.
(3) Missing value equals zero. Not applicable value equals 11. Don't know value equals 12.
(4) Missing value equals zero.

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Variable list II refers to the Demographic Section II of the OAP. The largest available response category for these variables is ten. The "not applicable" response will be coded as an eleven and the "don't know" responses will be coded as a twelve.

Variable lists III, IV, and V refer to the multi-digit demographic variables in Demographic Section III of the OAP. These variables do not have a "not applicable" or a "don't know" response category available.

Validate work group codes. The "Validate Work Group Codes" process will initially sort all of the Translated Response Records from the previous process in ascending work group code order. The process will then read each sorted record and verify that the work group code has been defined in the Work Group Code File. If the work group code is not found, the process will write a message to the user indicating the work group code and the sequence number associated with the response.

After all of the records have been processed, the process will allow the user to correct the work group codes before continuing to the next process. If corrections are made, all of the survey responses will have to be scanned and translated again.

Once the user is satisfied with the results of this process, the processing will proceed to the "Edit Responses" process. The output of the "Validate Work Group Codes"

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process is in the same format as the Translated Response Records, except that the records are now sorted by work group code.

Edit responses. Once all of the input survey responses have been verified to contain valid work group codes (or else rejected), the "Edit Responses" process will ensure that valid responses have been provided to the demographic variables.

The attitudinal variable responses do not have to be edited since they are all required to be measured on a 7-point Likert scale and only seven response categories are available in the Attitudinal Section of the OAP.

The demographic variables, on the other hand, may not use all of the response categories available. In addition, the multi-digit demographic variables may have a specific range of valid responses.

The "Edit Responses" process will determine the valid range of each demographic variable used in the survey from the Demographic Variable File within the OAP Structure Data Base. This information will be placed in a table to be referenced while editing each response.

Once the range of each demographic variable has been determined, each survey response will be checked to ensure that only valid demographic responses have been given. In the event that an invalid response is discovered, the

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response will be converted to zero and the invalid response will be treated as a missing response.

The output of this process consists of all validated responses and the format of each response record is the same as the Translated Response Record in Table 16.

Evaluate Responses

The "Evaluate Responses" process was further divided into four sub-processes.

1. Compute Individual Scores
2. Compute Elementary Scores
3. Compute Aggregate Scores
4. Perform Standards Comparison

Compute individual scores. Once all of the input responses have been validated to ensure valid responses have been given, the "Compute Individual Scores" process will compute the factor scores, inventory scores, and overall effectiveness score for each validated response.

The output of this process is in the same format as defined earlier under the OAP Historical Response Data Base. The data base consists of historical collection of the output of this process.

The "Compute Individual Scores" process will initially prepare the Header Record (see Table 9). The inventories, factors, and variables used in the analysis are identified by the Survey Version File of the OAP Structure

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Data Base. If supplemental variables are used, they will be defined by the Analysis Identification Cards. The unique structure of the variable list discussed earlier is prepared.

Once the Header Record has been prepared, each validated response is formatted into the Individual Scores Record (see Table 10). The corresponding factor, inventory, and overall effectiveness scores are computed using the formulas described in Chapter 3. The scores are then stored in the appropriate places in the Individual Scores Record.

If a particular factor score cannot be computed because the respondent did not provide at least two valid responses to the variables that determine the factor, the factor score will be set equal to zero. The corresponding inventory score that the factor score is used to compute is also set equal to zero, as well as the overall effectiveness score.

If a variable response is from a variable that was negatively stated in the OAP survey version, the corresponding response in the Individual Scores Record will be multiplied by minus one before being stored in the record. When the variable response is used to compute a factor score, the value of eight is added to the negative response prior to being used to compute the factor score. This will effectively convert the variable response to a normal scale.

Upon completion of building all of the Individual
Scores Records, the processing will proceed to the "Compute
Elementary Scores" process.

Compute elementary scores. The "Compute Elementary Scores"
process aggregates the Individual Scores Records produced by
the previous process into elementary and dummy Work Group
Scores Records. The format of these records is the same as
the Work Group Scores Record (Table 11) described earlier.

The elementary and dummy work group scores will be
computed as follows. The process will maintain three running
totals for each variable response, factor score, inventory
score, and overall effectiveness score for the individuals
within a particular elementary or dummy work group: (1) sum
of the responses (or scores); (2) sum of the squared
responses (or scores); and (3) a count of the number of
individuals that provided a valid response (or score).

As each Individual Scores Record is processed for a
given work group, the three totals will be adjusted accord-
ingly. Only valid responses and scores will be added to the
totals. A valid response or score is identified as having
a value between one and seven, inclusively.

Once all of the Individual Scores Records for a
particular elementary work group have been entered into the
three totals, the work group scores sample means and sample
standard deviations will be computed using the formulas

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described in Chapter 3. The scores will then be stored in the Work Group Scores Record and written out to the Elementary Scores File.

The above process will be repeated until all of the elementary and dummy work groups have been processed.

Compute aggregate scores. The "Compute Aggregate Scores" process aggregates the elementary and dummy Work Group Scores Records from the previous process into aggregate and consolidated Work Group Scores Records. The format of these records is the same as the dummy and elementary Work Group Scores Records.

The aggregate and consolidated work group scores will be computed as follows. As in the previous process, three running totals will be maintained for the elementary or dummy work groups within a particular aggregate or consolidated work group. The sample mean scores and sample standard deviation scores for the elementary and dummy work groups are converted to a sum of responses (or scores) and a sum of squared responses (or scores) using the formulas from Chapter 3. The sum of responses (or scores), sum of squared responses (or scores), and the number of individuals that provided a valid response (or score) for the elementary or dummy work group are then added to the three totals. By doing this, the sample mean scores and sample standard deviation scores for the aggregate and consolidated work

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groups will reflect the sample mean and standard deviation for all individual responses within the aggregate or consolidated work group.

Once all of the elementary and dummy work groups have been processed for a particular aggregate or consolidated work group, the aggregate/consolidated work group scores are computed using the formulas from Chapter 3, formatted into the Work Group Scores Record, and written out to the Aggregate Scores File.

The above process is repeated until all of the scores for all of the aggregate and consolidated work groups have been computed and written out to the Aggregate Scores File.

Perform standards comparison. Once all of the work group scores have been computed for all elementary, dummy, aggregate, and consolidated work groups, the "Perform Standards Comparison" process will compare the work group scores sample means to the three standards of comparison--Air Force, similar work group, and organization.

The Air Force and similar work group standards are maintained in the OAP Work Group Standards Data Base. The organization standards were computed in the previous process under the aggregate work group code of "0000000".

The format of the input to this process (Organization Effectiveness Scores File) consists of the Header Record prepared by the "Compute Individual Scores" process.

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This is followed by the Individual Scores Records also produced by the "Compute Individual Scores" process. The elementary and dummy Work Group Scores Records produced by the "Compute Elementary Scores" process are next. Finally, the last group of records are the aggregate and consolidated Work Group Scores Records produced by the "Compute Aggregate Scores" process.

For each Work Group Scores Record, the scores for the work group are compared to the three standards of comparison using the following test hypotheses:

1. H_o: $\mu_{WG} = \mu_{AF}$

   H_a: $\mu_{WG} \neq \mu_{AF}$

2. H_o: $\mu_{WG} = \mu_{SWG}$

   H_a: $\mu_{WG} \neq \mu_{SWG}$

3. H_o: $\mu_{WG} = \mu_{ORG}$

   H_a: $\mu_{WG} \neq \mu_{ORG}$

where μ_{WG} refers to the population mean score for the work group.

μ_{AF} refers to the population mean score for the Air Force.

μ_{SWG} refers to the population mean score for all similar work groups.

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μ_{ORG} refers to the population mean score for the organization.

If the results of a student's t-test indicates a rejection of the null hypothesis at the .05 significance level, the difference between the scores will be computed as follows:

(1) $\Delta_{AF} = \bar{X}_{WG} - \bar{X}_{AF}$

(2) $\Delta_{SWG} = \bar{X}_{WG} - \bar{X}_{SWG}$

(3) $\Delta_{ORG} = \bar{X}_{WG} - \bar{X}_{ORG}$

where Δ_{AF} refers to the difference between the work group score and the Air Force standard.

Δ_{SWG} refers to the difference between the work group score and the similar work group standard.

Δ_{ORG} refers to the difference between the work group score and the organization standard.

$\bar{X}_{WG}$ refers to the work group score sample mean.

$\bar{X}_{AF}$ refers to the Air Force score sample mean.

$\bar{X}_{SWG}$ refers to the similar work group score sample mean.

$\bar{X}_{ORG}$ refers to the organization score sample mean.

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The results of the comparisons will be formatted into the Work Group Comparison Record. The format of this record is presented in Table 17.

The output of this process (called Organization Evaluation Data File) consists of the Header Record, all Individual Scores Records, and, for each work group, the Work Group Scores Record followed immediately by the Work Group Comparison Record.

Prepare Analysis Reports

The "Prepare Analysis Reports" process formats the information contained in the Organization Evaluation Data File into the various analysis reports. The process consists of six sub-processes:

1. Print Comparison Report
2. Print Demographic Report
3. Print Organization Summary
4. Print Detailed Summary
5. Print Strengths and Weaknesses Report
6. Print Distribution Report

Print comparison report. For each aggregate or consolidated work group specified by the OAP Comparison Analysis Report Option Card, the "Print Comparison Report" process will prepare the OAP Comparison Analysis Report. An example of this report is given in Figure 20.

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Table 17

Work Group Comparison Record

Positions	Data Names	Length	Type	Notes
0001-0007	Work group code	7	A/N	
0008-1807	Variable difference list occurs 200 times			
	Air Force difference	3	N	S9V99, (1)
	Similar work group difference	3	N	S9V99, (1)
	Organization difference	3	N	S9V99, (1)
1808-2707	Factor difference list occurs 100 times			
	Air Force difference	3	N	S9V99, (1)
	Similar work group difference	3	N	S9V99, (1)
	Organization difference	3	N	S9V99, (1)
2708-2797	Inventory difference list occurs 10 times			
	Air Force difference	3	N	S9V99, (1)
	Similar work group difference	3	N	S9V99, (1)
	Organization difference	3	N	S9V99, (1)
2798-2800	OES -- Air Force difference	3	N	S9V99, (2)
2801-2803	OES -- Similar work group difference	3	N	S9V99, (2)
2804-2806	OES -- Organization difference	3	N	S9V99, (2)
2807-2860	Job enrich. difference list occurs 6 times			
	Air Force difference	3	N	S9V99, (3)
	Similar work group difference	3	N	S9V99, (3)
	Organization difference	3	N	S9V99, (3)
2861-2863	MPS -- Air Force difference	3	N	S9(3), (3)
2864-2866	MPS -- Similar work group difference	3	N	S9(3), (3)
2867-2869	MPS -- Organization difference	3	N	S9(3), (3)

Notes: (1) Value equals zero if not used.
        (2) OES refers to Overall Effectiveness Score.
        (3) Value equals zero if job enrichment factors not measured.

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OAP COMPARISON ANALYSIS

(Title of present work group ———→)
(W.G. Code)
(Title of sub-work group ———→) (W.G. Code) CASES = 9999

WG 01:
WG 02:
WG 03:
⋮
WG 10:

NUMBER OF CASES = 9999

############### COMPARISON OF WORK GROUPS ###############

INVENTORY/FACTOR/VARIABLE	SCORE	WG 01	WG 02	WG 03	WG 04	WG 05	WG 06	WG 07	WG 08	WG 09	WG 10
JOB INVENTORY											
F999 JOB ENRICHMENT	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
V999 (Variable description)	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
V999	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
V999	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
SUPERVISOR INVENTORY	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
SUPPLEMENTAL VARIABLES											
V999 (Variable description)	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
V999	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
V999											
JOB ENRICHMENT FACTORS											
F999 SKILL VARIETY	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
F999 TASK IDENTITY											
F999 TASK SIGNIFICANCE											
F999 JOB FEEDBACK											
F999 TASK AUTONOMY											
F999 NEED FOR ENRICHMENT	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99
F999 MOTIVATION POTENTIAL SCORE	999.	±999.	±999.	±999.	±999.	±999.	±999.	±999.	±999.	±999.	±999.
OVERALL EFFECTIVENESS SCORE	9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99	±9.99

Figure 20

OAP Comparison Analysis Report

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The process will initially determine those work groups (called sub-work groups) which are to be compared to the parent work group. Once the sub-work groups have been identified, the scores for all of the sub-work groups will be compared to the scores for the parent work group using the following test hypothesis:

$$H_o: \quad \mu_{PWG} = \mu_{SWG}$$

$$H_a: \quad \mu_{PWG} \neq \mu_{SWG}$$

where μ_{PWG} refers to the population mean score for the parent work group.

μ_{SWG} refers to the population mean score for the sub-work group.

If the results of a student's t-test indicate a rejection of the null hypothesis at the .05 significance level, the difference between the scores will be computed as follows:

$$(4) \quad \Delta = \overline{X}_{SWG} - \overline{X}_{PWG}$$

where Δ refers to the difference between the sub-work group score and the parent work group score.

$\overline{X}_{SWG}$ refers to the sub-work group score sample mean.

$\overline{X}_{PWG}$ refers to the parent work group score sample mean.

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If the results of the t-test indicate no significant difference between the scores, the difference between the scores will be set equal to zero. These differences are then displayed in the comparison of work groups section of the report. The differences were computed in this manner, so that an analyst could easily go down the solumn pertaining to a particular sub-work and identify those areas where the sub-work group is stronger than the parent work group (identified by a positive difference) and weaker than the parent work group (negative difference).

The report format allows for a comparison of ten sub-work groups to a page (due to space limitation). In the event that more than ten sub-work groups are identified, the remainder of the sub-work groups will be compared on subsequent pages of the report.

The results of the comparisons will be formatted into the OAP Comparison Analysis Report. The top portion of the report describes the parent work group and the sub-work groups (maximum of ten). The names of the work groups are obtained from the Work Group Code File.

The bottom portion of the report shows the results of the comparison. The columns labeled "WG 01" to "WG 10" contain the differences for the ten sub-work groups defined at the top of the report. The column labeled "SCORE" refers to the parent work group's score sample means.

The sequence in which the scores are given in the report is as follows. The scores for the standardized portion of the OAP will be presented first. This refers to the scores for the inventories, factors measured by them, and variables contained in them. The variable scores are listed under the factor that they measure. The factor scores are listed under the inventory that they are measured in. This format is produced easily given the unique structure of the inventory list, factor list, and variable list within the Work Group Scores Record.

The scores for the supplemental variables will be presented next. The scores for the job enrichment factors will then be presented. The bottom line of the report presents the overall effectiveness score.

The names of the inventories, factors, and variables shown on the left side of the report are obtained from the OAP Structure Data Base.

Print demographic report. The "Print Demographic Report" process will prepare the OAP Demographic Analysis Report for each work group specified by the level of analysis on the OAP Demographic Analysis Option Card. The work groups must also satisfy the frequency limits specified on the option card. An example of the report is given in Figure 21.

The process will use as its input the Individual Scores Records within the Organization Evaluation Data File. For each value of each demographic variable within the OAP

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OAP DEMOGRAPHIC ANALYSIS

NUMBER OF CASES = 9999

(Title of work group →
(u.s. code)

VALUE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE FREQUENCY (PERCENT)
0	23	3.8	16.8	16.8
1	96	16.0	18.2	35.0
2	104	14.3	20.3	55.3
3	116	14.3	9.6	64.9
4	55	9.2	13.8	78.7
5-6	94	13.1	21.3	100.0
8	132	20.3		
9	4	0.7		
	1	0.2		

VALUE

TITLE: TOTAL YEARS IN AIR FORCE

MISSING
LESS THAN 1 YEAR
MORE THAN 1 YEAR, LESS THAN 2 YEARS
MORE THAN 2 YEARS, LESS THAN 3 YEARS
MORE THAN 3 YEARS, LESS THAN 6 YEARS
MORE THAN 6 YEARS, LESS THAN 8 YEARS
MORE THAN 8 YEARS
NOT APPLICABLE
DONT KNOW

TITLE: TOTAL MONTHS IN PRESENT CAREER FIELD

Figure 21

OAP Demographic Analysis Report

version, an accumulator variable will be used to maintain the absolute frequency of re ..onse. The Individual Scores Records for all individuals within the work group will be processed and the appropriate accumulator variables will be incremented.

Once the information from each individual in the work group has been processed, the relative frequency, adjusted frequency, and cumulative adjusted frequency for each value of each demographic variable will be computed using the following formulas:

$$(5) \quad RF_{ij} = \frac{F_{ij}}{TF_j} \times 100.0$$

$$(6) \quad AF_{ij} = \frac{F_{ij}}{TVF_j} \times 100.0$$

$$(7) \quad CF_{ij} = \Sigma AF_{kj}$$

The above summation is from $k = 1$ to i.

Where RF_{ij} refers to the relative frequency of the ith value of the jth demographic variable.

F_{ij} refers to the absolute frequency of the ith value of the jth demographic variable.

TF_j refers to the total frequency for the jth demographic variable.

AF_{ij} refers to the adjusted frequency of the ith value of the jth demographic variable. AF_{ij} is not

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computed if the ith value is "not applicable",
"don't know", or missing.

TVF_j refers to the total valid frequency for the
jth demographic variable. TVF_j does not include
"not applicable", "don't know", and missing values.

CF_{ij} refers to the cumulative adjusted frequency for
the ith value of the jth demographic variable. CF_{ij}
is not computed if the ith value is "not applicable",
"don't know", or missing.

Once all of the above frequencies have been computed,
the information is formatted into the report. The description of each value of the demographic variable will be
printed on the report if it has been previously defined in
the Demographic Variable File of the OAP Structure Data Base.
The name of the demographic variable will also be obtained
from the Demographic Variable File. The title of the work
group will be obtained from the Work Group Code File within
the Analysis Code Data Base (a part of the OAP Data Base
System).

Print organization summary. The "Print Organization Summary"
process prepares the OAP Organization Summary Report. An
example of the report is given in Figure 22. The process
will use as its primary input the Work Group Scores Records
within the Organization Evaluation Data File.

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OAP ORGANIZATION SUMMARY

(Title of organization ————————)

OVERALL EFFECTIVENESS SCORE------ 9.99
STANDARD DEVIATION --------------- 9.99
CONFIDENCE INTERVAL ------- 9.99 TO 9.99

INVENTORY	SCORE	STD DEV	CONFIDENCE INTERVAL
1. JOB INVENTORY	9.99	9.99	9.99 TO 9.99
2. SUPERVISOR INVENTORY			
3. ORGANIZATION CLIMATE	...	...	· · · · · ·
4. PERCEIVED PRODUCTIVITY			
5. JOB SATISFACTION			
6.			
8.			
9.			
10.	· · ·	· · ·	

INVENTORY SCORES

	CASES	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	WORK GROUP SCORE
	999	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99
	...	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·
	999	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99
	---	---	---	---	---	---	---	---	---	---	---	---
	999	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99

DESCRIPTION

(Name of elementary work group ————————)

ORGANIZATION SCORES

WORK GROUP CODE

(Code —)

Figure 22

OAP Organization Summary Report

The process will initially locate the Work Group Scores Record that corresponds to the overall organization. This will be the record with a work group code of all zeroes ("0000000"). Once the record has been found, the process will compute 95 percent confidence intervals for the overall effectiveness score and each inventory score using the student's t-distribution. The resultant confidence intervals will then be outputed in the organization summary at the top of the report. The names of the inventories will be obtained from the Inventory File of the OAP Structure Data Base.

Once the organization summary has been prepared, the work group code, work group sample size, inventory scores, and overall effectiveness scores for each elementary work group within the organization will be extracted from the Work Group Scores Records. This information will be placed in a temporary storage file and sorted in ascending overall effectiveness score order.

After the scores have been sorted, the information for each work group will be formatted into the work group summary at the bottom of the report. The name of each elementary work group is obtained from the Work Group Code File.

The sorting of the work groups by overall effectiveness score will allow the analyst to readily identify those

work groups that potentially need attention the most (these work groups will be listed at the top of the list).

Print detailed summary. The "Print Detailed Summary" process will prepare the OAP Detailed Analysis Report for each work group specified by the level of analysis on the OAP Detailed Summary Option Card. The work groups must also satisfy the frequency limits specified on the option card. An example of this report is presented in Figure 23.

The process will use as inputs the Individual Scores Records, Work Group Scores Records, and Work Group Comparison Records.

For each work group to be processed, the process will identify those Individual Scores Records that pertain to the work group and build frequency distribution tables for each value of each attitudinal variable. Once the frequency distribution tables have been prepared, the information will be used with the information in the Work Group Scores Record and Work Group Comparison Record to format the report.

The columns labeled "DIST AF STD", "DIST WRKGRP STD", and "DIST ORG STD" contain the results of the comparison of the work group scores and the three standards of comparison (found in the Work Group Comparison Record). A positive value indicates that the work group score is significantly better than the standard score. A negative score indicates that the work group score is significantly lower than the standard.

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OAP DETAILED ANALYSIS

(Title of work group ————→)

(w.6 Code)

NUMBER OF CASES = 9999

INVENTORY/FACTOR/VARIABLE	SCORE	STD DEV	DIST AF STD	DIST WKGP STD	DIST ORG STD	‡‡‡‡‡‡‡ FREQUENCY DISTRIBUTION ‡‡‡‡‡‡‡ 0000 1111 2222 3333 4444 5555 6666 7777	VALID FREQ
JOB INVENTORY							
F999 JOB ENRICHMENT	9.99	9.99	±9.99	±9.99	±9.99		9999
V999 (Variable description ———→)	9.99	9.99	±9.99	±9.99	±9.99	9999 9999 9999 9999 9999	9999
V999							
V999	:	:	:	:	:	: :	:
SUPERVISOR INVENTORY	9.99	9.99	±9.99	±9.99	±9.99		9999
:							
SUPPLEMENTAL VARIABLES							
V999 (Variable description ———→)	9.99	9.99	±9.99	±9.99	±9.99	9999 9999 9999 9999 9999 9999	9999
V999							
V999	:	:	:	:	:	: :	:
JOB ENRICHMENT FACTORS							
F999 SKILL VARIETY	9.99	9.99	±9.99	±9.99	±9.99	9999 9999 9999 9999	9999
F999 TASK IDENTITY							
F999 TASK SIGNIFICANCE							
F999 JOB FEEDBACK	:	:	:	:	:	: :	:
F999 TASK AUTONOMY							
F999 NEED FOR ENRICHMENT	9.99	9.99	±9.99	±9.99	±9.99		9999
F999 MOTIVATION POTENTIAL SCORE	999.	999.	±999.	±999.			9999
OVERALL EFFECTIVENESS SCORE	9.99	9.99	±9.99	±9.99	±9.99		9999

Figure 23

OAP Detailed Analysis Report

The columns labeled "SCORE" and "STD DEV" refer to the score sample mean and sample standard deviation for the corresponding overall effectiveness, inventory, factor, or variable score.

The column labeled "VALID FREQ" refers to the variables NV, NF, NI, and NMPS in the Work Group Scores Record.

The sequence in which the scores are given on the report is the same as described earlier for the OAP Comparison Analysis Report.

Print strengths and weaknesses report. The "Print Strengths and Weaknesses Report" process will prepare the Potential Strengths and Weaknesses Report for each work group specified by the level of analysis on the Potential Strengths and Weaknesses Report Option Card. The work groups must also satisfy the frequency limits specified on the option card. An example of the report is presented in Figure 24.

The process will use as its primary input the Work Group Scores Records for each work group for which the report is to be prepared. The process will initially identify the criteria specified to be used to identify the potential strengths and weaknesses. This information is obtained from the option card. The process will then determine whether factor or variable potential strengths and weaknesses are to be identified from the format field on the option card.

If the standard deviation criteria is specified, the mean score to be used (from the option card) will be

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Figure 24

Potential Strengths and Weaknesses Report

identified. For each variable (or factor, depending upon the format), a strength cut-off score and a weakness cut-off score will be computed using the following formulas:

$$(8) \quad SCS_i = \overline{X}_i + S_i \times SD$$

$$(9) \quad WCS_i = \overline{X}_i - S_i \times SD$$

where SCS_i refers to the strength cut-off score for the ith variable (or factor).

$\overline{X}_i$ refers to the standard score sample mean for the ith variable (or factor).

S_i refers to the standard score sample standard deviation for the ith variable (or factor).

SD refers to the input number of standard deviations (from the option card).

WCS_i refers to the weakness cut-off score for the ith variable (or factor).

Once the table of cut-off scores has been generated, the scores for the work group will be compared against them. If a score is above the corresponding strength cut-off score, the variable (or factor) is identified as a potential strength. If a score is below the corresponding weakness cut-off score, the variable (or factor) is identified as a potential weakness.

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For each potential strength and weakness, the absolute value of the difference between the variable (or factor) score and the corresponding cut-off score for the variable (strength cut-off score for potential strengths and weakness cut-off score for potential weaknesses) is computed. For each potential strength, the difference and variable (or factor) number and score are written out to a temporary file (Potential Strengths File). The potential weaknesses are similarly written out to the Potential Weaknesses File. Both files are then sorted by the difference and then outputed to the report.

The sorting of the potential strengths and weaknesses in this manner will cause the best potential strengths to be listed first under the potential strengths section of the report and the worst potential weaknesses to be listed first under the potential weaknesses section.

If the criteria for selection of potential strengths and weaknesses were the cut-off score criteria, the only difference from the above process would be that only one strength cut-off score and one weakness cut-off score would be used, instead of a cut-off score for each variable (or factor). The identified potential strengths and weaknesses would then be sorted according to the distance from these two cut-off scores.

If the top-ten bottom-ten criteria is specified, all variables (or factors) would be sorted in descending

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variable (or factor) score order. The top ten variables (or factors) would be identified as potential strengths and listed on the report in descending score order. The variables (or factors) with the bottom ten scores would be identified as potential weaknesses. These variables (or factors) would be listed on the report in ascending score order.

Print distribution report. The "Print Distribution Report" process will prepare the Work Group Distribution Report. An example of this report is presented in Figure 25.

The primary input into the process is the Work Group Scores Records within the Organization Evaluation Data File.

For each work group evaluated by the system, the process will extract the work group code and work group sample size out of the Work Group Scores Record. The information will then be placed in a temporary file and sorted in ascending work group code order. The contents of the sorted file will then be printed in the report. The work group names will be obtained from the Work Group Code File. The name of the organization printed at the top of the reports is obtained using the base code from the Header Record and the Base Code File.

The report indents the work groups to indicate the hierarchal level of the organization in which the work groups are located.

WORK GROUP DISTRIBUTION REPORT

HOLLAND AFB SECURITY POLICE SQUADRON

0000000	OVERALL ORGANIZATION	515
4520000	GROUP STAFF AGENCIES/OFFICES AND SQUADRON AGGREGATE	515
452F000	SECURITY POLICE GROUP (SPG) AGGREGATE	515
452F100	SECURITY POLICE GROUP COMMAND AGGREGATE	10
452F110	SECURITY POLICE GROUP COMMANDERS IMMEDIATE STAFF AGGREGATE	4
452F111	SECURITY POLICE GROUP COMMANDER	4
452F130	SECURITY POLICE GROUP ADMINISTRATION AND REPORTS AGGREGATE	6
452F131	SECURITY POLICE GROUP ADMINISTRATION AND REPORTS SUPERVISOR	4
452F200	SECURITY POLICE GROUP COMMANDERS AGGREGATE	41
452F210	SECURITY POLICE DEPUTY GROUP COMMANDERS STAFF AGGREGATE	8
452F212	SECURITY POLICE GROUP SUPERINTENDENT	8
452F420	SPO STANDBOARD EVALUATION AGGREGATE	10
452F241	SPO STANDBOARD EVALUATION SUPERVISOR	10

Figure 25

Work Group Distribution Report

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Chapter 5

SUMMARY

The preceding chapters presented the requirements, specifications, and system level design for a proposed OAP Analysis System. The system was designed to satisfy the requirements of the users of the system--that is, to be able to analyze an organization in such a way that management consultants can be directed to potential problem areas. The proposed system accomplishes this objective and will save the consultants vast amounts of time during the diagnostic phase. The system was not designed to identify the strengths and weaknesses. No automated system could accomplish this objective. Rather, the system was designed to identify potential strengths and weaknesses of organizations. The reports produced by the system will assist the consultants in focusing their attention on the potential problems.

In addition, adaptability and flexibility were designed into the system. The key to the adaptability and flexibility of the system is the system's capability to receive survey responses from a wide range of survey structures. The system is not tied to a particular survey instrument; consequently, the analysis of an organization can be tailored more to the specific needs and problems of the organization.

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RECOMMENDATIONS FOR FURTHER DEVELOPMENT

The design of the system presented in this report is only the first phase of the development effort. There is a need for a continuation of the development cycle so that the potential of the system can be utilized. The following sections describe briefly what the next steps in the development cycle should be.

Detailed Design

This document provided the system level design for the OAP Analysis System. The next step in the development cycle is the detailed design. During this phase, the system level design should be refined even further. The modules within the various processes of the system should be defined and the relationships among them.

The algorithms for each of the modules should be developed in detail. It is suggested that the processing within the modules be described using a Program Design Language (PDL). PDL is a structured english approach to specifying the operation of a module.

Coding

If the detailed design phase were developed as suggested above, the coding phase will merely require converting the PDL to a higher-order language. The actual program language to be used during the coding phase will not be

specified; however, it is recommended that the language be one that is easily converted from one computer to another, as the system will probably be operational on more than one computer. The programmer(s) responsible for the coding effort should also be intimately familiar with the language that is chosen.

The coding should be performed in a structured manner. This will be easy to accomplish if the detailed design was also developed in a structured manner. Additional adaptability and flexibility can be coded into the program by developing code that can be easily modified. The code should be developed with an understanding that it will probably be changed at some later time.

Testing

The testing phase of the system development should be accomplished concurrently with the coding phase. As a particular module is written, it should be immediately tested to ensure that it accomplishes its intended functions.

Since the OAP DBMS has not been developed, it will be necessary to build test data bases using small samples of the existing data bases used by the present system. Modules will also have to be written which will build the OAP Structure Data Base.

The actual system test should be done in a relatively small environment. If possible, the system could be tested on the AFIT organization.

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Once the testing has been accomplished and it has been verified that the system satisfies all of the requirements, the system should be turned over to LMDC for their use. It is suggested that LMDC use the system in parallel with their present system until they are satisfied that the system will withstand the operational inputs and requirements.

Documentation

The following documentation should be developed during the development of the system:

1. Detailed Design Specification Document

2. Programmer's Maintenance Manual

3. User's Manual

4. Operator's Manual (for computer operators)

These pieces of documentation should be considered integral parts of the development effort and should not be prepared as an afterthought.

Cyclic Development

It must be recognized that the development of the remainder of the system will probably not proceed in a straightforward fashion from detailed design to coding to testing. Information will probably be discovered during the detailed design phase that will affect the system level or maybe even the specifications presented in this document. If this occurs, one or the other will have to be modified.

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The specifications and system design presented in this document are not sacred. It is expected that they will probably be altered as more information is obtained; however, the requirements for the system presented at the beginning of Chapter 3 cannot be altered, unless it is determined that in fact the system is not required to accomplish it. The requirements, however, cannot be changed to satisfy the design. The requirements stated in this document are those functions that the system must achieve in order to be a viable tool for management consultants.

This cyclic nature of the development was experienced during the phases of development presented in this report. After the specifications for the system were developed, additional insight into the operation of the system was achieved during the development of the system level design that caused a modification to the specifications. These changes are acceptable as long as the initial requirements are satisfied.

Issues to Be Considered

The effect of the process by which factor scores are computed when invalid responses are given to a particular attitudinal variable needs to be studied. A validity study should be initiated to determine the effect of using only a subset of the highly loaded variables in computing the factor scores.

The possibility of implementing the proposed system using a data base management language should be investigated.

A study should also be conducted to determine the ideal subjective weights that should be used in computing the inventory scores and the overall effectiveness score.

CONCLUSIONS

The development and implementation of this survey feedback computer program package will provide Air Force management consultants with an efficient and effective means for summarizing the complexities and dynamics of the data obtained from surveys such as the OAP. The flexibility and timeliness of this program will provide a means for the consultants to better serve commanders throughout the Air Force and improve the overall effectiveness of the Air Force.

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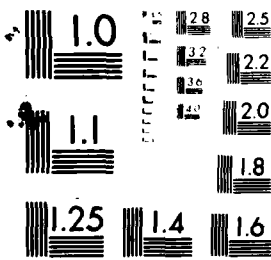
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