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In reply cite: 614-3-183  
RWB/KRO/tmb  
28 February 1963

**SUBJECT:** Contract AF04(695)-113  
Submission of Technical Report WDL-TR2016  
As a deliverable item

**TO:** Commander  
Space Systems Division  
Air Force Systems Command  
United States Air Force  
Air Force Unit Post Office  
Los Angeles 45, California

**ATTENTION:** Technical Data Center

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T. R. Tremper, AFSSD/SSOCK (w/o enclosure)

**REFERENCE:** (a) Contract AF04(695)-113, Exhibit "A"  
(b) Paragraph 3.2 of AFSSD Exhibit 62-44A  
(c) Exhibit "B" to S/A 17, Para. 2.1.12  
(d) Exhibit "C" to S/A 17, Item 21

In accordance with the requirements of references (a), (b), (c), and (d), we are forwarding ten (10) copies of the following document:

<u>Title</u>	<u>No. and Date</u>
Program 823 - Human Engineering Plan	WDL-TR2016 28 February 1963

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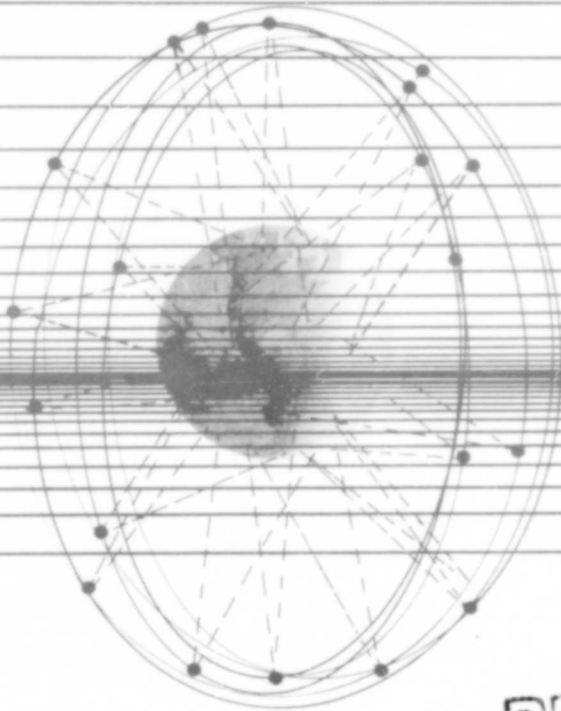
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R. W. Boyd  
Manager, Contracts Management

TECHNICAL OPERATING REPORT

WDL-TR2016

28 FEBRUARY 1963



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PROGRAM 823

HUMAN ENGINEERING PLAN

PREPARED FOR:

AIR FORCE SPACE SYSTEMS DIVISION  
AIR FORCE SYSTEMS COMMAND  
UNITED STATES AIR FORCE  
INGLEWOOD, CALIFORNIA

S/A 17 TO D/C AF04(695) -113

**PHILCO**  
A SUBSIDIARY OF *Ford Motor Company*

WESTERN DEVELOPMENT LABORATORIES  
PALO ALTO, CALIFORNIA

TECHNICAL OPERATING REPORT

PROGRAM 823  
HUMAN ENGINEERING PLAN

Prepared by

PHILCO CORPORATION  
Western Development Laboratories  
Palo Alto, California

S/A 17 to D/C AF04(695)-113

Prepared for

SPACE SYSTEMS DIVISION  
AIR FORCE SYSTEMS COMMAND  
UNITED STATES AIR FORCE  
Inglewood, California

**ABSTRACT**

PHILCO WDL-TR2016  
PROGRAM 823 - HUMAN  
ENGINEERING PLAN

UNCLASSIFIED  
28 pages  
S/A to D/C AF04(695)-113

This report describes the Human Engineering Program as it will be applied to Program 823 for new equipment at IOS and different modified equipment at VTS, NHS, and HTS.

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## FOREWORD

This Technical Operating Report on Supplemental Agreement 17 to Definitive Contract AF04(695)-113 describes the Human Engineering Program Plan as applicable to Program 823 and is submitted in accordance with Exhibit "A" of that contract.

This report was prepared by Philco, Western Development Laboratories in fulfilling the requirements of Paragraph 3.2 of AFSSD Exhibit 62-44A, "Humand Engineering for the Air Force Satellite Control System," dated 5 July 1962 and Paragraph 2.1.12 of Exhibit "B" and Item 21 of Exhibit "C" to Supplemental Agreement 17.

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## SECTION 1

## INTRODUCTION

## 1.1 PURPOSE

The Philco Western Development Laboratories (WDL) Human Engineering Program provides compliance with AFSSD Exhibit 62-44A, "Human Engineering for the Air Force Satellite Control System," dated 1 July 1962. This program insures that the general principles of human engineering, as outlined in AFSSD Exhibit 62-44A and further defined in MIL-STD-803, are successfully achieved in Philco-developed ground electronic systems.

Human Engineering is "the application of scientific knowledge concerning human performance to the establishment of requirements and to the design, development, evaluation and utilization of Air Force Systems."

The objectives of human engineering are: (a) "to assist in achieving system performance requirements by the appropriate use of Man as a system component; (b) to select, design and develop equipment, procedures, work-environment and facilities to assure efficient, reliable and safe human performance (operate) within system tolerance limits; and (c) to optimize demands upon manpower resources, Man's skill, training, procedural-data and cost within the parameters established for the system."

## 1.2 SCOPE

This plan, prepared in compliance with AFSSD Exhibit 62-44A, describes the Human Engineering Program as it will be applied to the 823 Program for new equipment at IOS and different modified equipment at VTS, NHS, and HTS. The human engineering effort is limited to effort on equipment identified in a letter report to AFSSD-SSOCO, "Identification of 823 Program Equipment for Human Engineering," dated 14 November 1962. Safety engineering principles are applied to the design of newly developed equipment, facilities, and work environments in compliance

with Paragraph 13, "Hazards and Safety" of MIL-STD-803 "Human Engineering Criteria for Aircraft, Missile, and Space Systems Ground Support Equipment," dated 5 November 1959.

## SECTION 2

## HUMAN ENGINEERING PROGRAM MANAGEMENT

## 2.1 PROGRAM DESCRIPTION

The human engineering program consists of five interrelated areas of activity:

1. Participation in System Analysis and Design

The system analysis provides identification and definition of satellite control operation functions requiring human performance. The human engineering system design provides specification of human performance requirements at the subsystem level and establishes the system operational management structure.

2. Equipment Design

The design activity consists of selection, definition and detail design of equipment, procedures, and facilities (including work-environments) associated with satellite control functions requiring human performance.

3. Design Assurance

The design assurance activity comprises a continuous review of specifications, drawings, and program office change orders to assure that the design complies with the established human engineering criteria. Liaison is maintained with equipment designers to provide human engineering design guidance.

4. Design Verification

Design verification consists of participation in acceptance testing in order to verify human engineering design of equipment; and participation in system test and evaluation to verify human engineering design of system procedures, work-environments and facilities associated with satellite control functions requiring human performance.

## 5. Studies and Experiments

The studies and experiments include laboratory and field tests related to the development of the Air Force Satellite Control System.

The overall human engineering program activity sequence and relationships are illustrated in Fig. 2-1.

## 2.2 ORGANIZATION

The organizational structure of related Philco WDL organizations is shown in Fig. 2-2. Human engineering is the primary responsibility of two engineering groups within the Man/Machine Design Section. These groups, the Analysis and Planning Group and the Design Group, receive general engineering assistance from the Support Engineering Group. The responsibilities of the three groups in the Man/Machine Design Section are described below:

### 1. Analysis and Planning Group

The Analysis and Planning Group is responsible for the following:

- a. Planning human engineering programs.
- b. Participating in system analysis and design (see Section 3).
- c. Developing acceptance test criteria and design verifications plans (see Section 6).
- d. Identifying, planning, and/or executing studies and experiments necessary to support system human engineering.

### 2. Design Group

The Design Group is responsible for the following:

- a. Detailed design of equipment selected for human engineering design (see Section 4).

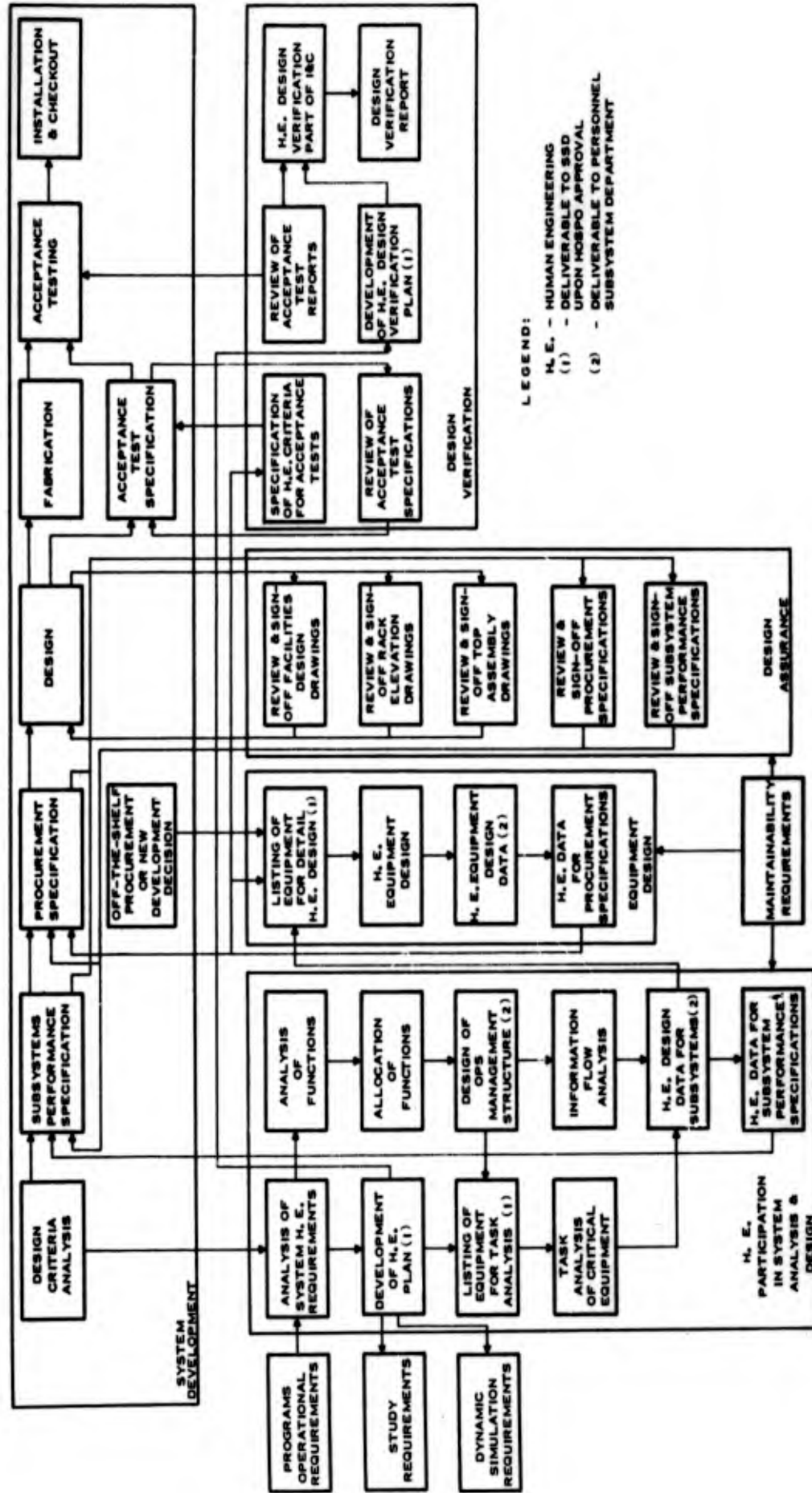
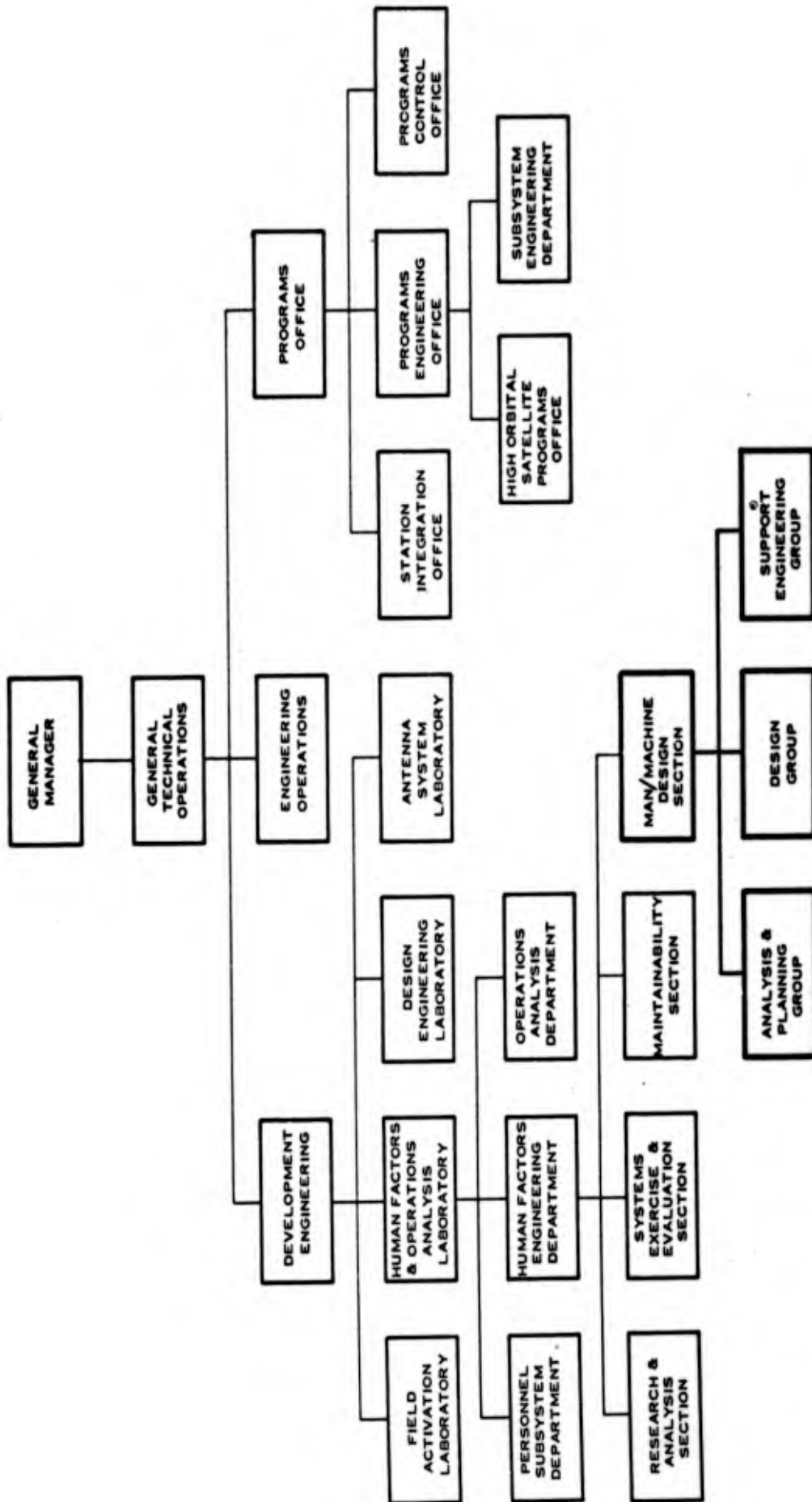
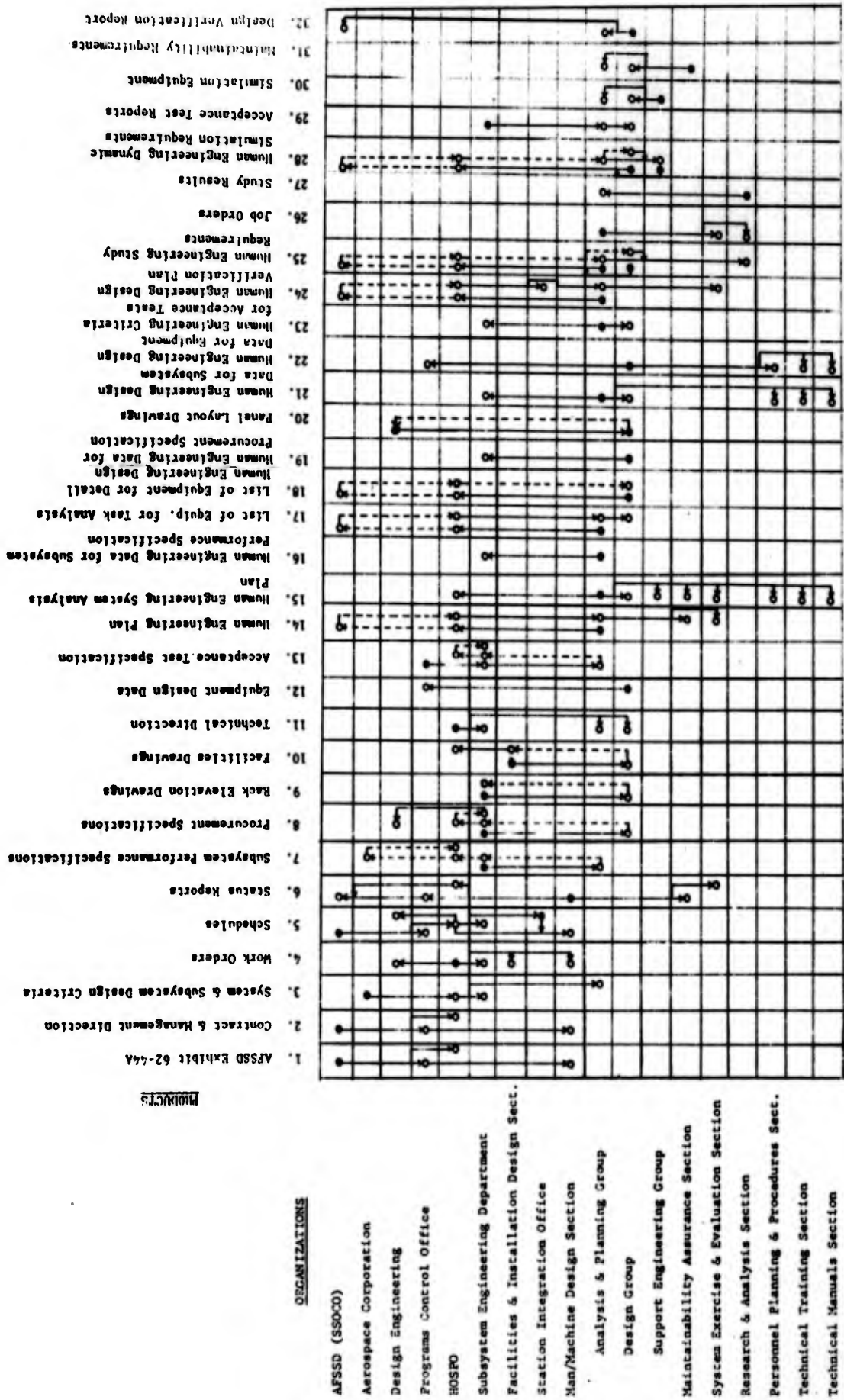


Fig. 2-1 Human Engineering Program



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Fig. 2-2 Philco WDL Organization



NOTES:  
 ● = Originator  
 ○ = Receiver  
 --- = Approval at Organization Line Leaves

Fig. 2-3 Integration of Human Engineering Program

- b. Design assurance covering equipment, facility, and computer program interfaces with operating personnel (see Section 5).
  - c. Identification, planning, and/or execution of studies and experiments necessary to support equipment human engineering (see Section 7).
3. Support Engineering

The Support Engineering Group is responsible for the development of all instrumentation required in the Human Factors and Operations Analysis Laboratory. Under the Human Engineering Program, this group is responsible for the design, fabrication, and/or procurement of dynamic simulation equipment for use in studies and experiments.

### 2.3 PROGRAM INTEGRATION

Program integration is achieved through the use of standardized procedures for distribution, review, and approval of program management and technical data. The integration of the Human Engineering Program is diagrammed in Fig. 2-3. The integration is shown in terms of information flow between the various organizations which interface with the Human Engineering Program.

## SECTION 3

## PARTICIPATION IN SYSTEM ANALYSIS AND DESIGN

## 3.1 GENERAL

The system analysis and design phase begins with the receipt of design criteria from Aerospace Corporation and ends when Aerospace Corporation approves the subsystem performance specifications. During this interval, the design criteria are translated into subsystem performance specifications and decisions are made as to off-the-shelf procurement versus new development. Human engineering participation in this area further assures that equipment procurement decisions reflect the most efficient man/machine design within the initial cost and schedule constraints of the system. The following paragraphs describe the analytical and design tasks of the system development cycle.

## 3.2 ANALYSIS OF OVERALL HUMAN ENGINEERING REQUIREMENTS

This initial step of the system analysis process establishes general criteria for human engineering design and the scope of the program to be executed. The data analyzed during this step includes the system and subsystem design criteria, operational requirements of the program to be supported, and contractual direction from AFSSD including schedules, procurement directions, and funding. End products of this step consist of the following:

1. Human Engineering Criteria for System Design

Human Engineering System Design criteria consist of a statement of human engineering design objectives including the expected service loads (mission profiles), control/display concept, standardization goals, and general qualifications of the operating personnel.

2. Human Engineering Task Description

The Human Engineering Task Description is a detail description of tasks to be performed by the human engineering functions. This task description is supplemented by a milestone schedule and a funding estimate.

### 3.3 DEVELOPMENT OF THE HUMAN ENGINEERING PLAN

The Human Engineering Plan is developed from the human engineering task description in accordance with the format specified in AFSSD Exhibit 62-44A. This plan is tailored to the Philco WDL management procedures and to the human engineering criteria for system design.

### 3.4 ANALYSIS OF FUNCTIONS

Functions to be performed by each subsystem, as specified in the subsystem design criteria, are identified and described in terms of their relationship and performance requirements. A system flow diagram is prepared to show the relationship of the functions and a list identifying and describing each function is prepared. The flow diagram and the function list are updated and detailed as subsystem design becomes more definite.

### 3.5 ALLOCATION OF FUNCTIONS

Allocation of functions to man-equipment combinations is accomplished by comparing performance requirements with performance capabilities of man versus equipment. Accuracy, time, frequency, and load parameters are particularly compared to determine the most efficient design approach for satisfying system performance requirements. The allocation of functions may require a detailed analysis of tasks and probable contingencies and a detailed review of the expected service loads. The end product of this step is a list showing the allocation of functions to man/machine combinations.

### 3.6 DESIGN OF OPERATIONAL MANAGEMENT STRUCTURE

The design of the operational management structure allocates the man-equipment functions to operating positions and establishes the information flow requirements between the operating positions. The operational management structure is validated by performing a task analysis and an information flow analysis.

### 3.7 LISTING OF EQUIPMENT FOR TASK ANALYSIS

The listing of equipment for task analysis is performed after the operational management structure is established and the operating positions are identified. Equipment identified for task analysis includes only the equipment at those operating positions that are critical in terms of task, time, accuracy or load factors. The list is submitted via the High Orbital Satellite Program Office (HOSPO) to AFSSD in accordance with Exhibit 62-44A.

### 3.8 TASK ANALYSIS

Task analysis is an extension of system functional analysis. The objective of task analysis is to validate the allocation of functions to operating positions and to provide more detailed criteria for the control/display design at these positions. The task analyses are updated when required as the subsystem and equipment design become better defined. Task analysis aids in determining the sequence, logic, tolerance, and frequencies of tasks. The sequence and logic of the tasks are analyzed by means of a decision-action flow diagram. The task, tolerance, and frequency are analyzed by relating the tasks to the expected service loads. A time line analysis is performed and the data are compiled into a detailed man/machine function list.

### 3.9 INFORMATION FLOW ANALYSIS

Information flow analysis is an extension of system functional analysis and task analysis. The objective of information flow analysis is to validate the proposed operational management structure, to verify compatibility between the operating positions and between the operating positions and the STC, and to provide design criteria for the communication subsystem. The information flow analysis may also reveal the need for additional status displays and controls. The information flow analysis covers data content, duration, distribution, and frequency of voice and equipment communications.

### 3.10 SPECIFICATION OF SUBSYSTEM HUMAN ENGINEERING DESIGN

The final step in the analysis and design phase is the definition of human engineering design requirements for each subsystem and their submission for inclusion in the subsystem performance specifications. A human engineering subsystem data package is submitted to the Subsystem Engineering Department for review and concurrence. The data package consists of descriptions of operating positions, man/machine function lists, task analysis data, and information flow data. The data are reviewed and necessary trade-offs are made with subsystem engineers. The finalized man/machine function lists and design sketches of the operating position are submitted for inclusion in the subsystem performance specifications.

## SECTION 4

## HUMAN ENGINEERING EQUIPMENT DESIGN

## 4.1 GENERAL

The design phase is concerned with the selection and specification of control/display components, layout and arrangement of components and equipment, configuration of communication nets, and specifications of work environment. The key design parameters are accuracy, time, frequency, efficiency, maintainability, reliability, and safety. The limits of these parameters are defined in the system analysis documentation and subsystem performance specifications. These limits may be modified or specified more accurately during the equipment design phase. Tasks performed during the human engineering design phase are described in Paragraphs 4.2 through 4.8.

## 4.2 LISTING OF EQUIPMENT FOR DETAIL DESIGN

The first step in equipment design is to identify the end items of equipment for human engineering design. The identification is made after the operating positions are defined and the decisions are made as to off-the-shelf procurement versus new development. The list is submitted to AFSSD in accordance with Exhibit 62-44A.

## 4.3 DESIGN OF CONTROL/DISPLAY EQUIPMENTS

The design of control/display equipment involves component selection, panel layout, panel location, and console configuration. The primary considerations in the design are Man's perceptual capabilities and anthropometric characteristics. Control and display components are selected on the basis of required accuracy, time, and frequency of information inputs and operator responses as specified in the man/machine function lists. Panels are designed and located on the basis of sequence, logic and utilization data as shown on decision action flow diagrams and man/machine function lists. Static mock-up and dynamic simulation may be required to select an optimum design or to validate the design of control/display equipment.

The end product of a control/display design is a package of data consisting of a recommended control/display design including available experimental data. The design is reviewed and trade-offs are made with the Subsystem Engineering Department. Upon selection of a design approach, the data are revised and submitted for inclusion in the procurement specification and facilities design criteria.

#### 4.4 DEVELOPMENT OF STATIC MOCK-UPS

Full scale static mock-ups of control/display consoles may be used to validate the console configuration and arrangement. Primary considerations are the accessibility of controls and the readability of displays, particularly displays shared by more than one operator. Mock-ups are constructed of cardboard or other equally inexpensive self-supporting material, and are updated to reflect design changes.

#### 4.5 EXPERIMENTS UTILIZING DYNAMIC SIMULATION

Experiments utilizing manned simulation are included as part of detailed equipment design when analytical techniques fail to resolve a design problem and when experimental data are not available from other sources. The experiments may be used for evaluation of competitive designs of complete operating positions or parts thereof. Statistically treated error, response time, and communications data are used as the basis for comparing various design approaches. The experimental data may result in a modification of the system information flow, control/display design, and/or communications design.

#### 4.6 SPECIFICATION OF HUMAN ENGINEERING DESIGN FOR EQUIPMENT PROCUREMENT

Equipment procurement specifications include requirements for control/display design as developed by human engineering and subsystem engineering. Human engineering inputs to the specifications are provided in the form of a control/display component lists and layout drawings of control/display panels. Human engineering signature approval of the procurement specifications assures that the inputs are included.

#### 4.7 FUNCTIONAL DESIGN OF COMMUNICATION EQUIPMENT

The functional design of communications equipment establishes the configuration of intra-station communication nets and the location and type of communication panels required at each operating position. Task analysis and information flow analysis provide the criteria for communication design. The human engineering communications design documentation includes a net configuration chart and a facility layout drawing, indicating communications equipment location.

#### 4.8 SPECIFICATION OF FACILITIES DESIGN

Human engineering and subsystem engineering determine work space requirements, location of control/display and communication equipment, and acceptable environmental conditions for facilities design. A preliminary equipment layout drawing is prepared and submitted with other human engineering design data for subsystem engineering review and concurrence. The Subsystem Engineering Department submits the data for inclusion in the facilities design criteria. Human engineering signature approval of the equipment layout drawings assures that the facilities design meets human engineering requirements.

## SECTION 5

## HUMAN ENGINEERING DESIGN ASSURANCE

## 5.1 GENERAL DESCRIPTION

Human engineering design assurance provides guidance to equipment designers and a continuous review of specifications and drawings to ensure proper application of human engineering criteria from initial design to final equipment acceptance. WDL-TR1968, "Human Engineering Design Check List," dated 1 February 1963 is distributed to equipment designers for use as a design guide. Specifications and drawings for equipment requiring human engineering design are reviewed and signed off by a human engineering representative. The design assurance activity comprises six formal review and sign-off actions:

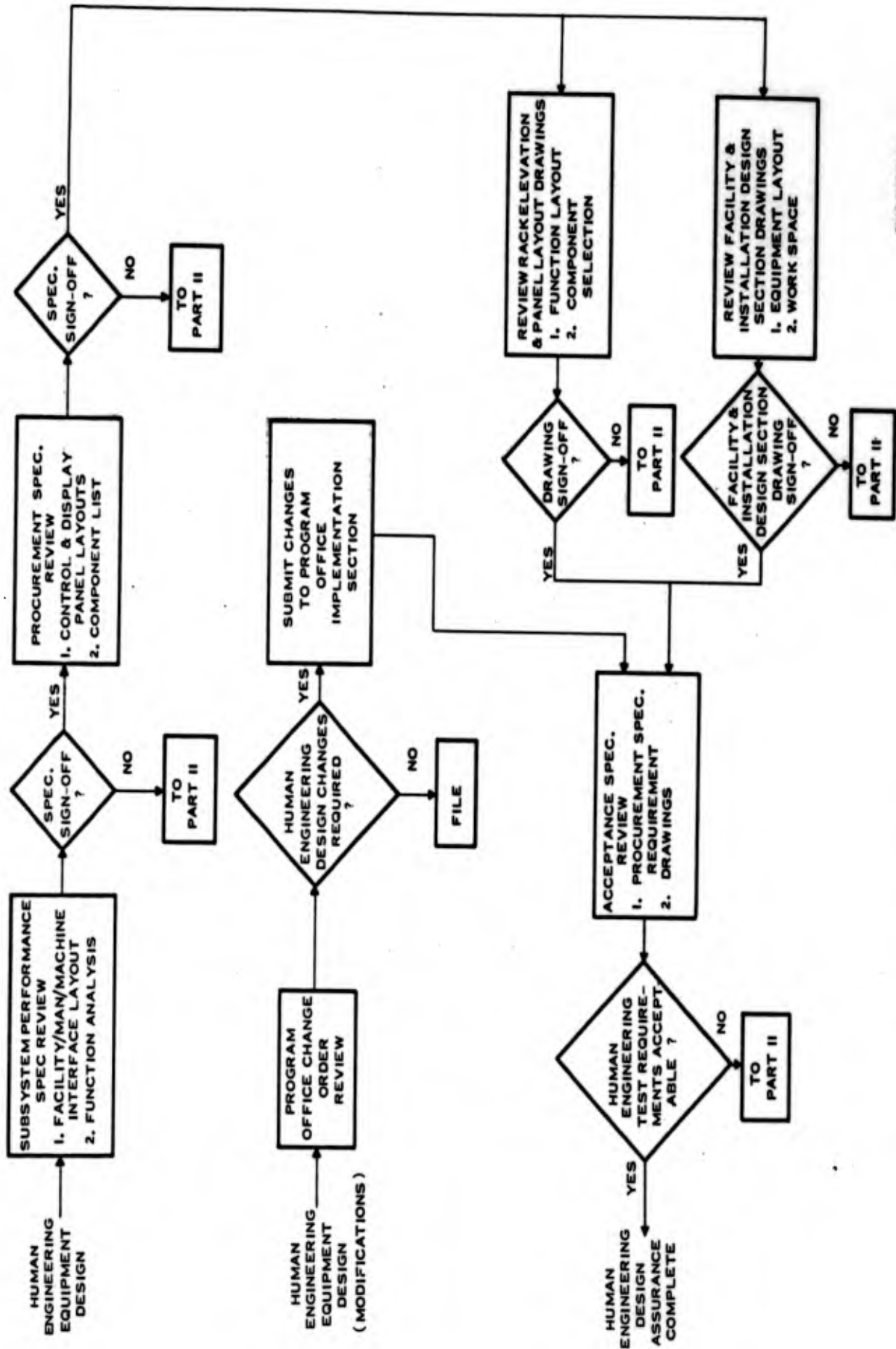
1. Subsystem performance specification review and sign-off.
2. Procurement specification review and sign-off.
3. Rack elevation and panel top assembly drawing review and sign-off.
4. Facility equipment layout drawing review and sign-off.
5. Program office change order review.
6. Acceptance test specification review.

## 5.2 DESIGN ASSURANCE PROCEDURE

The design assurance and sign-off procedure is illustrated in Figs. 5-1 and 5-2.

## 5.3 DESIGN REVIEW REQUIREMENTS

Design review requirements for each review action are described below:



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Fig. 5-1 Human Engineering Design Assurance Procedure (Part I)

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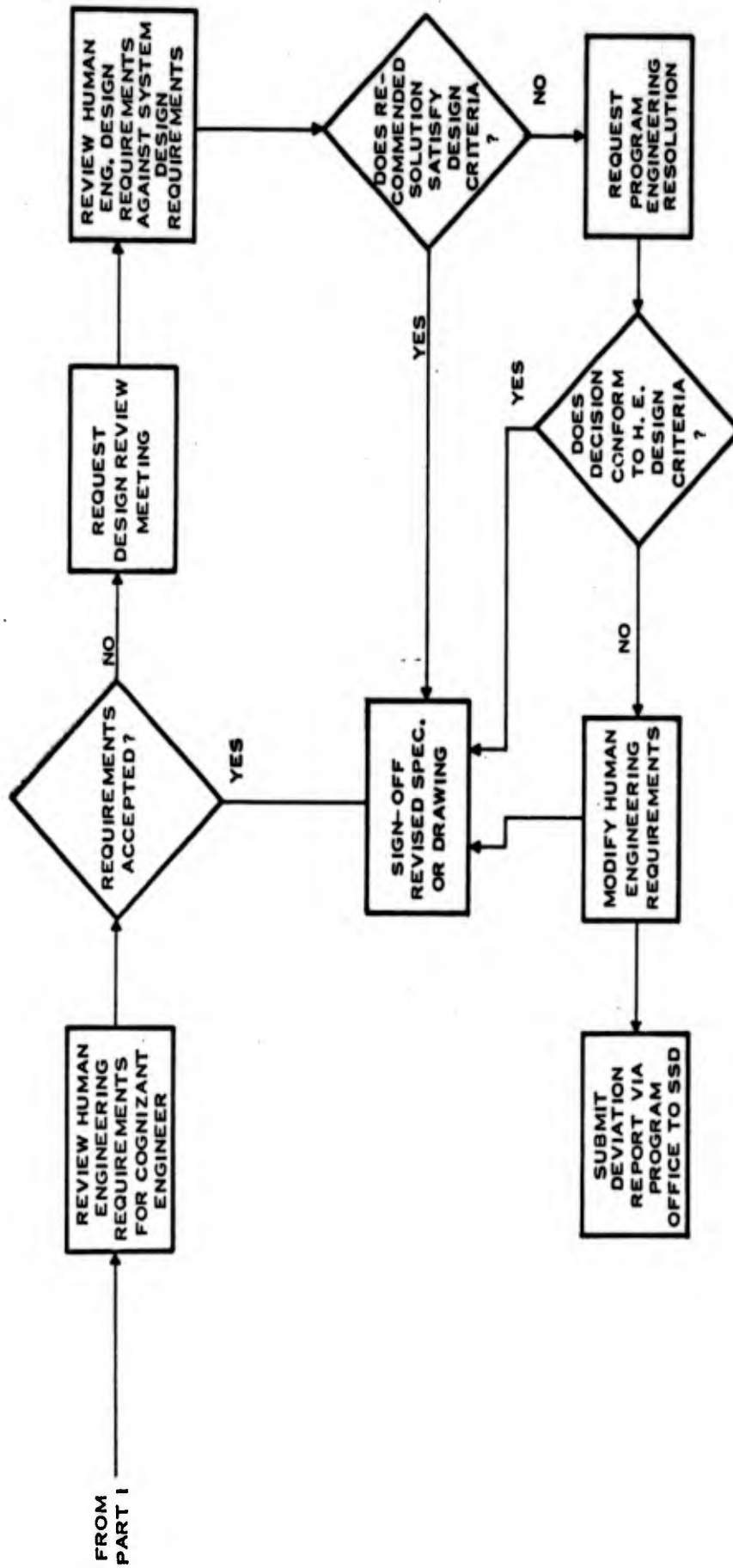


Fig. 5-2 Human Engineering Design Assurance Procedure (Part II)

1. Subsystem Performance Specifications

Man/machine function descriptions and control/display layout drawings are reviewed to assure that they comply with the previously established human engineering design for the sub-system.

2. Procurement Specifications

Control/display component descriptions and detailed panel layout drawings are reviewed to assure that they comply with the established human engineering design for the equipment.

3. Rack Elevation and Panel Top Assembly Drawings

Panel locations, mechanical design, and part lists are reviewed to assure that the final design is acceptable prior to release to fabrication.

4. Facility Equipment Layout Drawings

The locations of operating positions, time and status displays, and communications equipment, and the availability of work space is reviewed to assure that the facilities design complies with human engineering facilities criteria prior to equipment installation.

5. Program Office Change Orders

Change orders are reviewed for changes affecting human engineering design.

6. Acceptance Test Specifications

Test requirements affecting man/machine functions are reviewed to assure that the functional verification of control/display operation is in accordance with the previously established human engineering design.

## SECTION 6

## HUMAN ENGINEERING TEST AND VERIFICATION

## 6.1 GENERAL DESCRIPTION

Human engineering design is verified during acceptance testing and during Phases III and IV of Installation and Checkout (I&C) at IOS. Where deemed necessary, design verification for modified equipment will be performed during Phase III at VTS and HTS and Phases III and IV at NHS. The human engineering acceptance test is performed on the first deliverable article of equipment. The acceptance test is conducted in-plant during equipment acceptance testing and completed at the test site if required. The acceptance test comprises two parts: a visual inspection in accordance with a check list, WDL-TR1968, based on MIL-STD-803 and a control/display function test as specified in the equipment acceptance test specification.

Design verification is conducted at IOS concurrently with the subsystems and system checkout. This verification consists of the following efforts:

1. Completion of checks required to verify compliance with MIL-STD-803 on equipment acceptance tested in-plant.
2. Inspection and test of all control/display equipment not previously tested, in accordance with the acceptance test check list.
3. Evaluation of work space/environment and facilities including hazards and safety considerations in accordance with MIL-STD-803 and other applicable human engineering criteria.
4. Monitoring of subsystems functional tests.

5. Monitoring of system functional tests during fly-bys and during system checkout.
6. Analysis, evaluation, and documentation of the verification results.

The acceptance test and the design verification procedures are outlined in the following paragraphs.

## 6.2 ACCEPTANCE TEST PROCEDURE

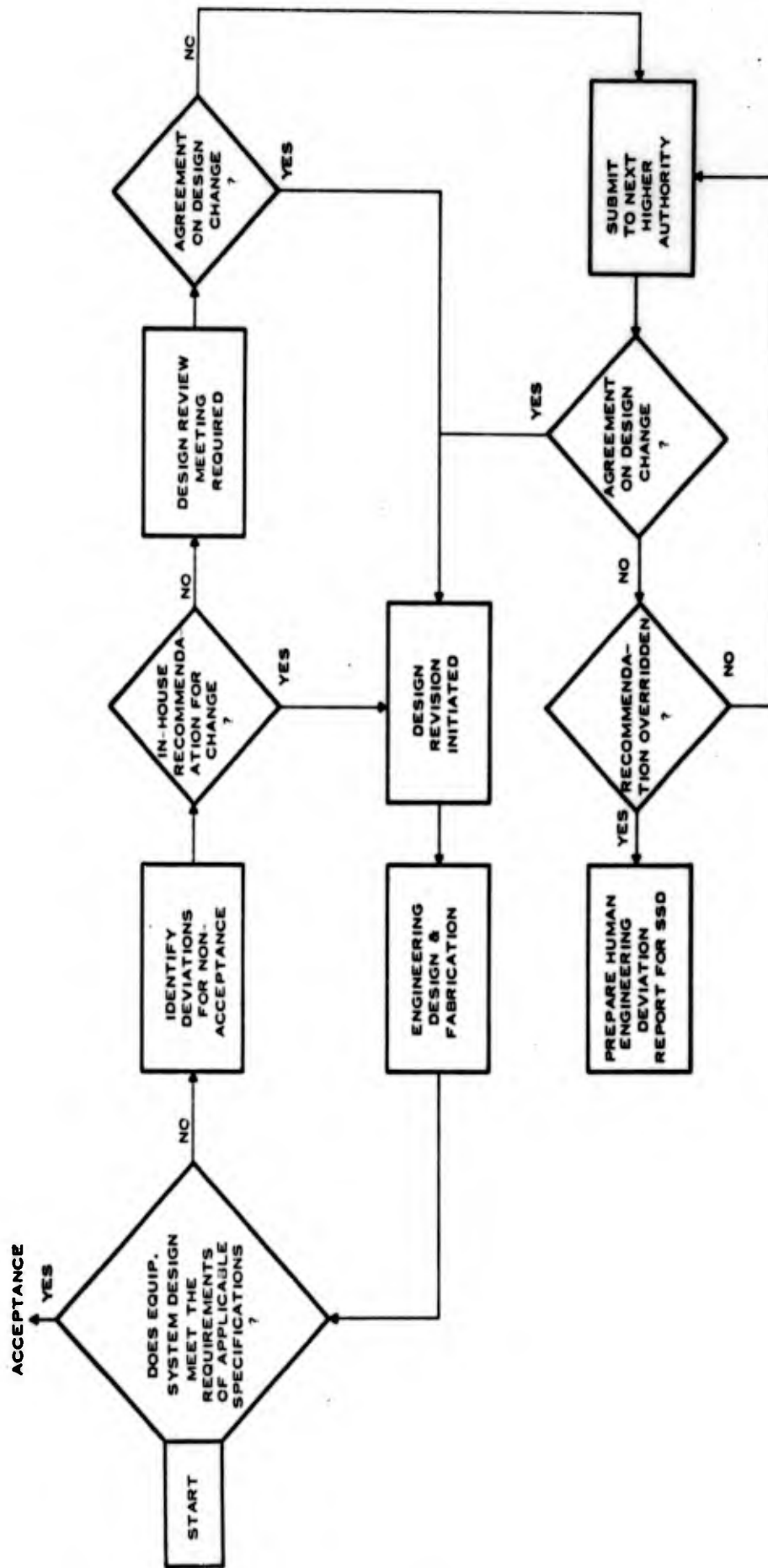
The human engineering acceptance test is performed with the assistance of the Test Operations Section of the WDL Product Assurance Organization. Human engineering provides the Test Operations Section with the acceptance test check list, answer sheets, and a list of the equipment to be acceptance tested. The Test Operations Section provides the test schedules and the personnel for operating equipment during the acceptance test. The acceptance test answer sheets are completed and signed by a test operations representative and a human engineering representative. The completed answer sheets form a part of the acceptance test report. If the equipment does not meet the acceptance test requirements, action is initiated to resolve the problem as illustrated in Fig. 6-1.

### 6.2.1 Visual Inspection

The visual inspection is concerned with the mechanical operation, location, arrangement, form, readability, and coding of controls and displays. Power is applied to the equipment to check control interlocks and multi-color displays.

### 6.2.2 Function Test

During the functional test, human engineering is concerned with the functions and the interaction of controls and displays. Equipment acceptance test specifications are used as the reference for monitoring this portion of the test. The test includes monitoring of equipment activation, checkout, normal operation, manual override operation, and



OWG 812716

Fig. 6-1 Procedure For Deviation From Human Engineering Criteria

shutdown. Particular attention is given to the operations sequence and information feedback. The functional test is performed to the extent possible with the capabilities of the equipment acceptance test setup.

Noise sound, temperature, humidity and illumination levels; work space adequacy, and safety compliance are measured and/or verified at the test site.

### 6.3 DESIGN VERIFICATION PLAN

Design verification is conducted with assistance from the Station Integration Office, Field Activation Department, and site operations and maintenance personnel, if required. After approval by HOSPO, this Design Verification Plan is coordinated with the Station Integration Office, Personnel Planning and Procedures Section (PP&PS) and System Exercise and Evaluation Section (SEES). The Integration Office prepares checkout schedules and provides the personnel for equipment checkout and operation. The Man/Machine Design Section personnel, with assistance from Field Activation Department personnel are responsible for monitoring and recording man/machine performance at subsystem and system levels. The verification results depend largely on conclusions formed by the analyzing personnel and are affected by the progress of the equipment checkout (the time available for monitoring of trouble-free operation). Although most of the tests are conducted on the I&C procedures, it is expected that at the system level there will be correspondence between the I&C procedures and the operational procedures. The task time and frequency, however, may vary considerably from an operational situation. It is expected that the station operational procedures are also available on-site for verification during Phase IV. The human engineering design verification will be continued throughout the operational procedures verification and shall be an integral part of the Personnel Subsystem Test and Evaluation (PST&E) Program.

### 6.3.1 Design Verification During Subsystem Checkout

The I&C Phases II and III checkout procedures establish the necessary requirements and sequence of events for subsystem checkout in accordance with the applicable subsystem, procurement, and acceptance test specifications.

Tests required by these procedures shall be performed under the conditions which exist at the time of the tests, provided the components are within the environments of their respective specifications. All performances and environmental measurements shall be made with instruments of the laboratory precision type whose accuracy has been certified by the responsible calibration agency of Philco WDL or by other approved certification group or groups with measurement standards traceable to the National Bureau of Standards. Should the subsystem fail to meet the requirements specified, acceptance shall be withheld until the extent and cause of failure can be determined. Tests will be continued after repair or replacement of defective components.

The test procedures are based upon selected acceptance test procedures performed in-plant and will be followed through by a functional test performed at the station(s). Only those tests which are within the scope of Phase III checkout procedures tests are included. Tests requiring fly-by support or integration with other ground station subsystems are considered Phase IV tests and will be covered during the system checkout.

The test data sheets will provide a documentary certification for approval or disapproval of the selected Phase III subsystem checkout test results. Upon completion of all documented tests the master vellum form data sheets shall be witnessed by authorized representatives and will be forwarded to the Philco WDL Station Integration Office for release approval.

### 6.3.2 Design Verification During System Checkout

The I&C Phase IV system checkout procedures determine and evaluate the technical performance of equipment/subsystem groups. They are used to verify link and system performance, evaluate proposed designs, investigate inherent capabilities and limitations, and to evaluate changes in performance resulting from equipment modifications.

Each checkout procedure is supported by text that describes the checkout and lists the participating procedures. Each checkout procedure is presented in step-by-step format in tabular form. In the integrated system checkout procedures, point-to-point checks are made within a loop and then the complete system loop is checked. The point-to-point check proves the continuity and operational capabilities of portions of loops. These system loop checks establish the operational readiness of the loop.

The operating capability of the overall system is determined by utilizing either fly-by aircraft or ground simulators. The 6594th Aerospace Test Wing Manual (ATWM) No. 375-X establishes the procedures required for this test. The ATWM is the controlling document that contains equipment procedures, checklists, and integrating procedures used by operational personnel to insure operational readiness of the tracking station, control of the facility, and comprehensive post-pass data reports. This manual is written in accordance with the requirements of the 6594th Air Force Test Wing Regulation 5-1.

The procedures provided in ATWM 375-X are designed to fulfill program requirements, as specified in the applicable Orbital Test Directives (OTD) and System Test Objectives (STO). All subsystems will be completely tested to meet applicable performance requirements. When all subsystems have been placed in a state of readiness, a composite station validation test will be conducted to determine the capability of the station equipment and personnel to meet applicable performance requirements. To perform these tasks, operators will use the equipment checklist in ATWM 375-X and station control personnel will direct these tasks as specified in the station control procedures in ATWM 375-X.

Station discrepancy summary reports will be prepared for system runs with ACES and/or fly-bys. All data sheets that permit the recording of test data, as may be necessary in the performance of the check-out tests, will be documented. The data sheet should be reproducible and complete with a sign-off sheet for Human Factors Engineering, Quality Assurance, and Air Force witnessing representatives.

### 6.3.3 Analysis of Data

Upon completion of all documented tests, the master vellum form data sheets shall be witnessed by authorized representatives and forwarded to the Philco WDL Station Integration Office for release approval. Monitoring notes, communication records, and I&C checkout lists are analyzed by human engineering personnel to identify errors, response time lags, interruptions in information flow, and excessive task loads. Since only in a very few instances are the limits of these parameters specified, the decision as to when and where the man/machine performance is degraded is based largely on the judgment of the data analyst. The analysis of the initial data will also determine if and where additional observations are required to gain added confidence in verification results.

The results of the analysis are evaluated by Human Factors Engineering personnel to determine if identifiable performance degradation can be corrected through modification of procedures or modification of control/display and/or communication design. The recommendations are documented in the design verification report.

## SECTION 7

## HUMAN ENGINEERING SCHEDULE

## 7.1 SCHEDULE REVIEW PROCEDURE

A formal PERT system has not been implemented for Program 823. A Work Order Schedule and Budgetary Control form is used for identification of the human engineering milestones and the start and completion dates of the various tasks. A weekly progress report is submitted to HOSPO and the milestone schedule is reviewed and updated as required to reflect the overall program schedule. Program 823 human engineering status is reported monthly to AFSSD and a formal human engineering report is submitted quarterly to provide detailed status of the human engineering program in accordance with AFSSD Exhibit 62-44A.

## 7.2 MILESTONE SCHEDULE

A human engineering milestone schedule is illustrated in Fig. 7-1. The schedule shows major completion milestones.

MAJOR WORK EFFORT AND SCHEDULE	YEAR		1963												
	MONTH		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	
Human Engineering Plan				15 ▲1			25 ▲2								
Human Engineering System Analysis			8 ▲1					15 ▲3							
Human Engineering Design and Assurance				15 ▲1					15 ▲4						
Acceptance Test									15 ▲5						
Design Verification														28 ▲6	
Quarterly Progress Reports							25 ▲2								

MILESTONES:

1. Effort Commences
2. Effort Complete
3. Task Analysis Complete
4. Design and Design Assurance Complete
5. Acceptance Test Complete
6. Design Verification Complete

Fig. 7-1 Human Engineering Milestone Schedule

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