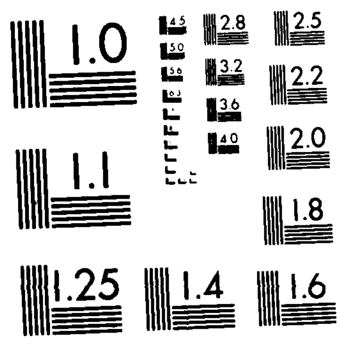
AD-A134 417 A DETERMINATION OF THE INFORMATION REQUIREMENTS FOR THE MANAGEMENT OF THE..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. T N TOWNER 1/1

UNCLASSIFIED SEP 83 AFIT-LSSR-31-83 F/G 5/2 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3

AD-A134 417

(2)

DEPARTMENT OF THE AIR FORCE

AIR UNIVERSITY (ATC)

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

83 11 04 025

A DETERMINATION OF THE INFORMATION
REQUIREMENTS FOR THE MANAGEMENT
OF THE ACQUISITION OF
TECHNICAL ORDERS

Timothy N. Towner, Major, USAF

LSSR 31-83

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the Air Training Command, the United States Air Force, or the Department of Defense.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER LSSR 31-83	2. GOVT ACCESSION NO. A134417	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A DETERMINATION OF THE INFORMATION REQUIREMENTS FOR THE MANAGEMENT OF THE ACQUISITION OF TECHNICAL ORDERS		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Timothy N. Towner, Major, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS School of Systems and Logistics Air Force Institute of Technology, WPAFB OH		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of Communication AFIT/LSH, WPAFB OH 45433		12. REPORT DATE September 1983 13. NUMBER OF PAGES 90
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Approved for public release: IAW AFR 190-17.

LYNN E. WOLAVER

Dean for Research and Professional Development

Air Force Institute of Technology (AIC)

Wright-Patterson AFB OH 45433

15 SEP 1983

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Data Acquisition
Data Management
Management Information Systems
Requirements Definition Methods
Technical Order Acquisition

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thesis Chairman: Ronald H. Rasch, Major, USAF

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

The Aeronautical System Division (ASD) Directorate of Logistics is currently involved in a project to determine the adequacy of the management information system for the 15 logistics elements in the system acquisition process. This thesis project was an effort to determine the information used to manage one of the logistics elements, Technical Order (TO) Acquisition. A structured requirements definition methodology was used to interview seven TO managers within ASD and summarize the information they use to manage TO acquisition. Most of the information they use is contained in three documents, the TO Publication Plan, Verification Plan, and Status and Schedule Report.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

LSSR 31-83

A DETERMINATION OF THE INFORMATION REQUIREMENTS FOR THE MANAGEMENT OF THE ACQUISITION OF TECHNICAL ORDERS

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 Requirements for the

Degree of Master of Science in Systems Management

By

Timothy N. Towner, BSIT
Major, USAF

September 1983

Approved for public release;
distribution unlimited

This thesis, written by

Major Timothy N. Towner

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

DATE: 28 September 83

COMMITTEE CHAIRMAN

TABLE OF CONTENTS

CHAPTER Page

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

BACKGROUND

The Aeronautical Systems Division (ASD) of Air Force Systems Command (AFSC) has been directed to establish an Acquisition Logistics Deputate.(23) The purpose of this new deputate is to provide integrated management of the 15 logistics elements in the systems acquisition process. These elements range from maintainability to technical data and constitute a major portion of the acquisition effort of a program office.

To perform this task of integrated logistics management, the new deputate and the program offices require a management information system (MIS) to gather, store, and process the logistics data generated during the acquisition cycle. The ASD logistics support personnel are uncertain whether the MIS currently in use adequately provides the data required at the program office/staff level. They have written a Logistics Management Information Requirements Identification Plan to determine the adequacy of the current MIS.(7) The plan establishes an eight step process as follows:

1. Identify which ASD Program Offices should be surveyed.

2. Select one representitive logistics element for preliminary survey.

3. Collect and analyze data for that one element.

4. Determine the feasibility of surveying the other 14 elements.

5. Collect and analyze data on those feasible elements.

6. Investigate existing management information systems at ASD.

7. Compare reported data needs to available management information systems.

8. Develop/recommend generic MIS format/contents.

Steps one and two have been accomplished. The Logistics Element that has been selected for preliminary survey is Technical Orders (TO). Technical Orders are the drawings, specifications, and operating, maintenance, and repair proceedures for a weapon system being procured.

RESEARCH QUESTION

The research question investigated in this study is what information is used to manage and control the acquisition of Technical Orders? (Step three from above)

RESEARCH OBJECTIVE

The objective of this research is to answer the research question by accomplishing the following subobjectives:

1. Determine the context in which Technical Orders acquisition occurs.

2. Determine what functions are performed in the Technical Orders acquisition process.

3. Determine what information outputs are generated for the management of the Technical Orders acquisition process.

LITERATURE REVIEW

Most methodologies for the development of management information systems use the systems approach adopted from general systems theory. The systems approach is a way of looking at a set of processes or functions which operate in a certain environment to transform a set of inputs into a different set of outputs. In the past 20 years a plethora of systems development methodologies have been written. All of these methodologies break the development process into a series of steps or phases. Although the number and titles of the steps may differ in different methodologies, the general philosophy is much the same. The steps in three representative methodologies are shown below:

A. Structured Systems Development by Ken Orr (17:198)

1. Plan - identify and scope the problem
2. Define - determine user needs, functions, and outputs

3. Design - write system specifications
4. Construct/Test - build and test hardware and software
5. Install - convert from old to new system
6. Operate - run the system
7. Use - use the products of the system
8. Evaluate - examine the effectiveness of the system.

B. Systems Development Methodology by Burch, Strater, and Grudnitski (4:298)

1. Systems Analysis - define and scope the problem; gather and analyze user needs
2. General System Design - develop broad design and present alternatives
3. Systems Evaluation and Justification - analyze cost effectiveness and employee impact
4. Detail System Design - write system specifications
5. Systems Implementation - train users, test system, convert to new system, and evaluate new system

C. Systems Development Methodology by Hice, Turner and Cashwell (12:3,5)

1. Definition Study - define and scope the problem, formulate objectives, conceive potential solutions, and analyze costs/benefits
2. Preliminary Design - identify system functions, study information requirements, and define subsystems
3. Detail Design - write specifications
4. Program and Human Job Development - write specific task discriptions and software programs
5. Testing - test hardware and software for proper operation
6. Data Conversion and System Implementation - convert from old to new system
7. Operations and Maintenance - use the system, train users, and keep the system effective

In general, the first step in all of these methodologies is to define and scope the problem, determine the user's needs, and determine the inputs and processes required to meet those needs. The second step is to design or describe in general terms a system that will meet those needs. The third step is to evaluate and refine the design to a point where procurement of the major components can begin. The fourth step is to construct and test the system. The fifth step uses the test results to further refine the system's ability to meet the user's needs. The sixth step is to implement and use the system. Since no organization remains static, the seventh step is to continually evaluate the effectiveness of the system. If new needs are identified, the first step is begun again in an iterative procedure.

Despite this well-established development process, information systems developed to support the management process have a poor record of success. Dickson and Simmons (8) surveyed 53 firms experienced in MIS implementation and found that people problems were the primary cause of MIS implementation failures. These people problems stem from user disatisfaction with the system. This results in a spectrum of behavior from refusal to use the system to deliberate sabotage of the system. In each case, the people problems resulted from the developers' failures to involve upper management and the system users in the development process.

Schewe (21) conducted a field survey of 79 MIS users in 10 companies to determine the relationship between user attitudes and MIS usage. He measured user attitudes, perceptions of the hardware and software, perceptions of the MIS management, and system use. He found that user attitudes about the usefulness of the system were more influenced by relations with the MIS staff than by the physical configuration or capabilities of the computer hardware used, but did not find a significant relationship between attitudes and system use. However, Robey (19) studied the sales force of a large manufacturer and found significant relationships between user attitudes and system use. Holland (13) interviewed 33 employees in 3 large organizations with similar results.

Cheney and Dickson (6) performed a field study of 79 users in 8 companies that were implementing a MIS for the first time. They used pre-installation and post-installation questionnaires to measure user decision style, decision environment, job satisfaction, satisfaction with the information provided by the system, and system use. User satisfaction was found to be influenced more by the management of the MIS department than by system technology, and they concluded that proper management of the MIS was more important than the technical sophistication of the system.

Roby and Farrow (20) looked specifically at the user/MIS staff relationship. They conducted a field study to test a constructive conflict model they had developed. The model links user participation in MIS design to influence, conflict and conflict resolution with the MIS staff. They interviewed 62 users in 8 companies that had recently installed an MIS. The data collected supported their model. User participation led to conflict, and where user influence was allowed, conflicts were successfully resolved.

It is apparent from the results of these studies that involvement of the MIS user in the first step of systems development is extremely important. It is the requirements definition step that provides the foundation upon which the rest of the system is built – in fact, it is impossible to build an MIS that meets the user's needs without knowing and understanding what those needs are.

A recent survey of 60 managers with a minimum of 11 years MIS experience showed that both user participation in MIS development and user satisfaction with the system have increased considerably in the past five years. (22) This increase is coincedent with the recent development and use of a number of requirements definition tools and methodologies. A literature review by Alpha Omega Group, Inc. (2:24-43) for the Office of Naval Research found 13 techniques that have been used, or suggested for use, as requirements analysis methodologies. Two of these methodologies, Structured Analysis and Design Technique (SADT) by Softec Inc. and PSL/PSA by the Department of Industrial and Operations Engineering at the University of Michigan, have gained somewhat wider use than the others, especialy within the Department of Defense.

The Air Force uses a version of SADT in its Integrated Computer-Aided Manufacturing (ICAM) System

Development Methodology. ICAM Defintion (IDEF) is the technique used in the definition/needs analysis phase of the methodology. IDEF produces function, information, and dynamic models of the system under study.(16:3-14)

The David W. Taylor Naval Ship Research and Development Center also uses a simplified form of SADT in its Information System Design Methodology. Because of the size of the system the Center is modeling, it also uses PSL/PSA, which is a computer-based technique. The data collected using the functional diagrams are expressed in the Problem Statement Language (PSL) and stored in the Problem Statement Analyzer (PSA) data base. The PSA can produce a variety of reports for the systems analysts' and designers' needs.(14:15-18) However, SADT, IDEF, and PSL/PSA require an extensive period of training and a high level of user sophistication.

A methodology developed by Ken Orr, called Structured Requirements Defintion, provides a similar approach and is easier to learn and apply. The Orr methodology emphasizes definition of the system outputs in two sequential phases. In the first phase, the logical definition phase, an ideal functional definition of the outputs is accomplished through a three step procedure that correlates with the subobjective of this research. In the second phase, the physical definition phase, constraints and characteristics unique to the specific user are incorporated. Because the steps in the logical definition phase correlate with the subobjectives of this research, structured requirements defnition will be used for this research application.

Chapter 2 of this thesis will outline and describe the procedure and tools used in the structured requirements definition methodology. Chapter 3 will then present a model of the TO acquisition process using the tools of the methodology. Chapter 4 provides a summary, findings, and recommended follow-on research.

CHAPTER 2

METHODOLOGY

STRUCTURED REQUIREMENTS DEFINITION

Structured Requrements Definition is an output-oriented methodology that defines a procedure for using a related set of tools. Emphasis is placed on defining the required system outputs. The tools are based on set and systems theory and have been modified and improved through use and experience. The primary tools are the entity diagram, Warnier/Orr diagrams, logical data layouts, and a data dictionary.(17)

TOOLS

The Entity Diagram. The entity diagram was developed to help the analyst get the project started. It allows the analyst to define who does what and the context of the system being analyzed. For each entity involved in the system, an ellipse is drawn and the name of the entity placed inside. Information that passes between entities is defined with arrows showing the direction of flow, as shown in Figure 1. The entity diagram helps the system user and analyst communicate with each other to define the scope of the system. But even more can be deduced from the diagram. For example, the origin and termination of

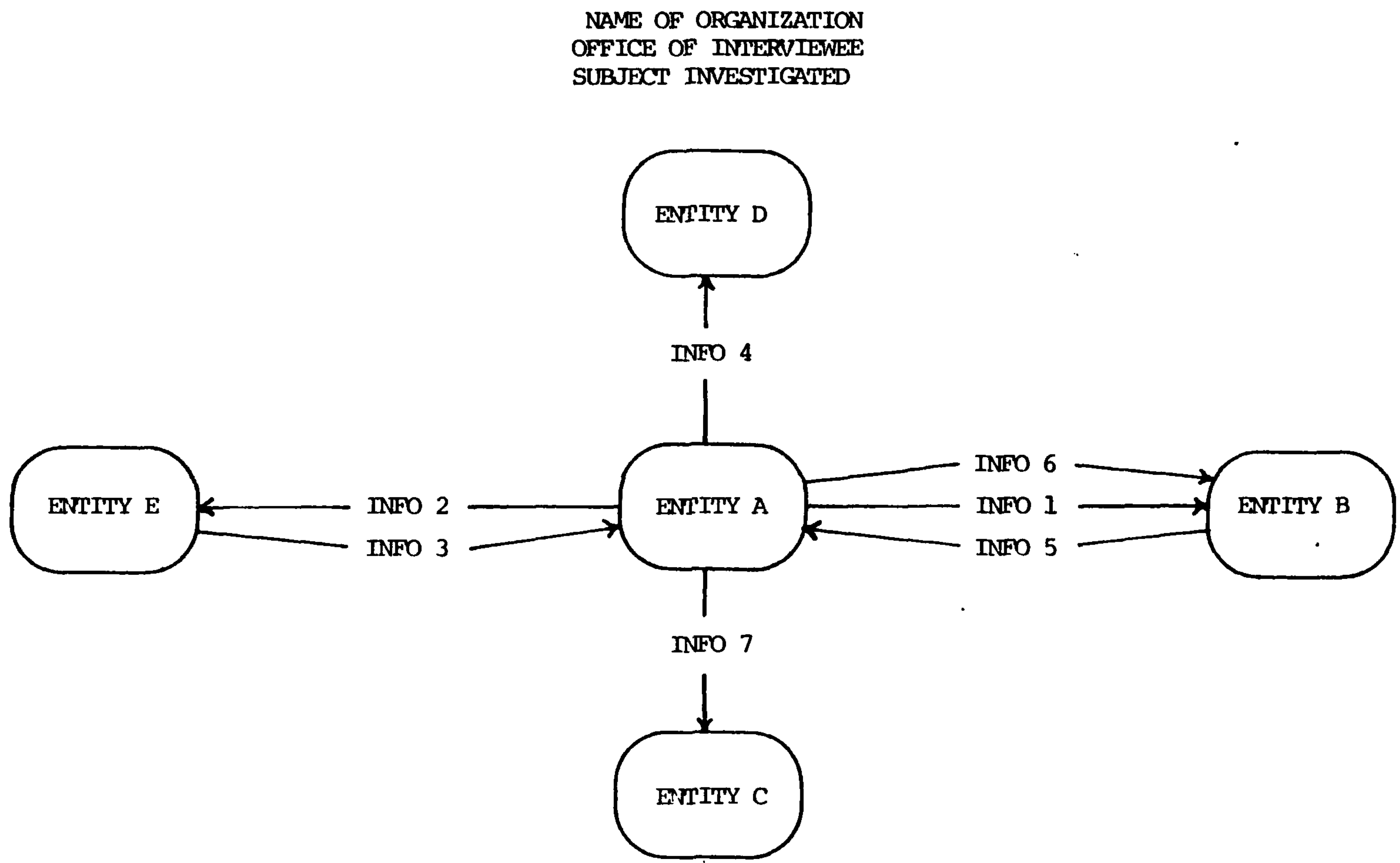


Figure 1

ENTITY DIAGRAM

each arrow represents events such as sending and receiving a report. Thus, events important to the system can be read off the diagram.

The Warnier/Orr Diagrams. As powerful as the entity diagram is, it is only the starting point for the requirements process. Warnier/Orr diagrams, logical data layouts, and the data dictionary are used to further define the system outputs. (17:89-94)

Warnier/Orr diagrams come from the formal definition of sets used in mathematics where a set is defined through the use of braces.

$$X=\{a,b,c,d\}$$

In the Warnier/Orr diagram, the equal sign and right hand brace are eliminated and the elements of the set are listed vertically instead of horizontally. The elements have an implied sequence top to bottom (a to d). Concurrency is indicated by a "+" which is the logical "or" symbol, and repetition of elements is indicated by placing the number of repetitions in parenthesis below the name (n), (0,n) etc. This convention makes it easy for Warnier/Orr diagrams to represent hierarchies of information sets so it is possible to describe an entire system or data base for an organization. (17:65-69)

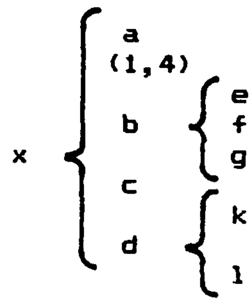


Figure 2
WARNIER/ORR DIAGRAM

The Assembly-Line Diagram. There is a special type of Warnier/Orr diagram called an assembly-line diagram to aid in process definition. By convention, in this diagram, the set of outputs appears on the left of the brace, the input set(s) appear on the right at the top, and the process set appears on the bottom with the concurrency operation "+" between them.

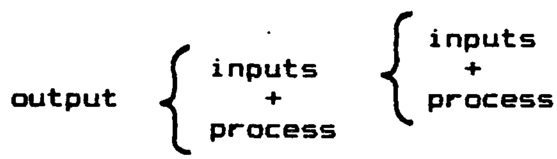


Figure 3
ASSEMBLY-LINE DIAGRAM

Here, as with the standard Warnier/Orr diagram, there is no limit to the number of hierarchical levels for output decomposition. The assembly line diagram is used to delineate the flow of information in a system and identify the needed outputs and processes. (17:70-89)

<u>The Logical Data Layout</u>. Logical data layouts represent a model of the output's physical layout. The logical layouts consist of three elements:

(1) a boundary

(2) "buckets" for elements

(3) the element names

An example is shown below. (17:95-97)

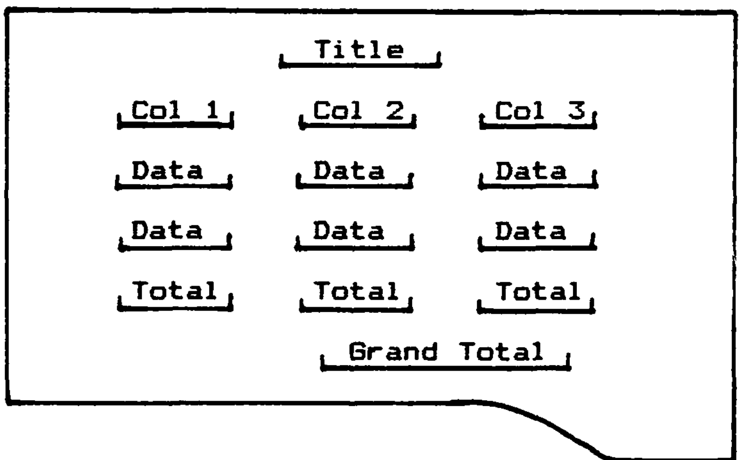


Figure 4
LOGICAL DATA LAYOUT

<u>The Data Dictionaries</u>. The data dictionaries provide a reference source for information about the data in the system. The data dictionary provides a consistent set of names to use when referring to various pieces of information. (17:97-101)

PROCEDURE

The procedure for using these tools is outlined using a Warnier/Orr diagram (Figure 5). There are two sequential phases to the procedure: the logical definition phase and the physical definition phase. In the logical definition phase, the system analyst attempts to define the ideal functional system, thus gaining an understanding of what must be done to support the application. Once this is done, the physical definition phase is used to deal with the characteristics that are unique to the specific user. (17:121-191)

Logical Definition Phase. The first step in the logical definition phase is to define the application context. Each system user is interviewed and an entity diagram created. The individual entity diagrams are then combined to make one overall user level entity diagram. This diagram will usually contain too much information (all the interaction within the system). What is really needed is a picture of only the critical interactions. This picture is achieved by defining the application level entity diagram. A boundary is drawn around all the entities internal to the organization under study, and these entities are combined into one elipse representing the organization. This strategy suppresses the internal interactions and leaves only the major objectives of the

- REQUIREMENTS DEFINITION PROCEDURE
  - LOGICAL DEFINITION PHASE
    - DEFINE APPLICATION CONTEXT
      - DEFINE USER-LEVEL ENTITY DIAGRAM (FOR EACH USER)
      - DEFINE COMBINED USER-LEVEL ENTITY DIAGRAM
      - DEFINE THE APPLICATION-LEVEL ENTITY DIAGRAM
      - DEFINE THE OBJECTIVES
    - DEFINE APPLICATION FUNCTIONS
      - DEFINE "MAIN-LINE" FUNCTIONAL FLOW
      - DEFINE SCOPE
      - ANALYZE FUNCTIONAL PROCESSES
        - ENTITY DIAGRAM OBJECTIVES
        - MAIN-LINE FUNCTIONAL FLOW
        - DEFINE CONTROL AND FEEDBACK
        - DEFINE TASKS AND PROCEDURES
      - DEFINE DECISION SUPPORT FUNCTIONS
    - DEFINE APPLICATION RESULTS
      - IDENTIFY OUTPUTS
      - DEFINE OUTPUTS
        - DEFINE FORM
        - DEFINE STRUCTURE
        - DEFINE CONTENT
        - DEFINE DATA ELEMENTS
      - DEFINE ORGANIZATIONAL CYCLES
  - PHYSICAL DEFINITION PHASE
    - DEFINE CONSTRAINTS
    - DEFINE ALTERNATIVE PHYSICAL SOLUTIONS
    - DEFINE BENEFITS/RISKS OF EACH ALTERNATIVE
    - SELECT RECOMMENDED COURSE OF ACTION
    - PREPARE REQUIREMENTS DEFINITION PROCEDURE

Figure 5

STRUCTURED REQUIREMENTS DEFINITION PROCEDURE system. The last step in defining the application context is to define measurable external objectives. This is done by inspecting the application-level entity diagram, and each point where a transaction enters or leaves the organization an objective is stated. The result is a list of objectives such as receive orders, send shipments, and receive payments.(17:125-142)

The second step in the logical definition phase is to define the application functions. To define the application functions, the application entity diagram is systematically converted to an assembly-line diagram which shows the main line functional flow. Each brace in the assembly-line diagram represents a functional process. The functional flow may be too large for the detail definition process to be attacked. However, the main line functional flow provides an excellent basis for defining a reduced scope. With the main line functional flow properly scoped, analysis of the functional processes can begin. At this point the procedure becomes regressive, each functional process is treated as a subsystem, and the same set of steps that have been accomplished to this point are repeated until all the functional processes in the assembly-line diagram can be thought of as simple activities that produce a single output or related set of outputs.(17:142-156)

The main line functional flow diagram is predicated on ideal circumstance - that every thing will go right. As this is not the way things work in the real world, processes must be added to handle exceptions and errors. This is called defining the control and feedback. Once this is done the tasks and procedures can be defined. The Warnier/Orr diagram is used for this purpose. The diagram for each task or procedure should identify the outputs created, the actions performed, the frequency of the actions, and the information required to perform the actions.(17:156-166)

The last step in defining the application functions is to define the decision support functions. Decision support functions are those processes management uses in planning and controlling the operations of the system. The task here is to get management to identify the few key variables they use to perform these tasks.(17:167-173)

The third and last step in the logical definition phase is to define the application results. Before the outputs can be defined, they must be identified. This is done by creating an in-out diagram for each functional process in the assembly-line diagram. The in-out diagrams give a simple, exhaustive list of the outputs, as shown in Figure 6.(17:173-174)

Definition of the outputs involves four steps. The output form is defined using the logical data layout. A Warnier/Orr diagram is created to define the output

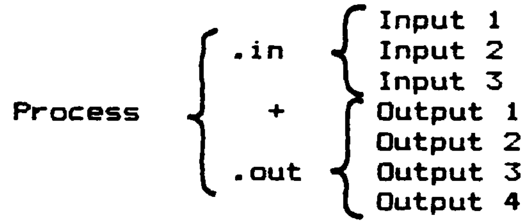


Figure 6
IN-OUT DIAGRAM

structure. The output content is displayed using a mock-up or sample. At the same time, the data dictionary is created to define the data elements. This process provides the user with a visual example of the outputs, which makes it easier for him to get an idea of what he will be getting from the system and to make constructive changes before things are implemented. The only remaining step is to identify the frequency of occurence for each output and fit the outputs into a total picture of the system. Again a Warnier/Orr diagram is constructed to display the total system picture. To this point, only the ideal functional system has been addressed, so it is then necessary to address the technical aspects. These have been left to the physical requirments definition phase.(17:173-183)

Physical Definition Phase. In this phase critical constraints such a volumes, response times, security of data, computer hardware, reliability, software, organizational considerations, and costs and schedules are identified. Once the constraints have been identified, alternative solutions to providing the functions identified in the logical definition phase can be identified, analyzed and a recommended course of action selected. Finally a requirments definition document is written to describe exactly what was discovered in the requirments definition process. The document should summarize and present the material that was developed during the logical and physical definition processes.(17:183-191)

APPLICATION

The logical definition phase of the structured requirements definition procedure provides a method to achieve the three subobjectives of this research. The three major steps in the procedure correlate with the three subojectives: To determine the context, functions, and outputs of the technical order acquisition process.

The entity diagram was used to conduct structured interviews with members of seven Technical Order Management Agencies (TOMAs) within ASD and the ASD staff TO specialist. This information, and information gained from a review of AF manuals and regulations on TO acquisition, and the logical definition phase procedure were used to create the TO acquisition process model presented in Chapter 3.

CHAPTER 3

TECHNICAL ORDER ACQUISITION PROCESS MODEL

INTRODUCTION

The results of this research are presented in three sections which correspond to the research subobjectives and the three steps of the logical definition phase of the methodology outlined in Chapter 2. The tools defined in Chapter 2 are used in presenting the model. The context definition section presents the application entity diagram and application objectives. The functional definition section presents the assembly-line diagram and describes the application and decision support functions. The output identification section identifies and describes the outputs used to manage the process.

CONTEXT DEFINITION

The application entity diagram in Figure 7 identifies the types of organizations and interfaces involved in the Technical Order (TO) acquisition process. Figure 7 is a summary of the individual entity diagrams contained in Appendix A. The diagram indicates that the Technical Order Management Agency (TOMA) is the manager of a team consisting of the user of the system being procured, the AFLC Air Logistics Centers (ALCs) responsible for support of the system, the agency responsible for operational test

AERONAUTICAL SYSTEMS DIVISION
TO MANAGEMENT AGENCY
TO ACQUISITION PROCESS

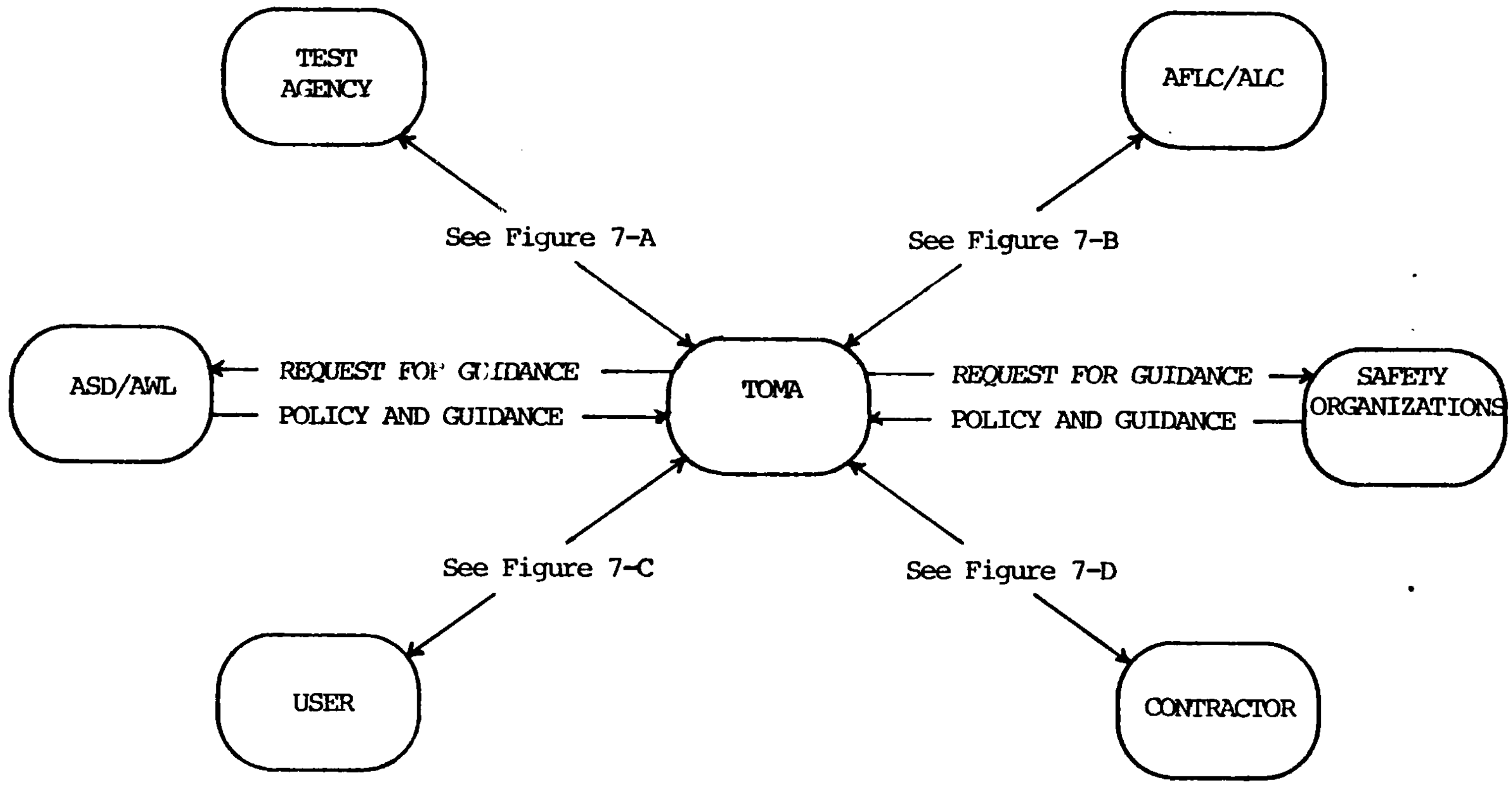


Figure 7

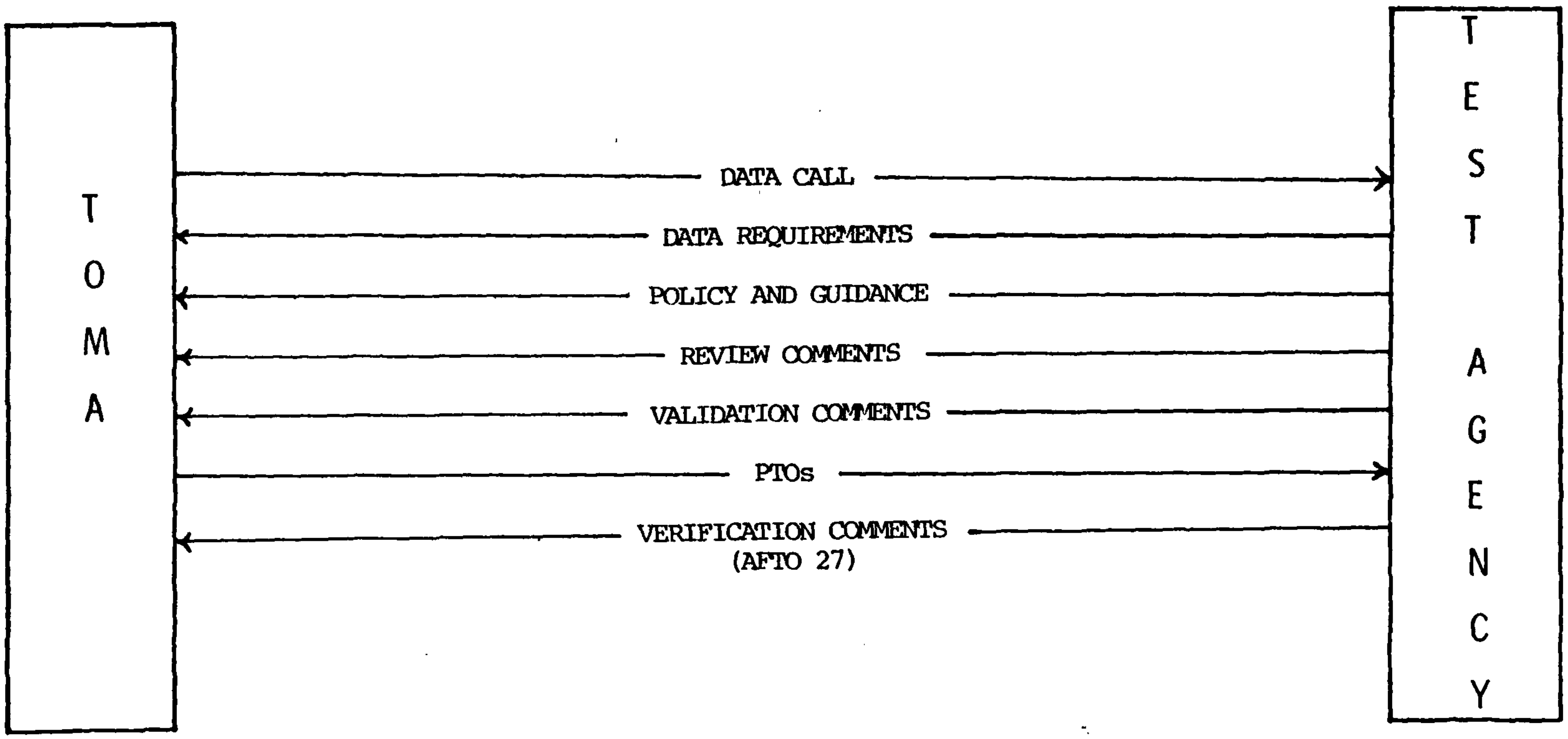


Figure 7-A

TOMA TEST AGENCY INTERFACE

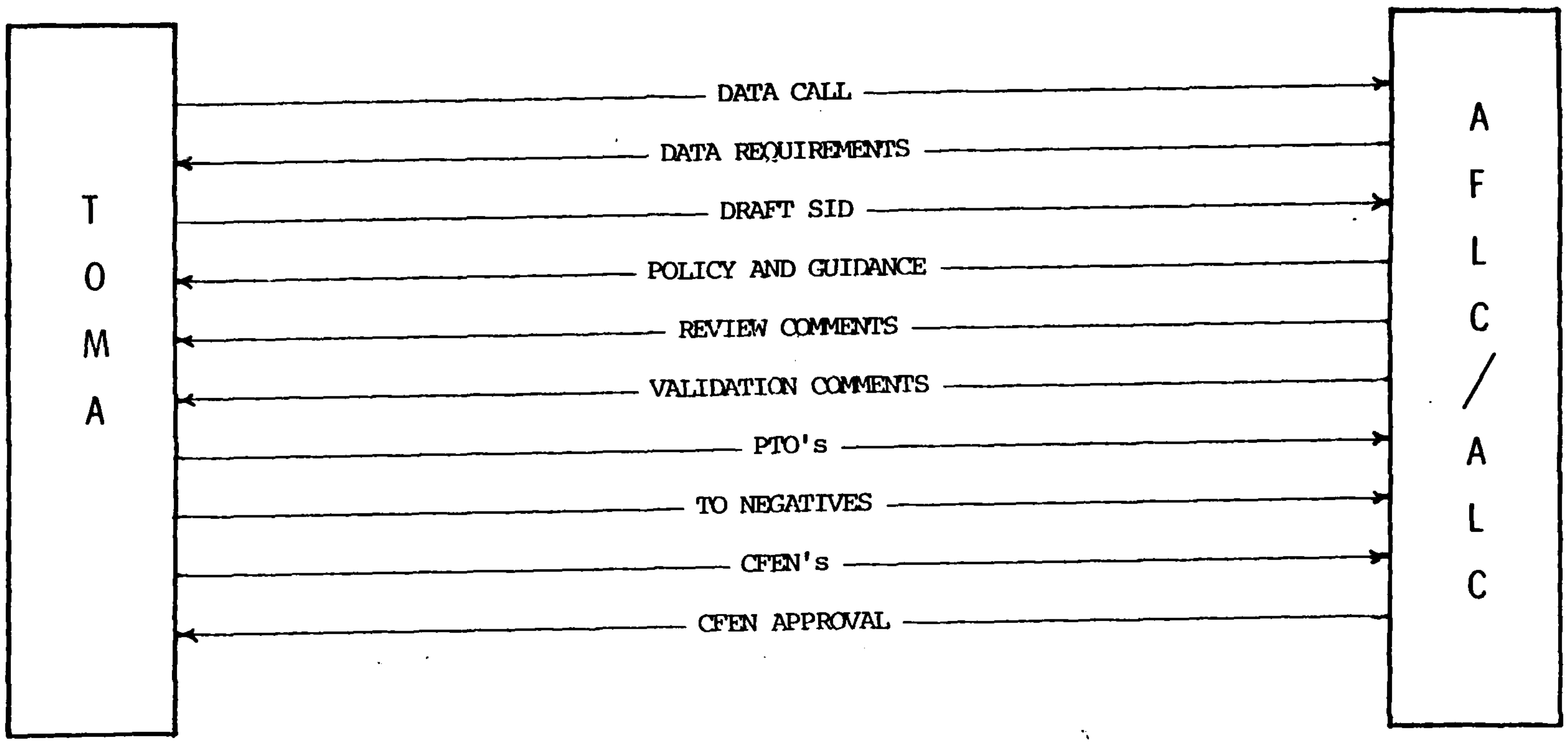


Figure 7-B

TOMA AFLC/ALC INTERFACE

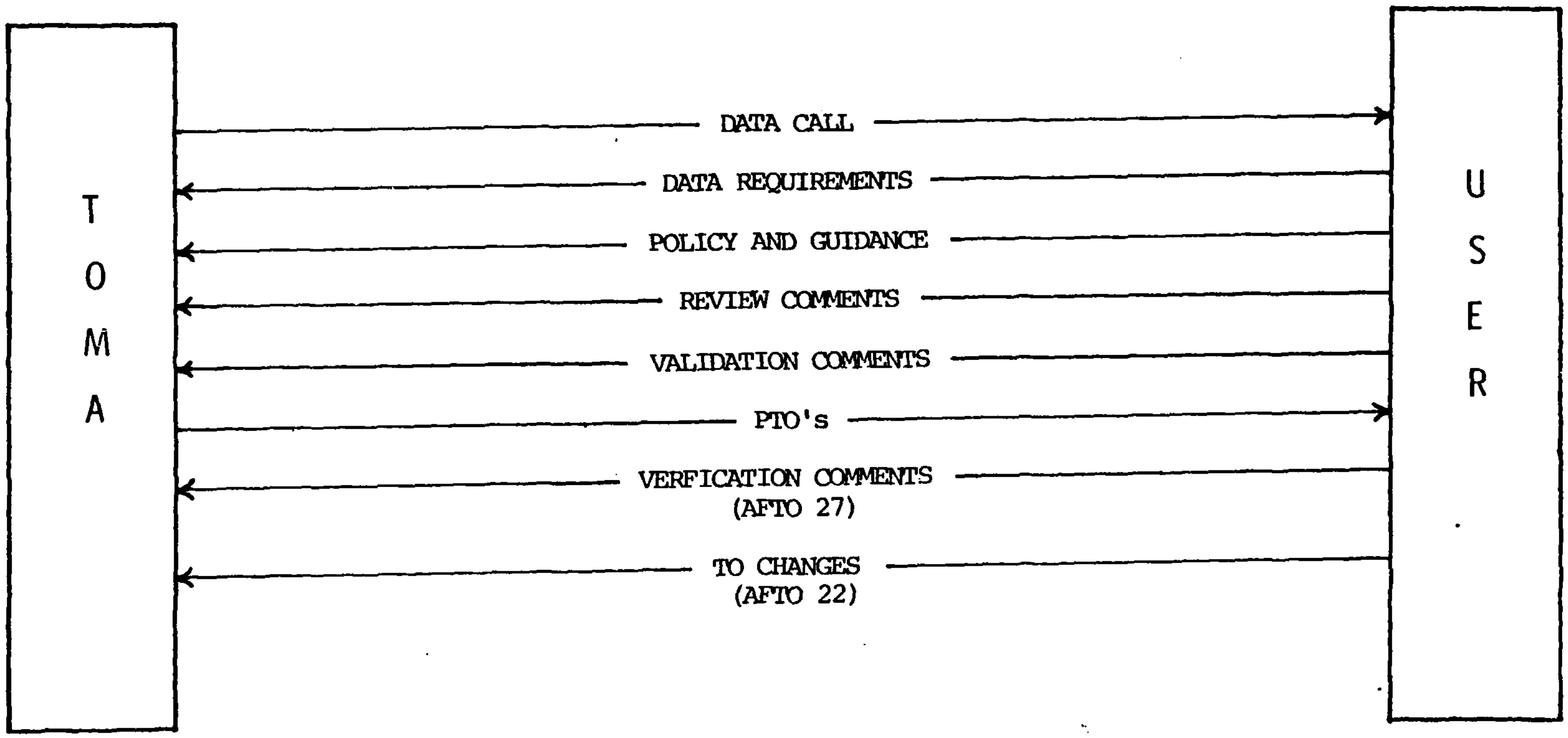


Figure 7-C

TOMA USER INTERFACE

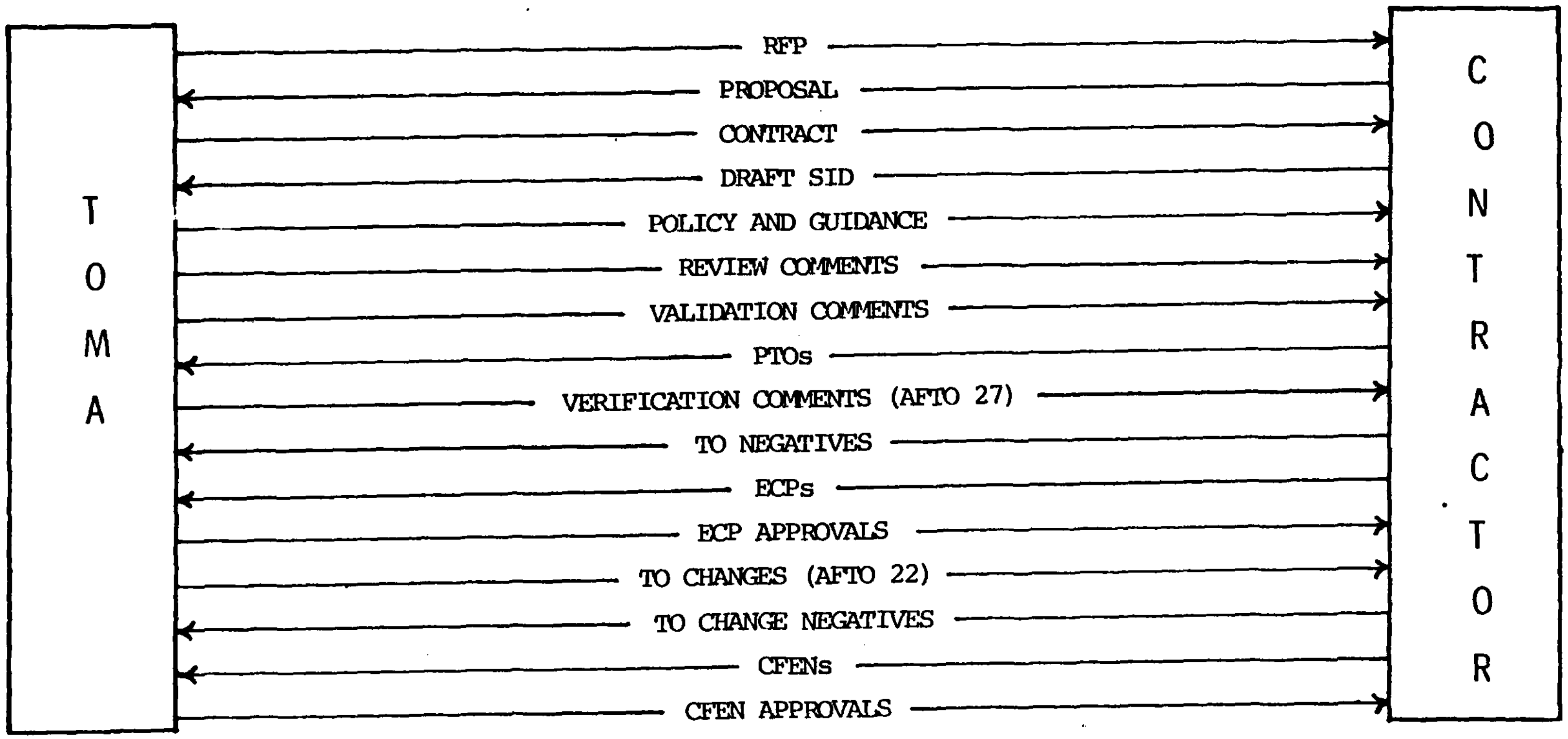


Figure 7-D

CONTRACTOR TOMA INTERFACE

and evaluation of the system and the contractor producing the system. This team is responsible for the type, quantity, and quality of the technical orders the contractor delivers. The TOMA also obtains guidance on TO acquisition policy from the ASD Deputy for Acquisition Support (ASD/AWL) and guidance on TO safety content from various safety organizations. The TOMA itself is a team of personnel from different offices within the system program office responsible for acquisition of the system.

The interfaces between the organizations in the application entity diagram provide an initial set of objectives for the TO acquisition process. These objectives are used in developing the assembly-line diagram which facilitates functional definition. A number of the interfaces, such as the data calls, occur simultaniously and are considered a single action. Also, those interfaces where the TOMA, user, and ALC work as a team with the contractor, such as with In-Process Review (IPR) comments, are treated as a single action. Therefore, the list of objectives below is shorter than the total number of interfaces in Figure 7.

Objectives

1. Send data call (to users, ALC, and test agency)
2. Receive data requirements (from users, ALC, and test agency)
3. Send Request For Proposal (RFP) (to contractor)

4. Receive proposal (from contractor)

5. Award contract (to contractor)

6. Receive draft Specification Interpretation Document (SID) and TO recommendations (from contractor)

7. Send policy and guidance (to contractor)

8. Send In-Process Review (IPR) comments (to contractor)

9. Send validation comments (to contractor)

10. Receive Preliminary Technical Orders (PTOs)(from contractor)

11. Send verification comments (AFTO Form 27) (to contractor)

12. Receive TO negatives (from contractor)

13. Send TO negatives (to ALC and Printer)

14. Receive Contractor Furnished Equipment Notice (CFEN) (from contractor)

15. Send CFEN approval (to contractor)

16. Receive Engineering Change Proposals (ECPs) (from contractor)

17. Send ECP approval (to contractor)

18. Receive TO changes (from user and ALC)

19. Send approved TO changes (to contractor)

20. Receive TO change negatives (from contractor)

21. Send TO change negatives (to ALC and printer)

FUNCTIONAL DEFINITION

The assembly line diagram shown in Figure 8 defines the main-line functional flow and identifies the principal outputs and functional processes that constitute the TO acquisition process. The decision support functions used to plan and control this process were identified separately, but they will also be discussed where they occur in the process. Each output and functional process is discussed, starting with the data call and requirements identification process, and concluding with the printing of the TO.

The data call is a request to all affected agencies to identify the type and quantity of TO and decision support documentation they require. Receipt of the data requirements starts the requirements definition-RFP preparation process. During this process the TOMA organizes and consolidates the requirements of the interested agencies and obtains clarification from them on any unclear areas and justification for requirements that seem unwarranted. The TOMA prepares two documents for the RFP, a statement of work which defines the work effort expected of the contractor and the contract data requirements list (CDRL) which identifies specifically what data are to be prepared and delivered. The first decision support function, TO Publication Planning, takes place during this process also. A TO Publication Plan (TOPP) outlines in detail how the entire TO acquisition process will be conducted. A draft TOPP is usually included in the RFP to serve as a guide for the contractor to follow in developing a detailed TOPP.

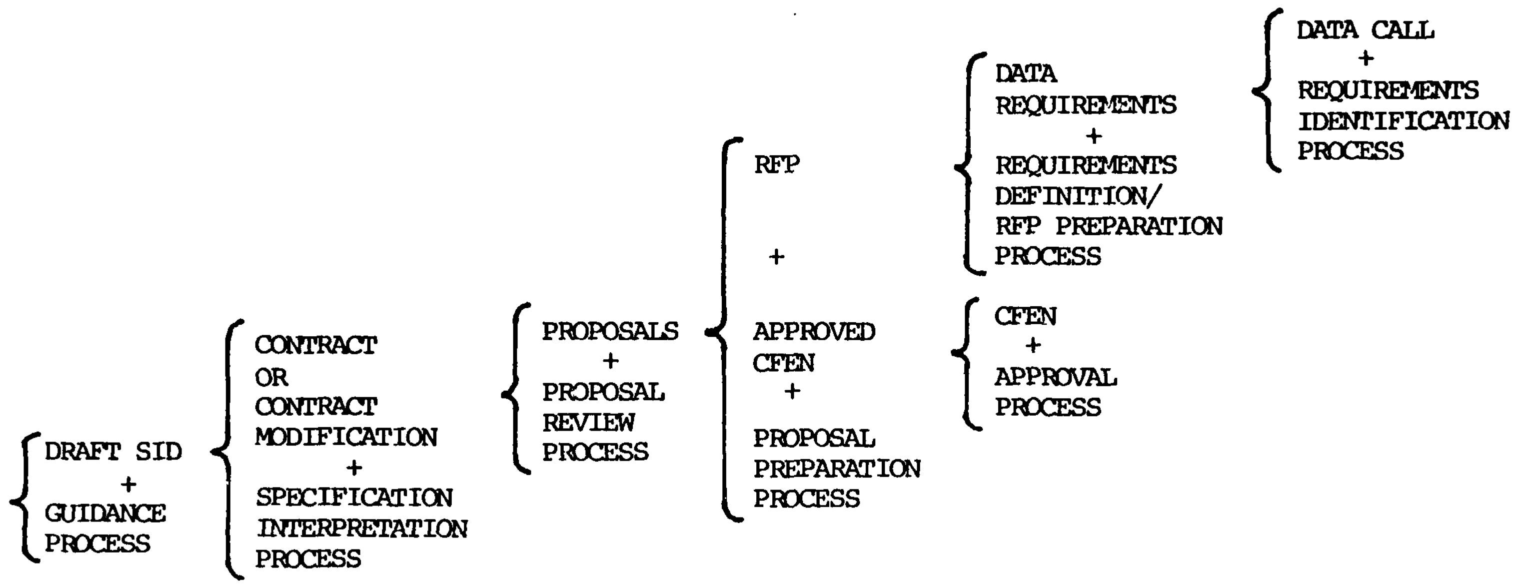


Figure 8

MAIN-LINE FUNCTIONAL FLOW

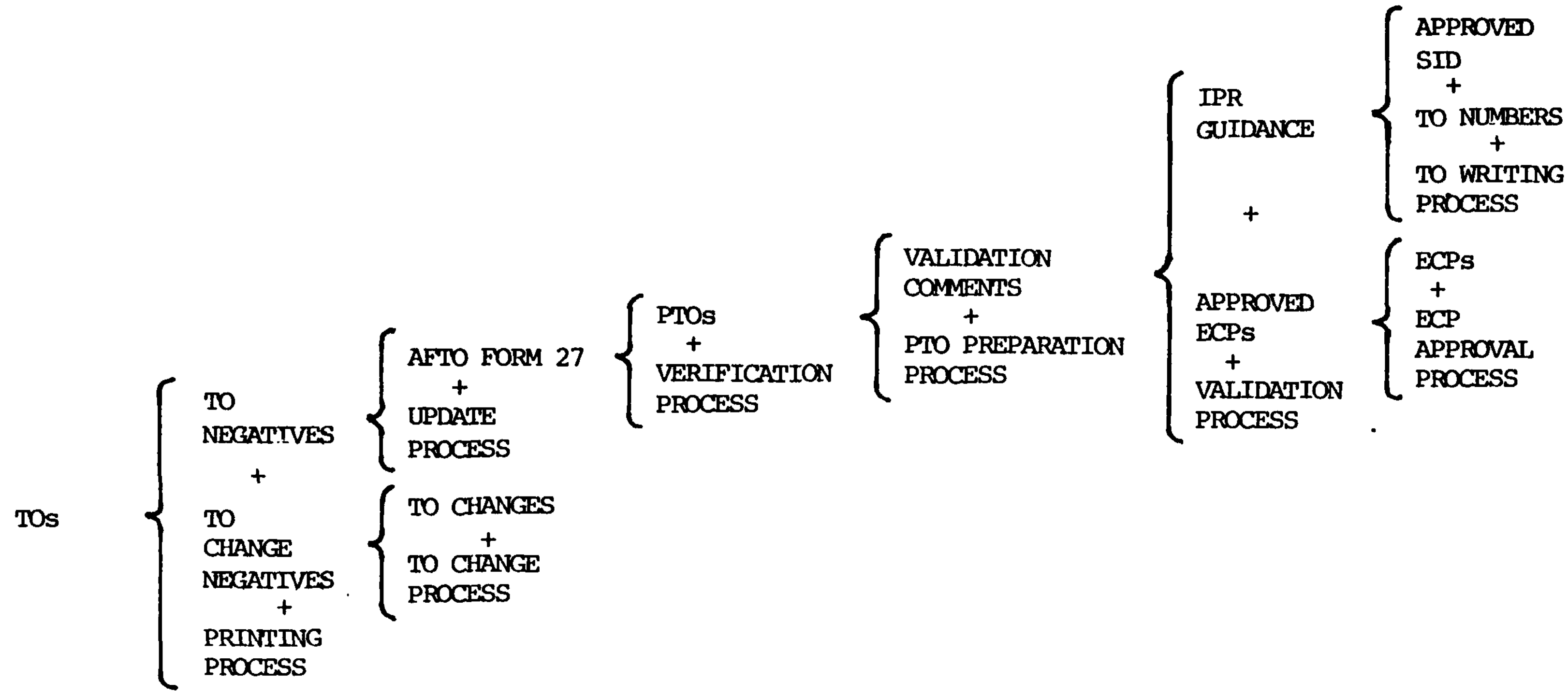


Figure 8 Cont

MAIN-LINE FUNCTIONAL FLOW

Because the TO requirements are defined early in the design of the system being procured, not all TO requirements can be identified during the requirements definition process. The Contractor Furnished Equipment Notice (CFEN) is a standard format the contractor uses throughout the design of the system to recommend additional TO requirements as they are identified. An approved CFEN performs the same function as the RFP. They both prompt a contractor to submit a proposal that defines how he will meet the TO requirments and the cost of doing so. The proposal is reviewed by the TOMA, user, ALC team, and a contract or contract modification is negotiated and awarded.

The award of the contract starts the specification interpretation (SID) process. During the process the contractor prepares a draft SID, which identifies the modifications and waivers to the contract specifications necessary to tailor the TOs to the system being procured and the contractor also writes the detailed TOPP. Both are reviewed by the TOMA, user, ALC team, and a guidance conference is held in which the contractor receives comments and guidance on the SID and TOPP. When understanding of the requirements is reached by all parties, the SID and TOPP are approved and a number is assigned for each deliverable TO. With this accomplished the contractor begins writing the TOs.

During the writing process the second decision support function, status and schedule monitoring, begins. The contractor submits monthly status and schedule reports, and In-process reviews (IPR's) are held to evaluate the contractors progress and understanding of the TO requirements. Guidance on technical content and safety requirements is provided, and meeting minutes are kept to record action items and policy decisions agreed to during the reviews.

Changes in the design or configuration of the system will usually have some effect on the TOs. Therefor, the TOMA participates in the review and approval of ECPs to ensure that the appropriate changes are incorporated in the TOs. Once the ECPs and IPR guidance are incorporated into the draft TOs, the contractor validates the draft by actual performance of the operating and maintenance procedures on the system. Representatives of all the interested organizations attend validation. Because this is the first time the written procedures are performed, there are usually a large number of deficiencies identified and provided to the contractor as validation comments. The contractor incorporates these comments into the draft TO, converting it to a preliminary TO (PTO) which is delivered to the TOMA for verification.

The verification process is similar to validation except user personnel perform the procedures. A third decision support function, verification planning, supports this process. The TOMA or verification agent, usually the operational test and evaluation agency, does the planning. Deficiencies found in the PTO during the verification process are provided to the TOMA and contractor on AFTO Form 27.

The contractor uses the AFTO Form 27 to update the PTO converting it to a formal TO. Prior to delivery of negatives from which the TO is printed a pre-publication review is held to verify that all of the verification deficiencies have been corrected. TO printing is accomplished by the TOMA through Government Printing Office established contracts. Distribution of the TO is controlled by the Oklahoma City ALC.

The TOMA and contractor may become involved with the Technical Order Improvement Reporting System (AFTO-22 System) if the TO is fielded and put to use before the transfer of management responsibility to the responsible ALC.

OUTPUT IDENTIFICATION

The TO acquisition process, as shown above, is managed through three decision support functions, TO Publication Planning, verification planning, and status and schedule maintenance. Each of these functions produces one or more outputs. TO publication planning produces the TOPP. Verification planning produces the verification plan. Status and schedule maintenance produces a number of status and schedule reports and meeting minutes reports.

The TOPP is the primary planning document for TO acquisition. It contains the requirements for style, type, quantity, and quality of the TOs being procured, as well as a delineation of the responsibilities of the agencies involved, and a schedule tying the TO acquisition milestones to the system design and production milestones. A detailed plan for the contractors validation effort is also included. The TOPP contains detailed plans for every function in the acquisition process except verification.

The verification plan defines the objectives, requirements, and responibilities of the agencies involved. Scheduling of the personnel and equipment is extremely difficult because it is impacted by the Operational test and evaluation (OT&E) schedule and the availability of PTOs. Therefore, the (OT&E) schedule is usually followed. The verification plan does identify whether full verification (one-step) or partial verification (two-step) will be conducted on each TO. In the latter case the PTO is published as partially verified and does not become a formal TO until its entire contents are verified.

The status and schedule report is the primary management control document. It is usually submitted by the contractor on a monthly basis after the initial submittal and contains the status and schedule of the events outlined in the TOPP. Each TO being procured is treated separately in the report. In TO acquisitions where a large number of TOs are initiated through the CFEN process, the TOMA maintains a separate status and schedule report to track the actions and costs required in processing the CFENs. Meeting minutes are also used to track the progress and completion of action items identified during in-process, pre-publication, and post-publication reviews and guidance conferences.

SUMMARY

This chapter presented a model of the TO acquisition process. Basically, five agencies work together as a team to perform the processes outlined in the main-line functional flow shown in Figure 8. The TOMA uses three decision support functions to manage the team's effort. First, TO publication planning produces the TOPP which identifies in detail who does what and when. Second, status and schedule reporting is done to insure the plan is followed, and finally, verification planning helps bring together the men and equipment necessary to accomplish a smooth verification effort. The outputs of these three functions were identified and discussed.

CHAPTER 4

SUMMARY/FINDINGS/RECOMMENDATION

SUMMARY

This thesis answers the question asked by the ASD Logistics Support Personnel of what information is currently used to manage and control the acquisition of Technical Orders. Answering the question was the third step of a larger effort to determine the adequacy of the existing logistics MISs at ASD. A review of information requirements definition methodologies was conducted, and the logical definition phase of Structured Requirements Defintion by Ken Orr was selected as the most appropriate methodology to answer the research question. This methodology emphasizes defining required system outputs, and consists of a three step procedure for using a set of related tools. These three steps, which correlate with the thesis subobjectives, are context definition, functional defintion, and output definition.

In the context definition step the entity diagram was used to interview seven TOMA's within ASD and the ASD staff TO specialist. The information gathered from the interviews and a review of AF Regulations and manuals on TO acquistion revealed there are five primary agencies involved in the TO acquisition process. These five agencies are the TOMA, user, AFLC/ALCs, Test agency, and contractor. The information gathered also indicates that there are some 21 major transactions, called objectives, that occur between these agencies.

In the functional definition step the 21 objectives were used to create an assembly-line diagram that allowed definition of the main functional processes and their associated inputs and outputs. Three decision support functions or management functions, used to plan and control the TO acquisition process, were also identified. These functions are Technical Order Publication Planning, verification planning, and status and schedule monitoring.

In the output definition step the outputs of the three decision support functions, the TOPP, verification plan, status and schedule reports and meeting minutes were identified and described.

FINDINGS

The Structured Requirements Definition methodology was easy to learn and apply. The entity diagram is an effective tool for conducting personal interviews. It helps keep the interviewee on the subject at hand and provides an easy way of recording the information provided during the interview. However, the interview topic must be kept relatively simple in scope or the entity diagram will become too complex to maintain. The assembly-line diagram was also a convenient and easy tool to use to identify a systems inputs, outputs, and processes.

As a result of the interviews and TO documention review, three findings emerged which were not in the mainstream of this research, but are of such significance that they should be reported.

First, there are no specific job descriptions or qualifications for TOMA personnel, and the TOMA is susceptible to rapid turnover of personnel. This was also a finding in a study performed for the Air Force Human Resources Laboratory (11:9). Second, there is no single comprehensive source of or responsibilty center for information describing the TO acquisition process. This makes it difficult for inexperienced TOMA personnel to learn the process. Third, very little, if any, of the management information collected and used by the TOMA is reviewed by higher levels of management. Together, these findings indicate a lack of attention to TO acquisition by senior Air Force management.

RECOMMENDATION

Further research should be conducted to determine the information required to manage the other 14 system acquisition logistics elements. The findings of this and future research can then be compared to the information available in ASD's current management information systems to evaluate their adequacy. The information so gathered can then be used to develop and recommend MIS improvements.

APPENDIX A

ENTITY DIAGRAMS

LIFE SUPPORT SPO
TO MANAGER (10)
TO ACQUISITION PROCESS

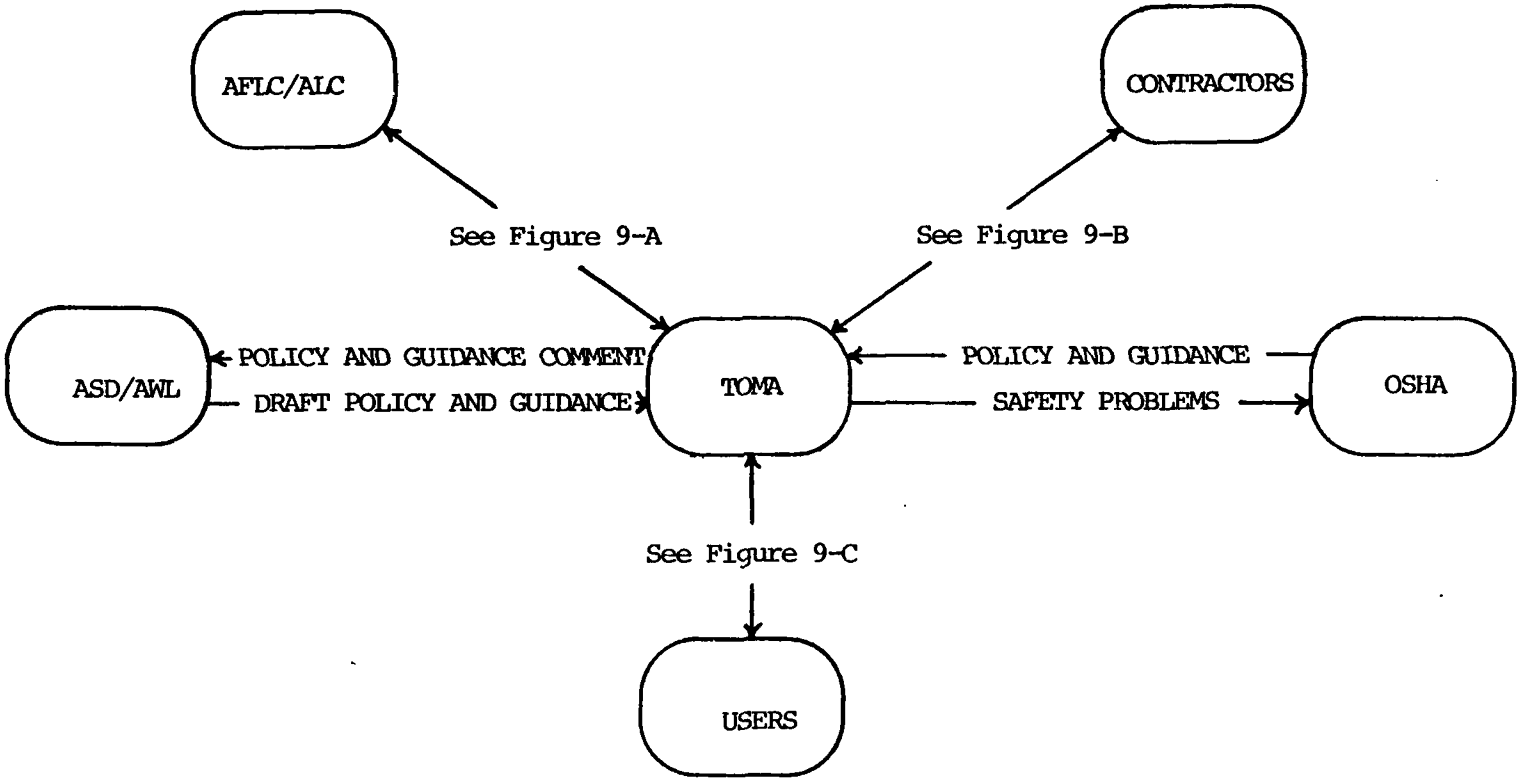


Figure 9

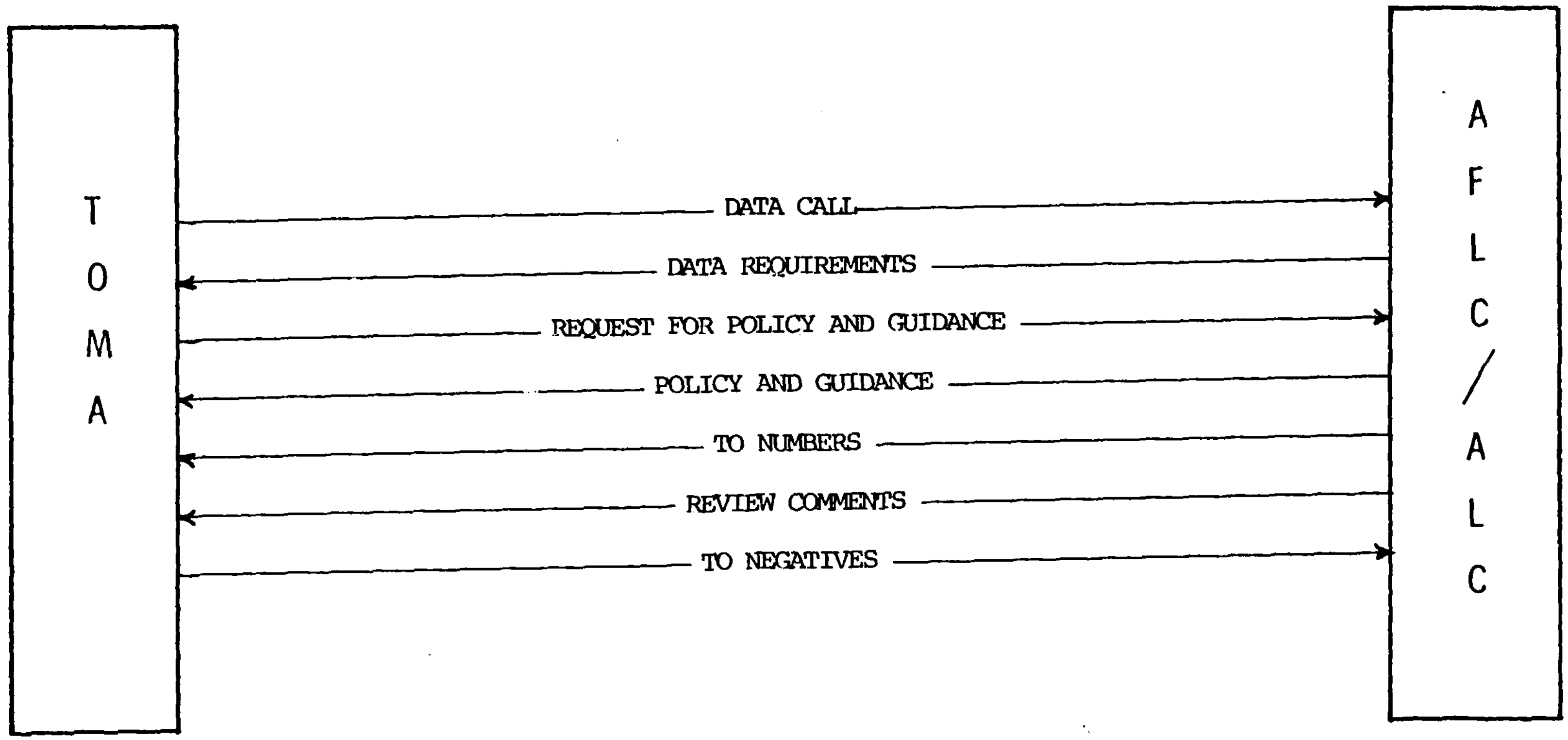


Figure 9-A

TOMA AFLC/ALC INTERFACE

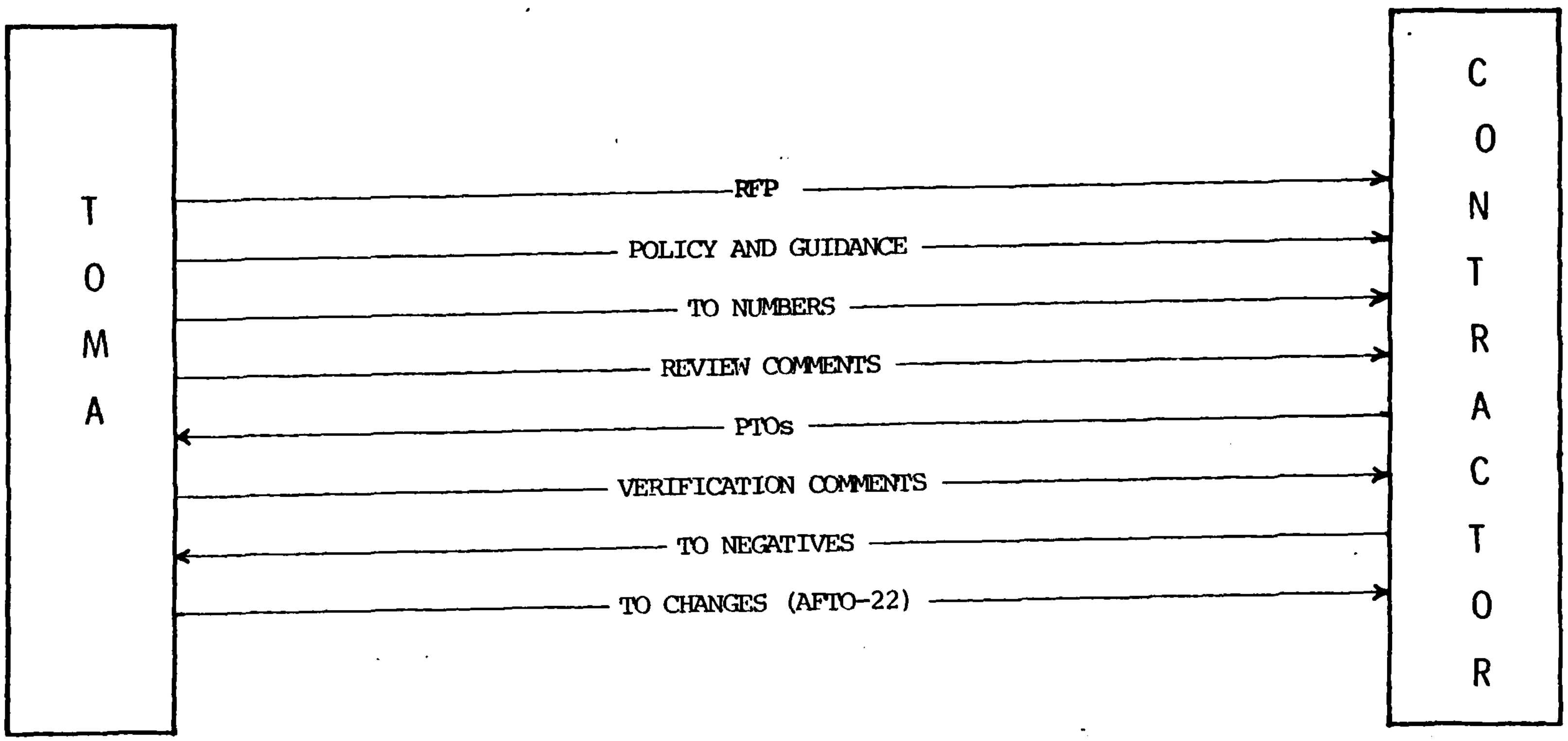


Figure 9-B

TOMA CONTRACTOR INTERFACE

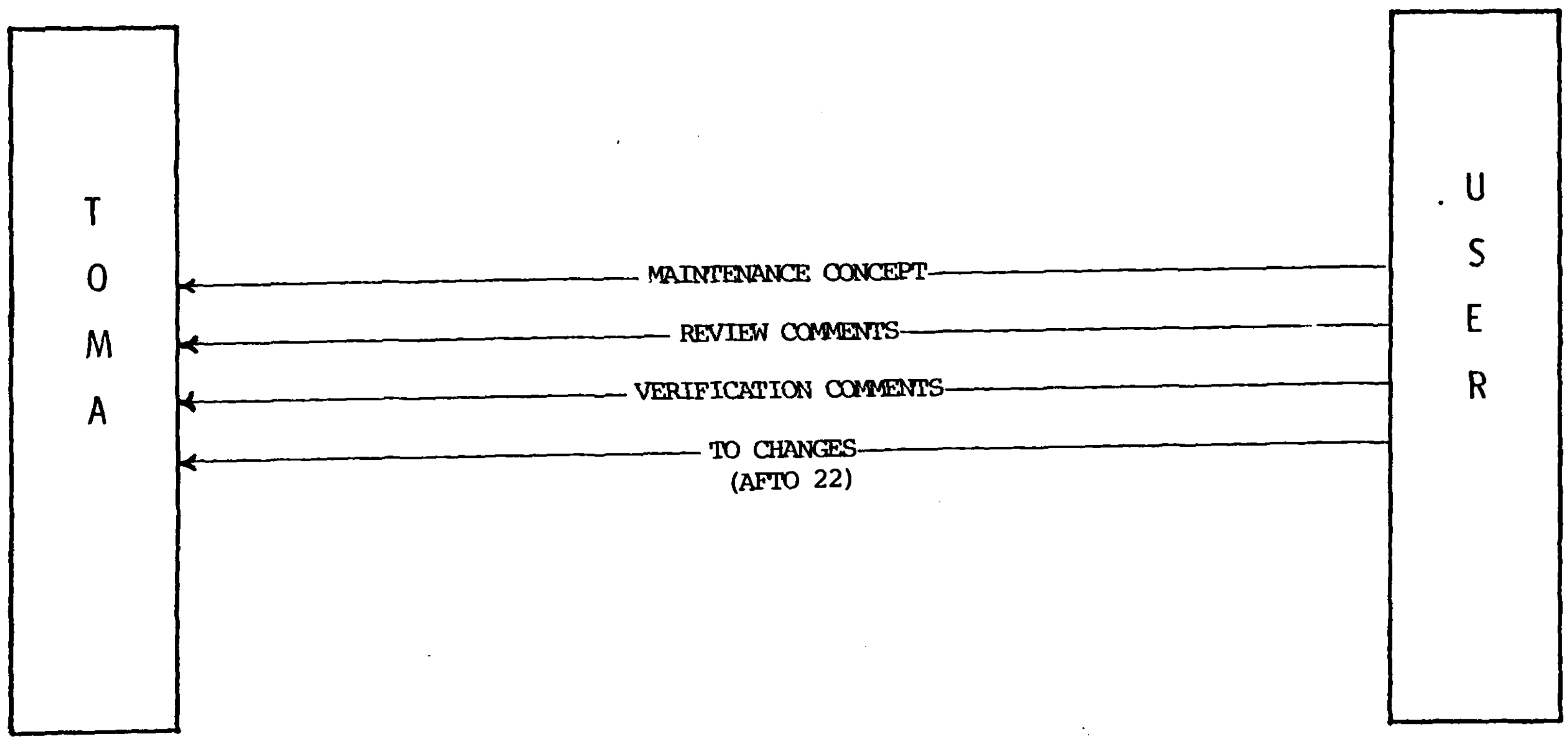


Figure 9-C

TOMA USER INTERFACE

DEPUTY FOR SIMULATORS AND TRAINERS
KC-135, KC-10 SYSTEMS BRANCH (1)
TO ACQUISITION PROCESS

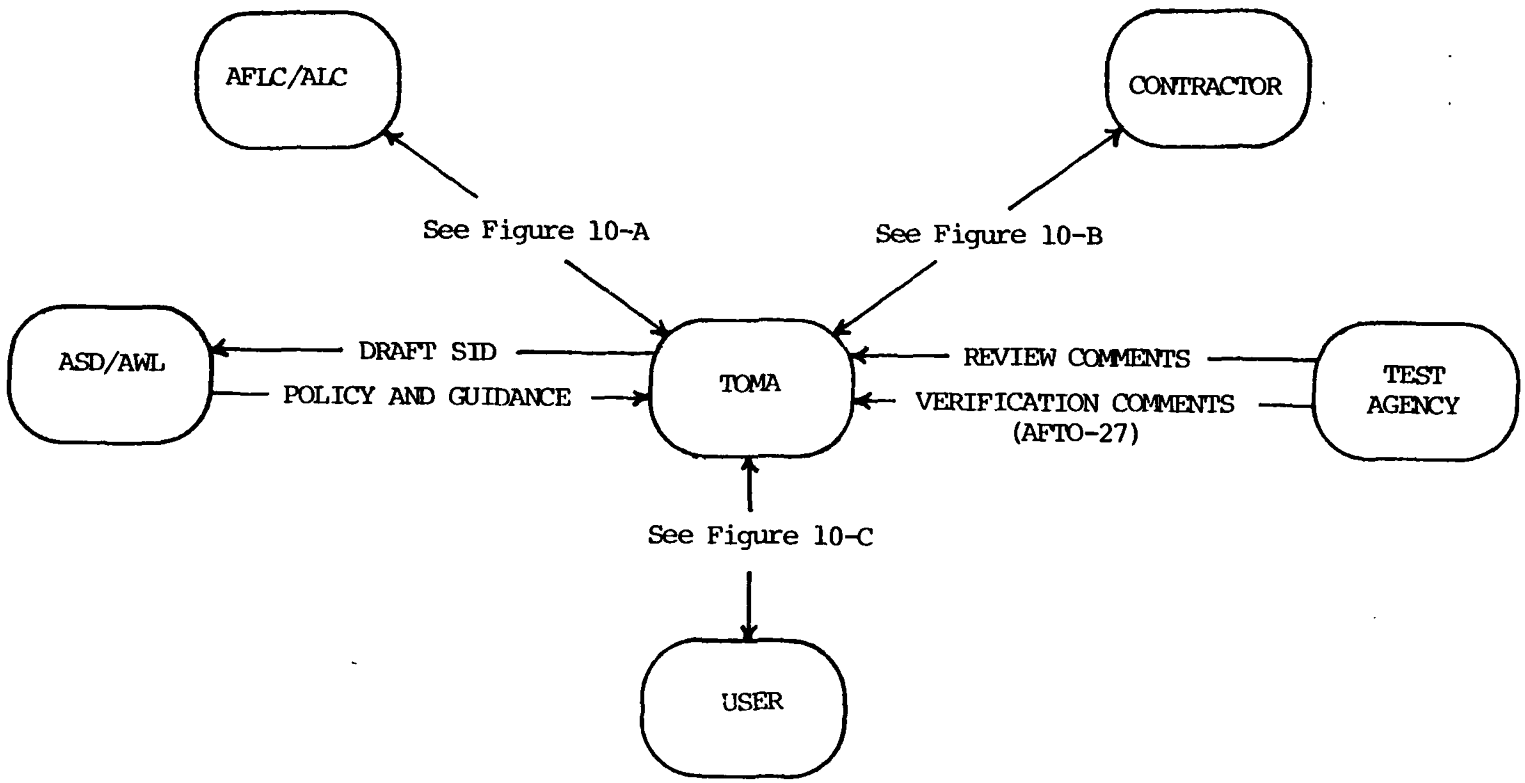


Figure 10

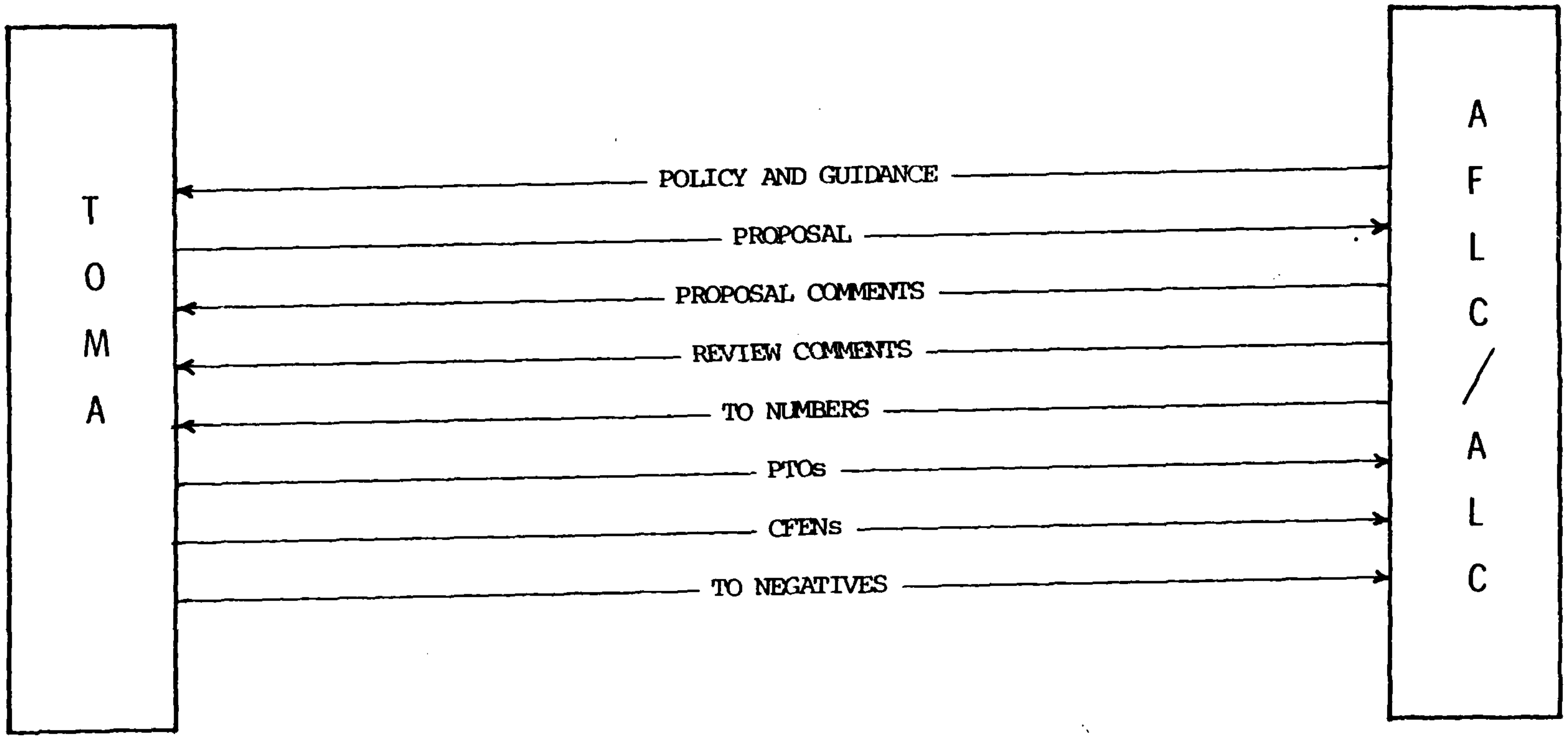


Figure 10-A

TOMA AFLC/ALC INTERFACE

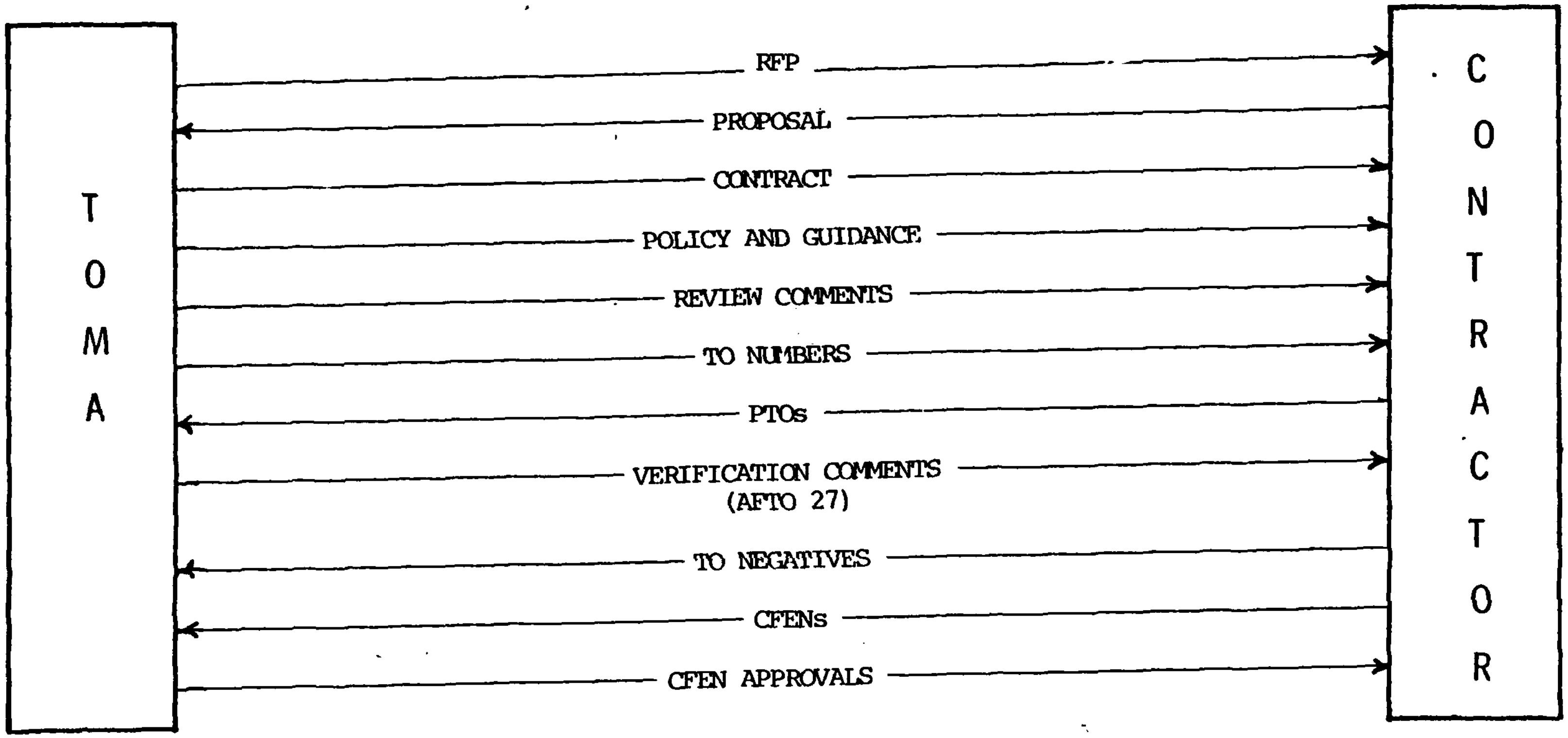


Figure 10-B

TOMA CONTRACTOR INTERFACE

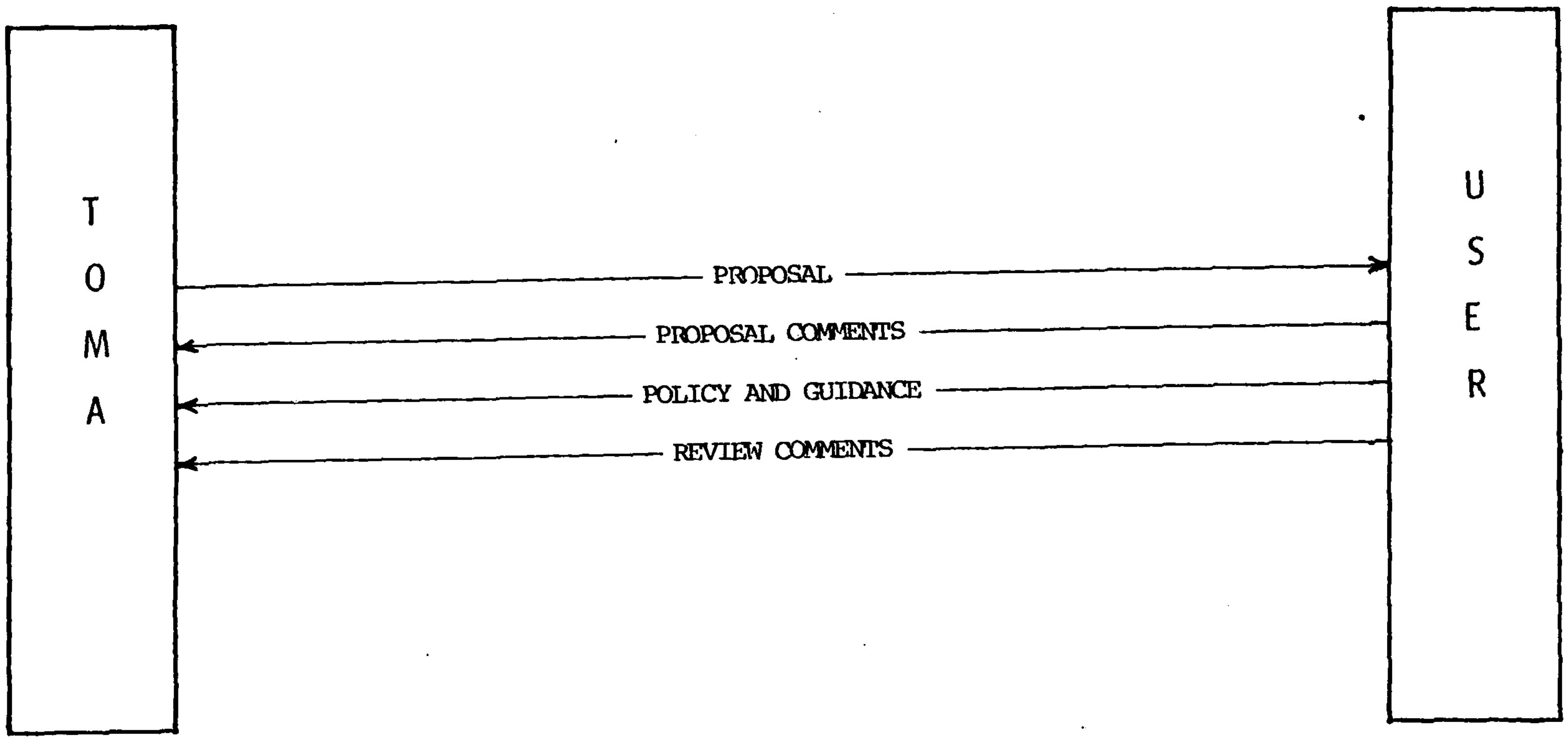


Figure 10-C

TOMA USER INTERFACE

STRATEGIC SPO
LOGISTICS DIRECTORATE (15)
TO ACQUISITION PROCESS

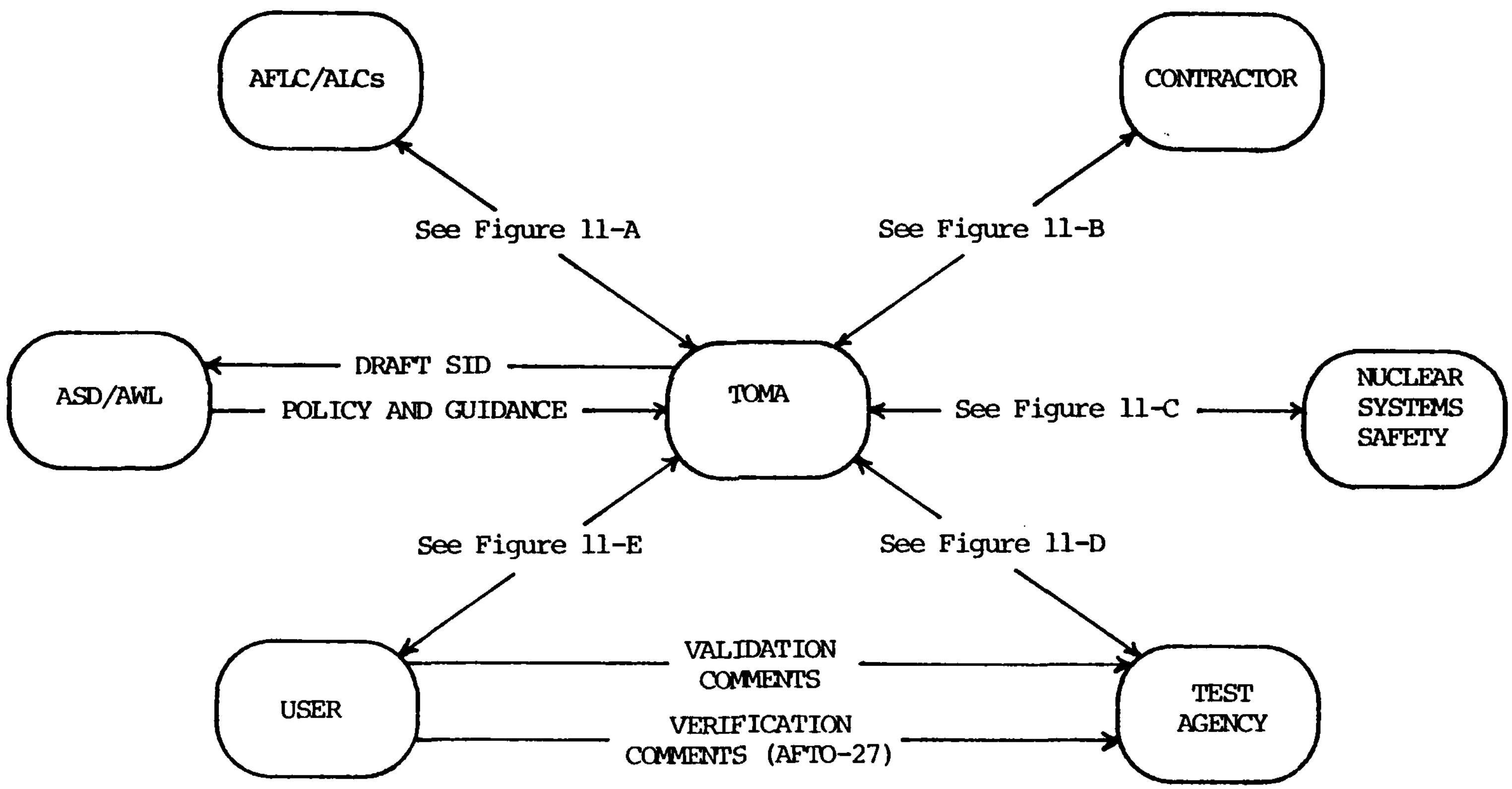


Figure 11

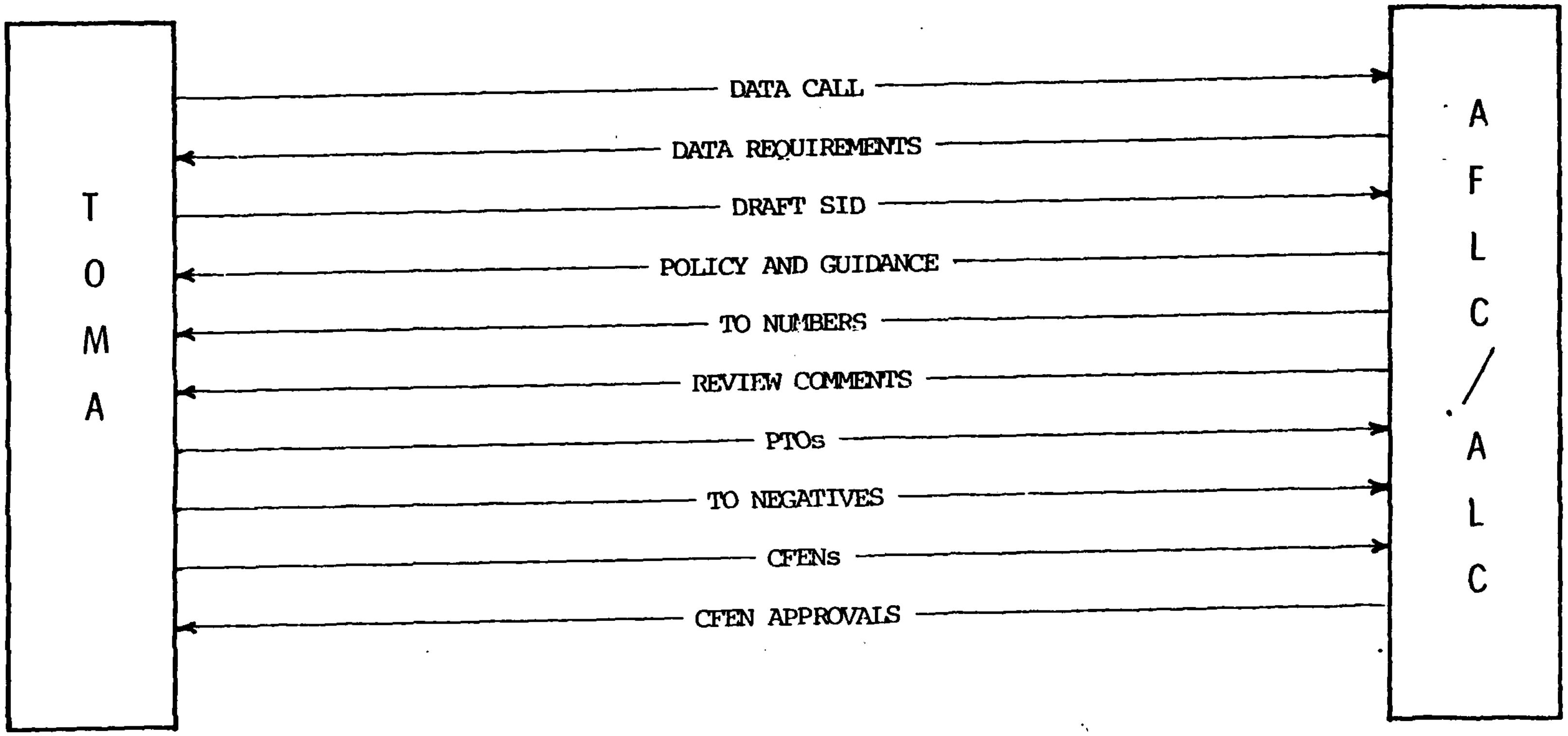


Figure 11-A

TOMA AFLC/ALC INTERFACE

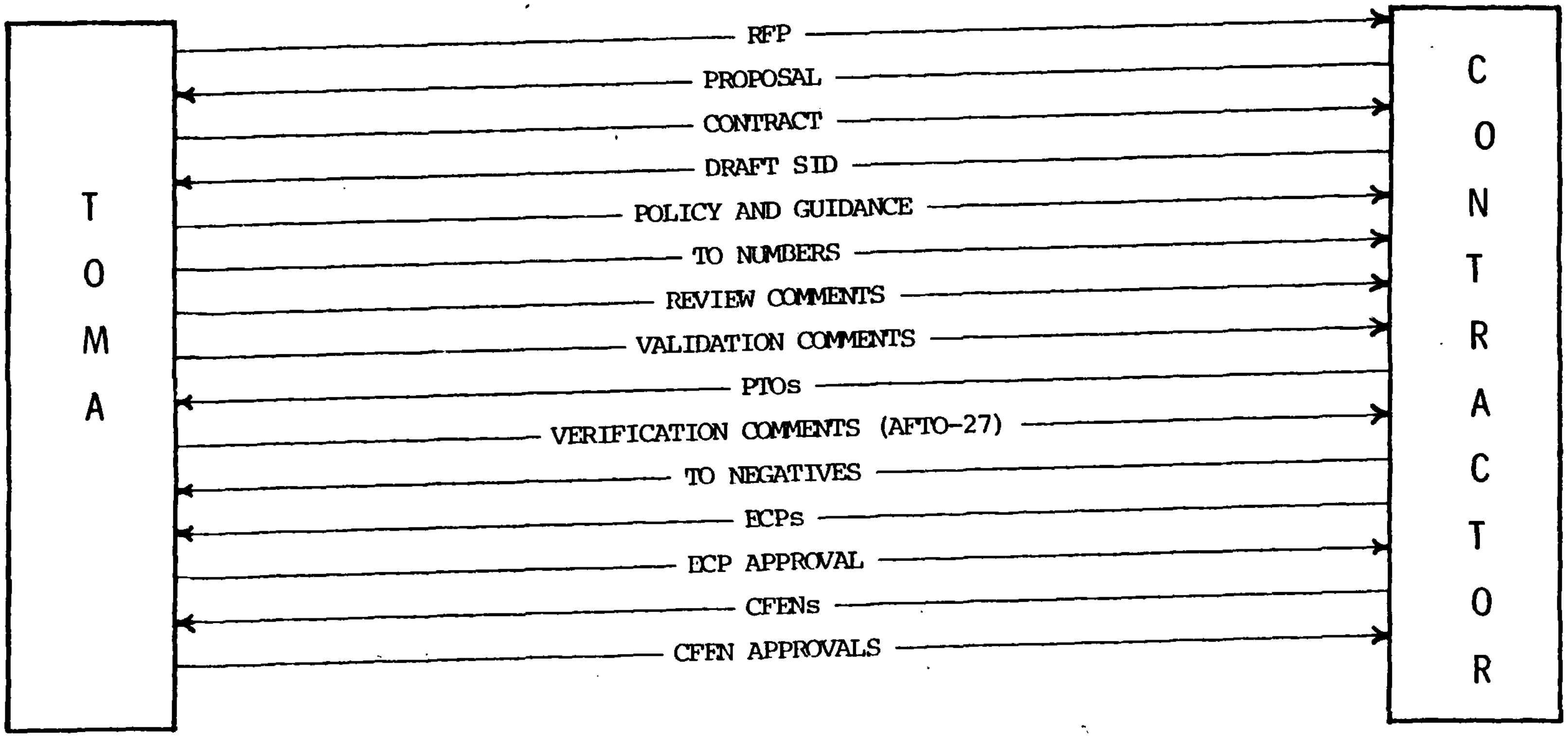


Figure 11-B

TOMA CONTRACTOR INTERFACE

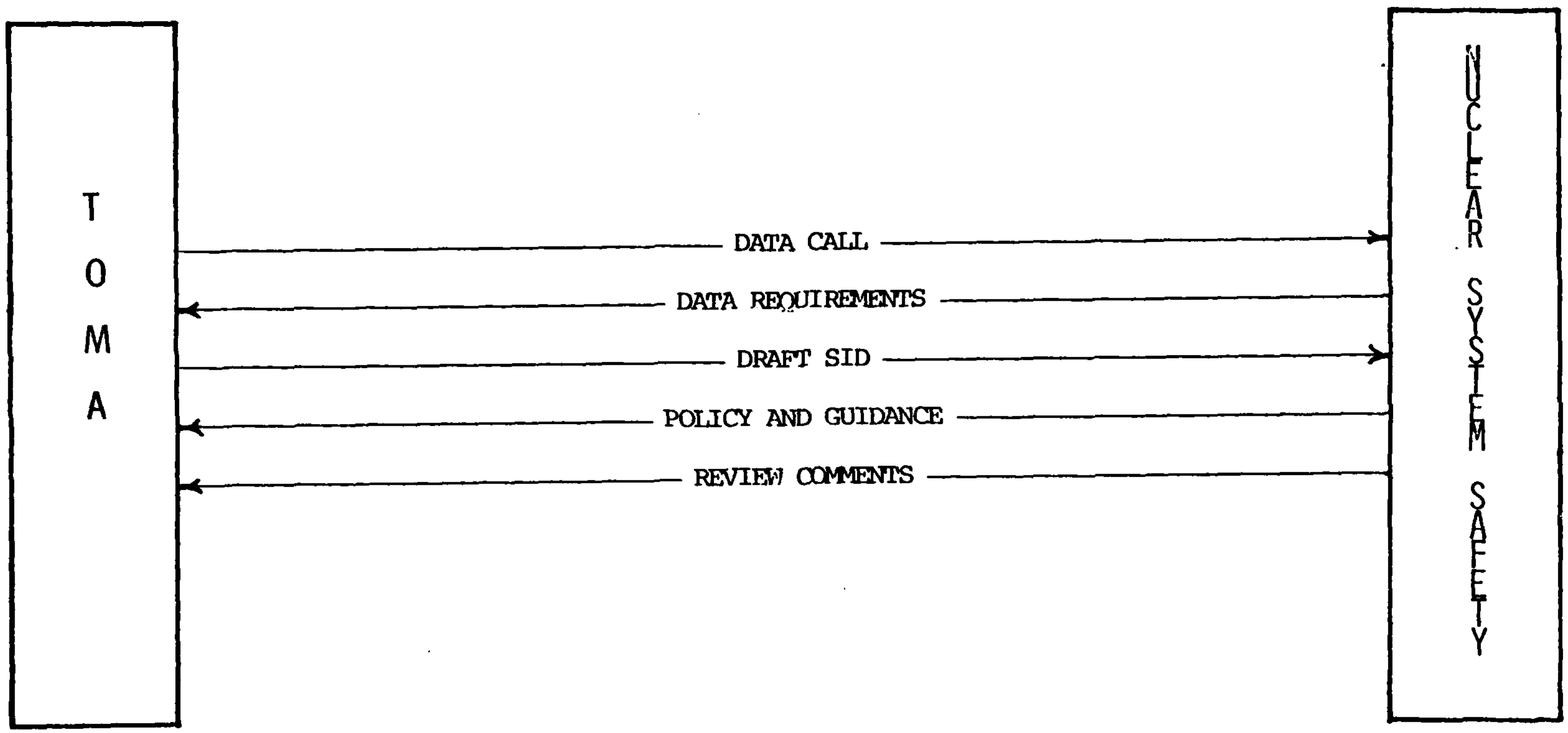


Figure 11-C

TOMA SAFETY INTERFACE

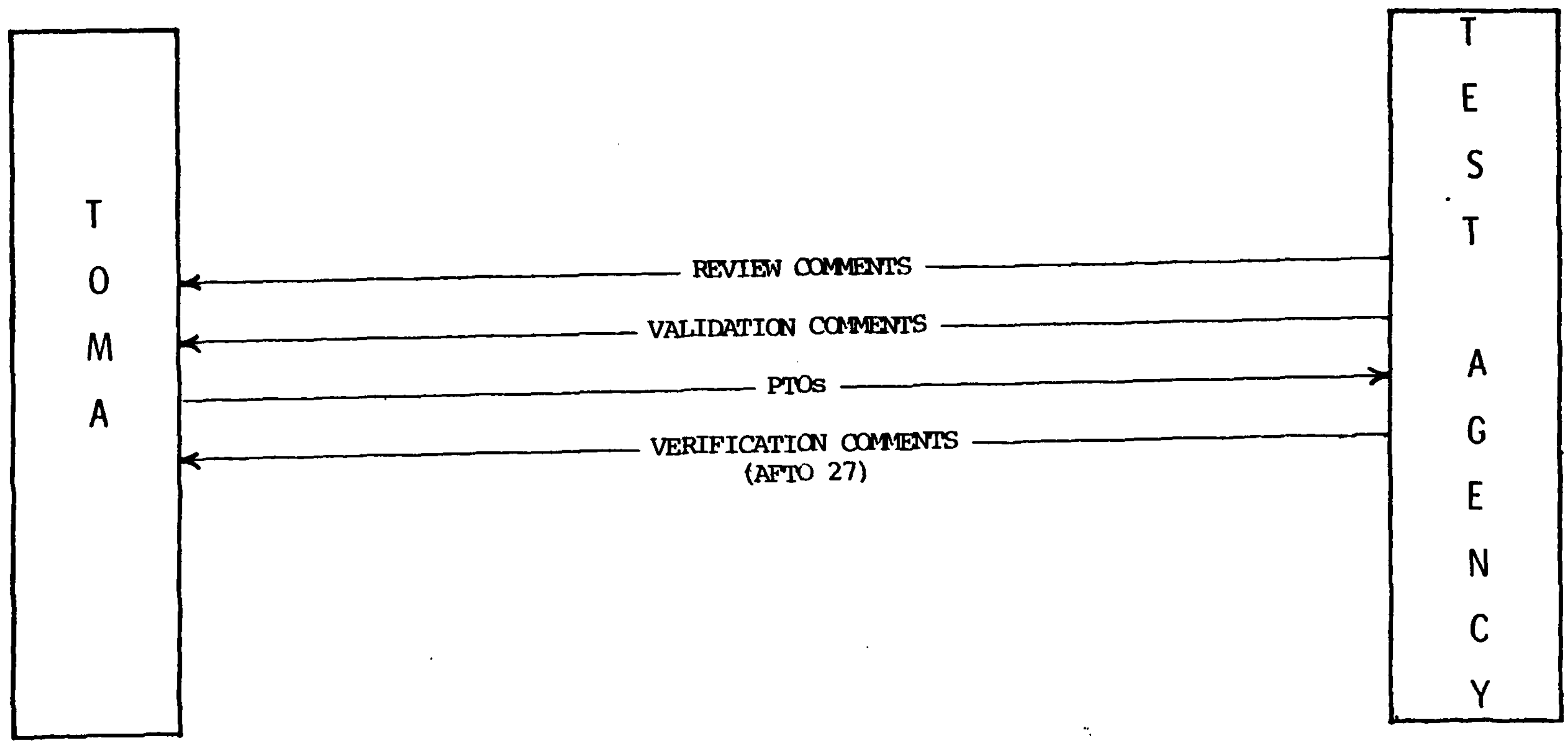


Figure 11-D

TOMA TEST AGENCY INTERFACE

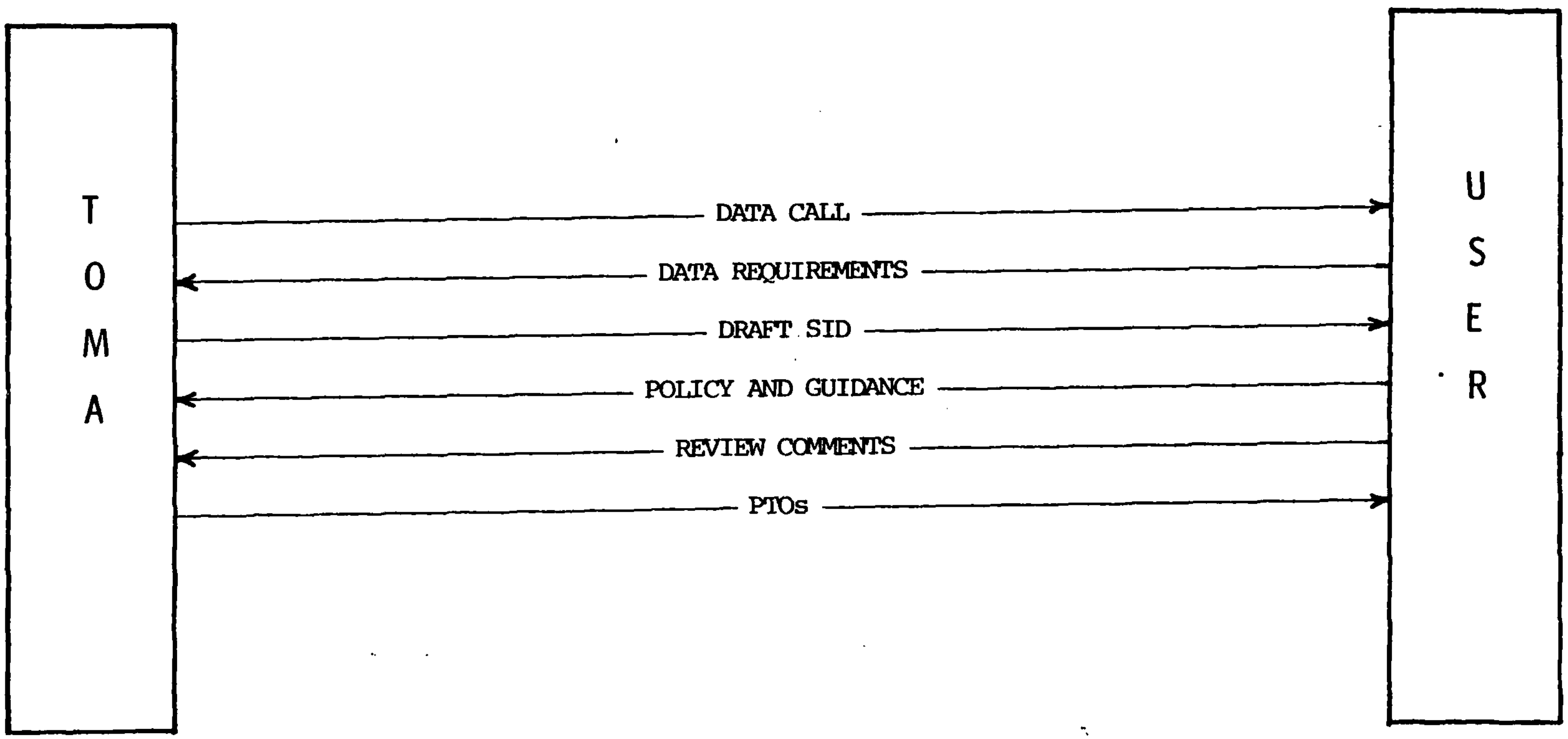


Figure 11-E

TOMA USER INTERFACE

DEPUTATE FOR AIRLIFT AND TRAINERS
TO MANAGER (9)
TO ACQUISITION PROCESS

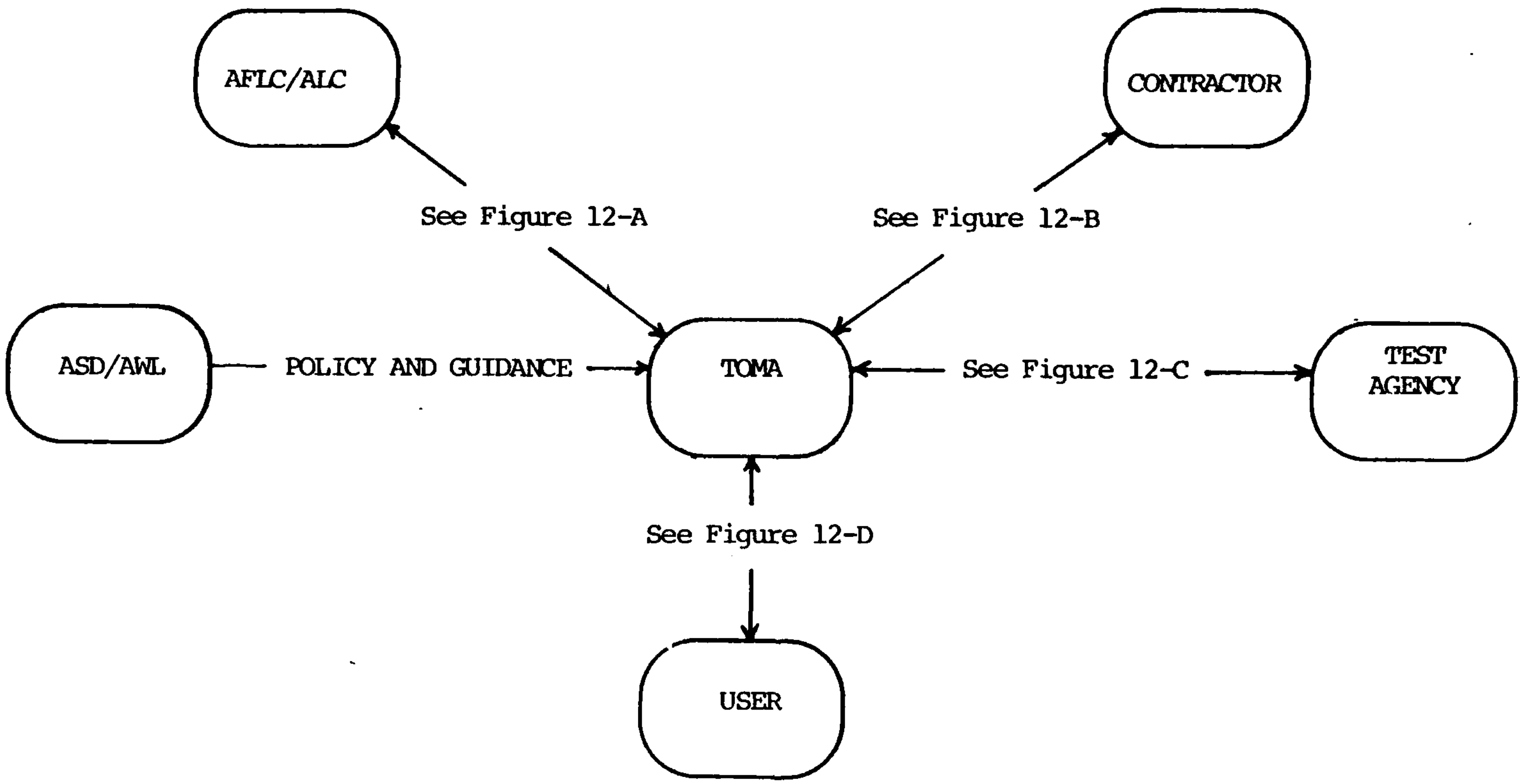


Figure 12

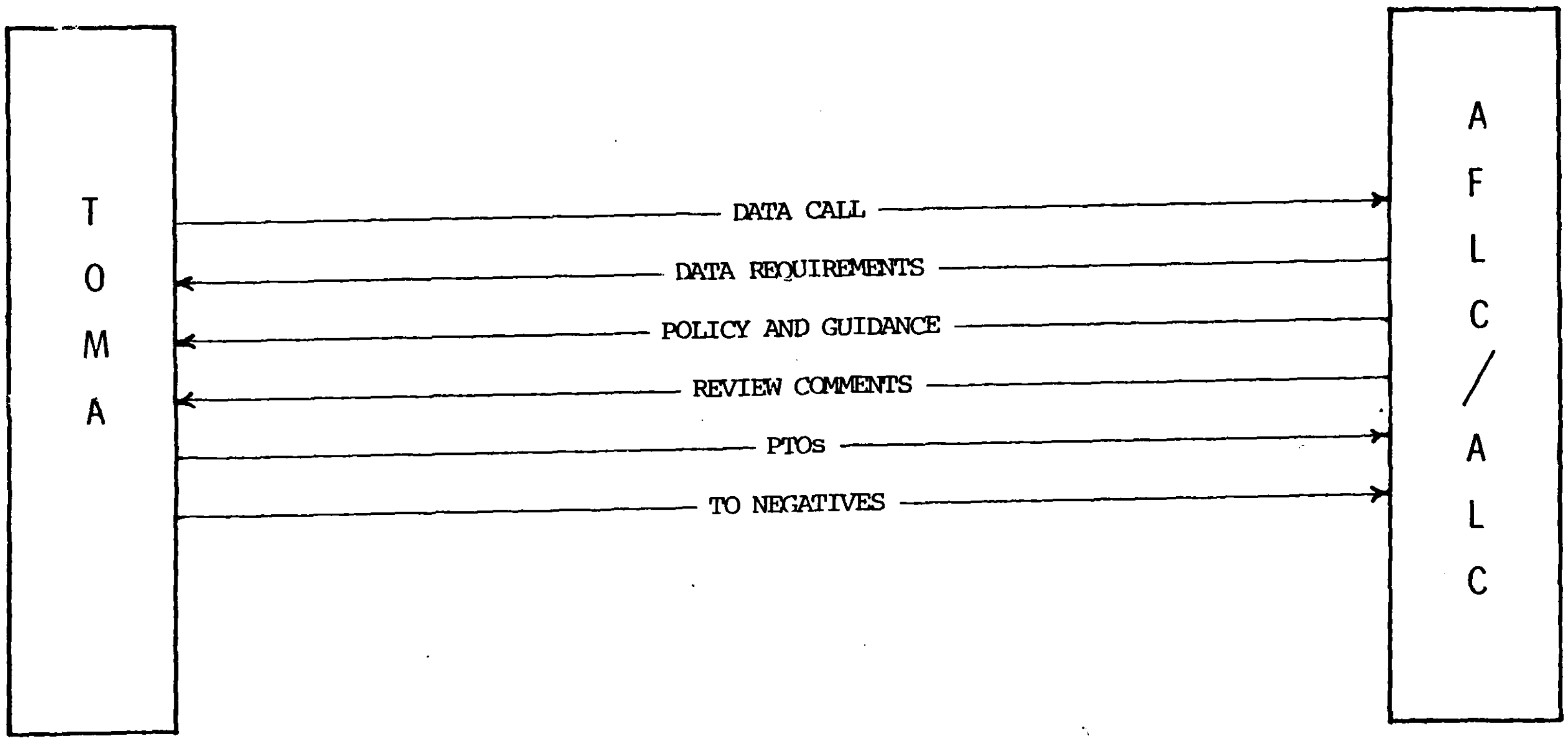


Figure 12-A

TOMA AFLC/ALC INTERFACE

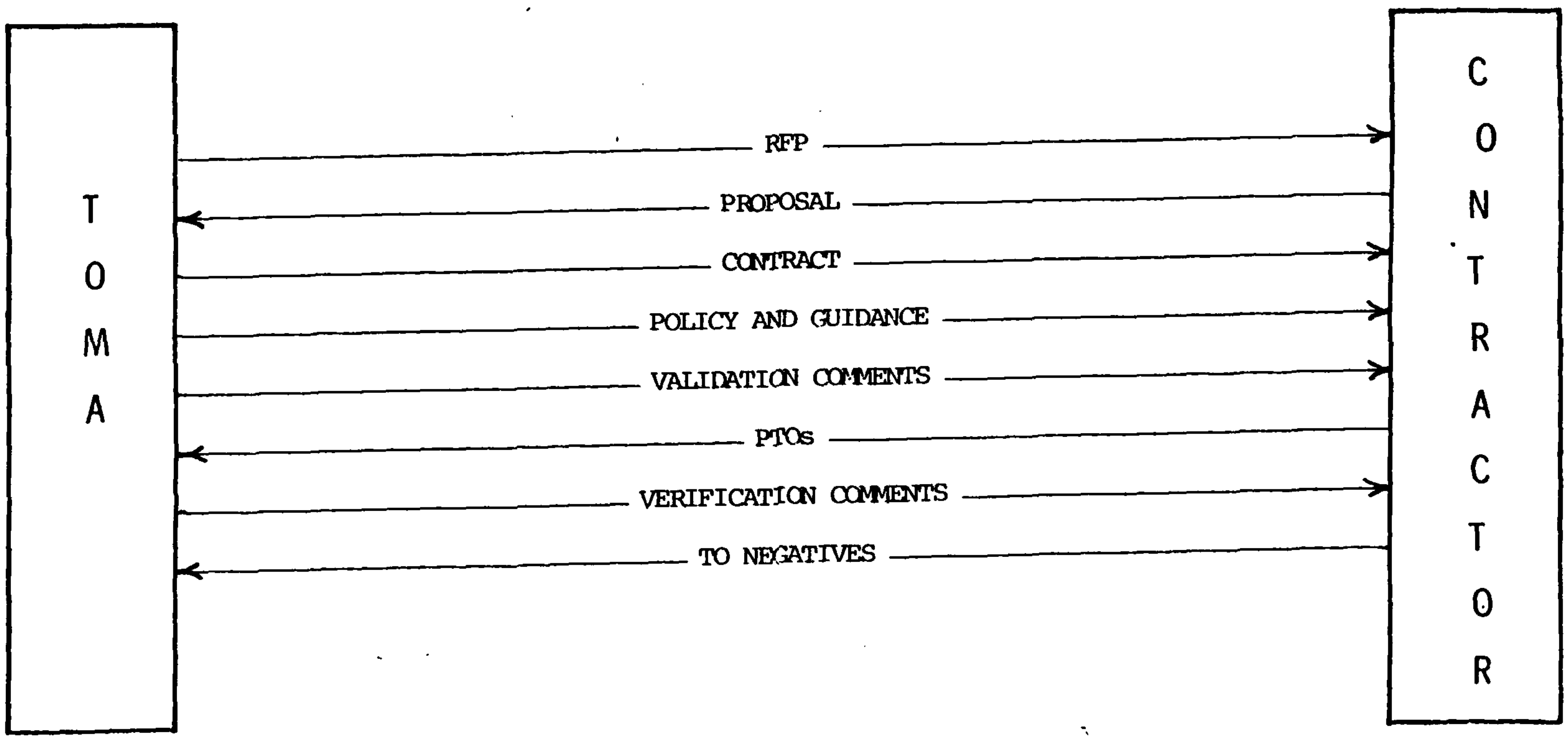


Figure 12-B

TOMA CONTRACTOR INTERFACE

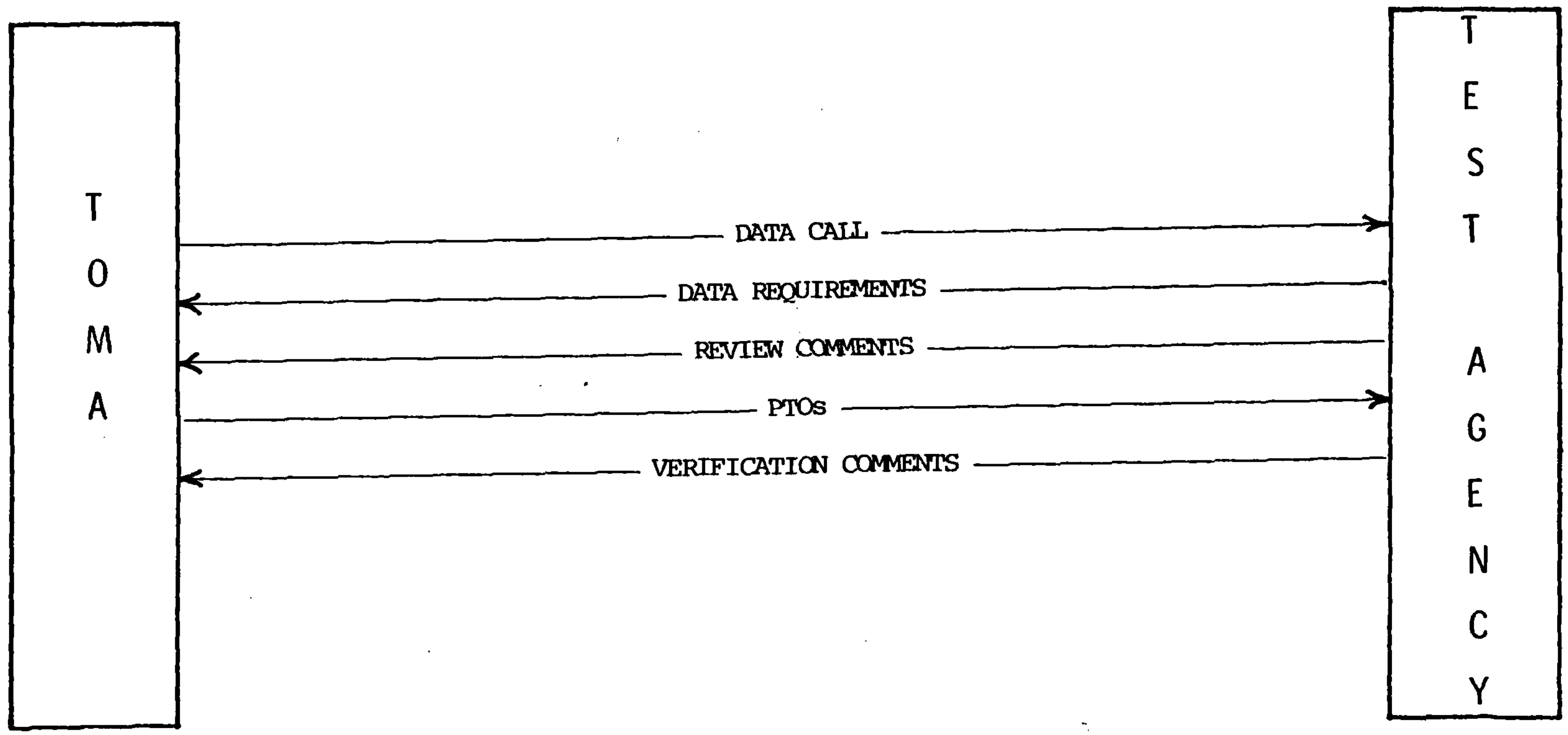


Figure 12-C

TOMA TEST AGENCY INTERFACE

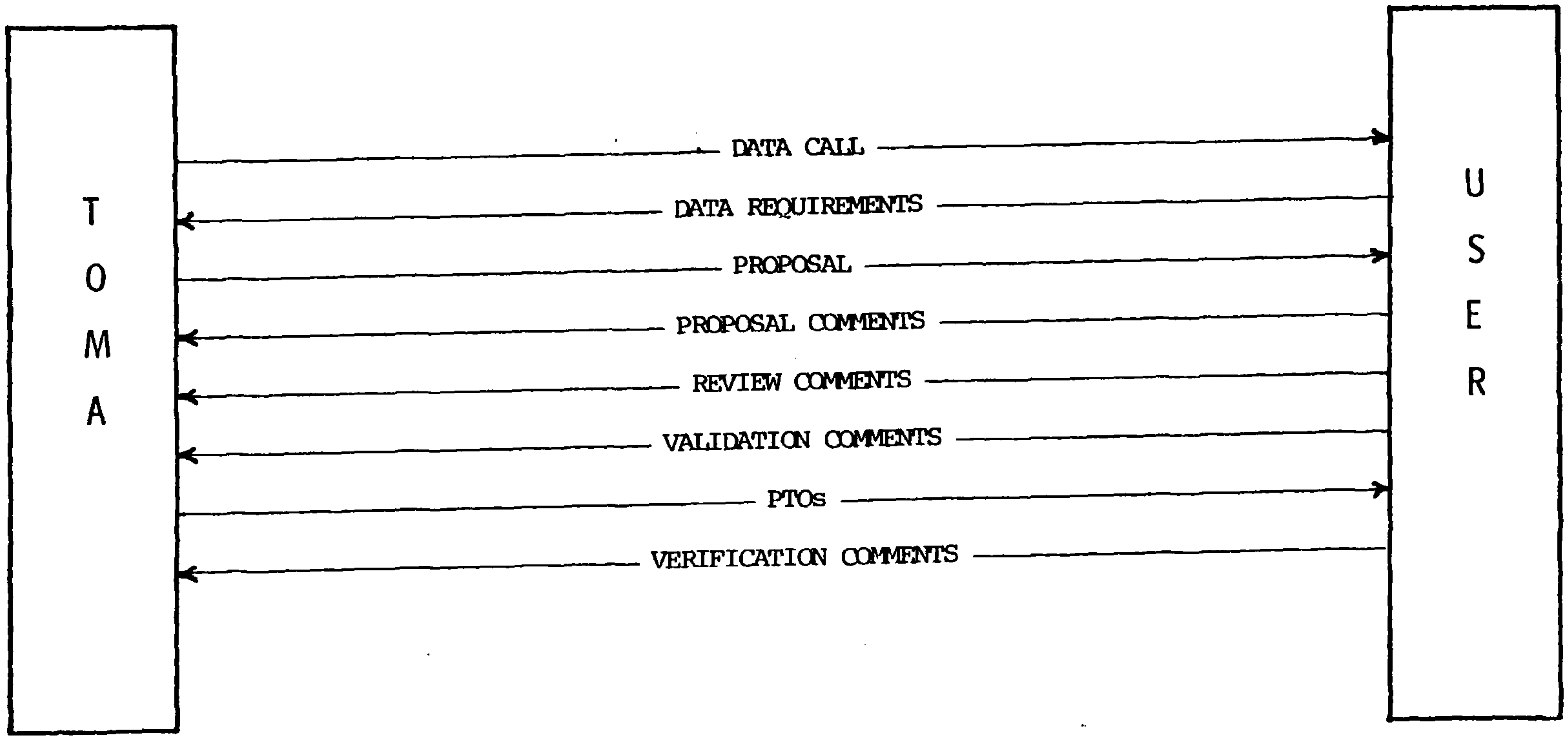


Figure 12-D

TOMA USER INTERFACE

SIMULATOR SPO
TO MANAGER (5)
TO ACQUISITION PROCESS

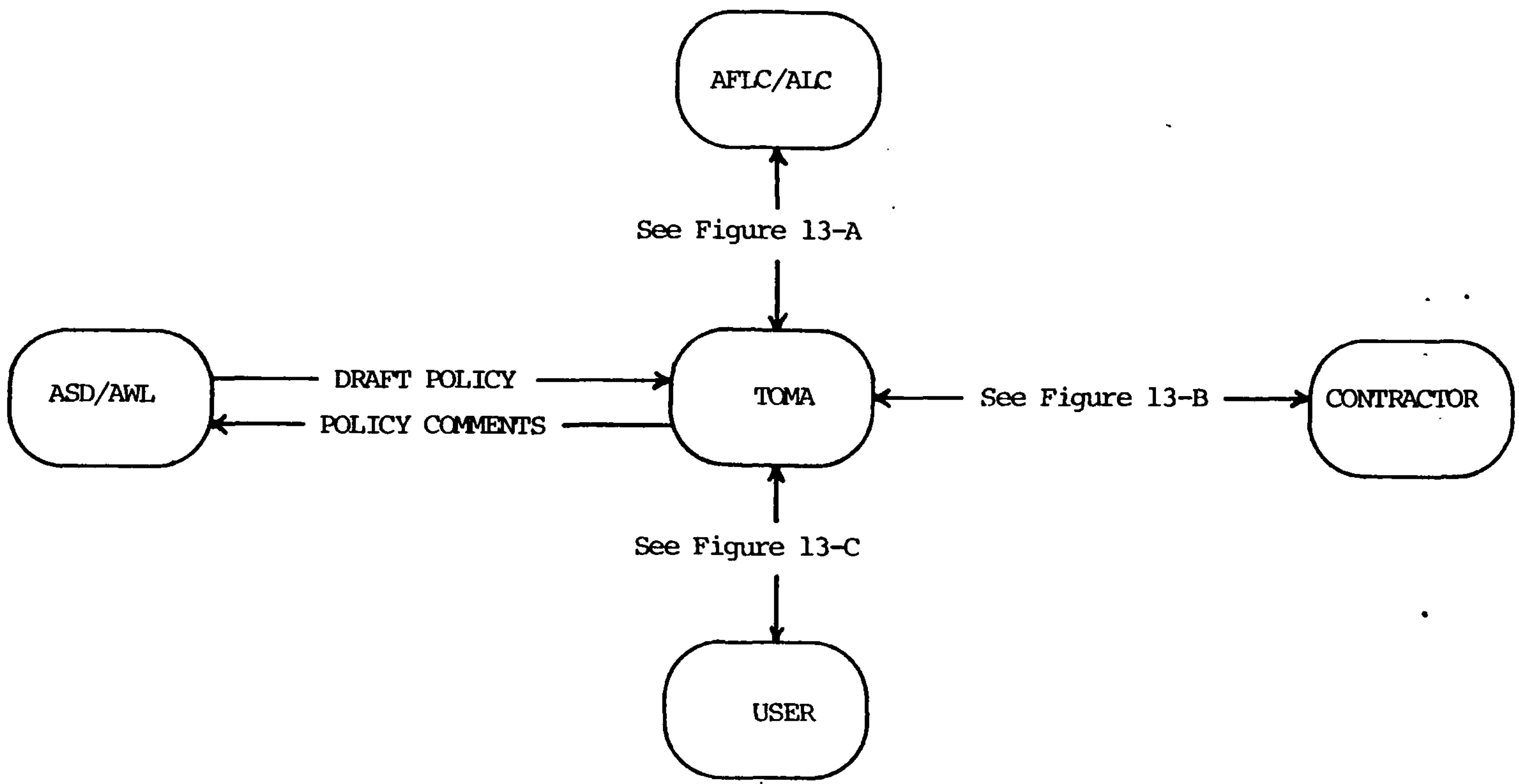


Figure 13

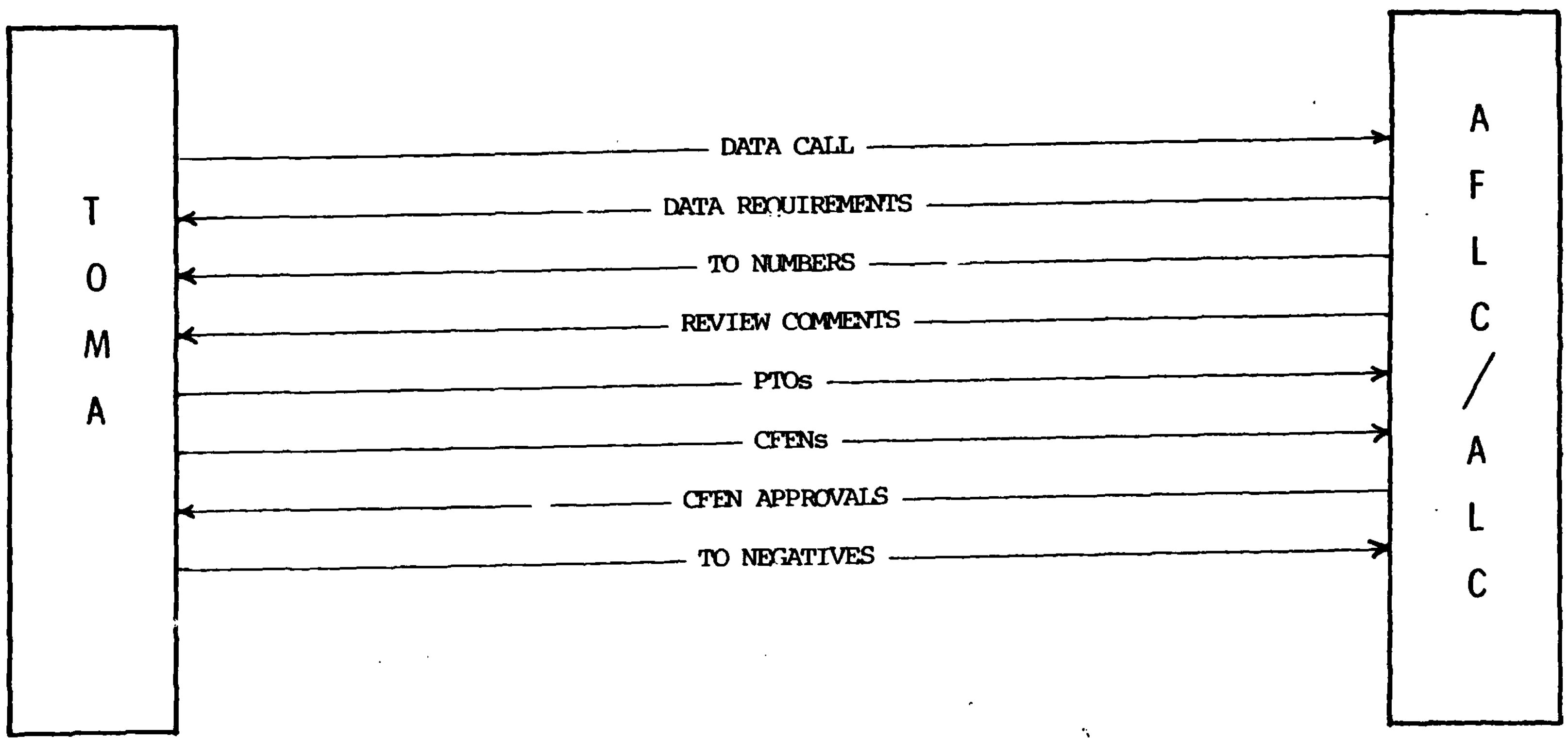


Figure 13-A

TOMA AFLC/ALC INTERFACE

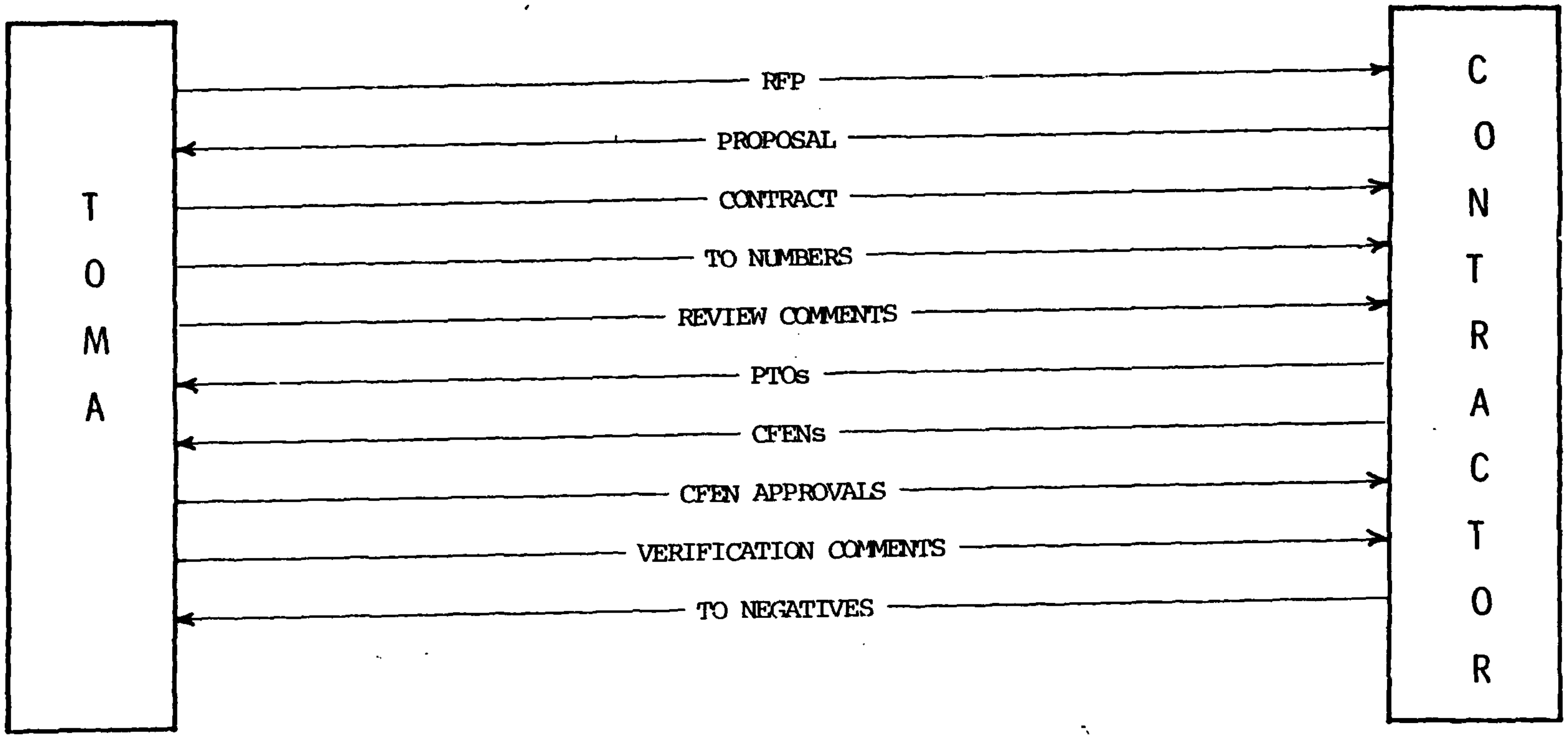


Figure 13-B

TOMA CONTRACTOR INTERFACE

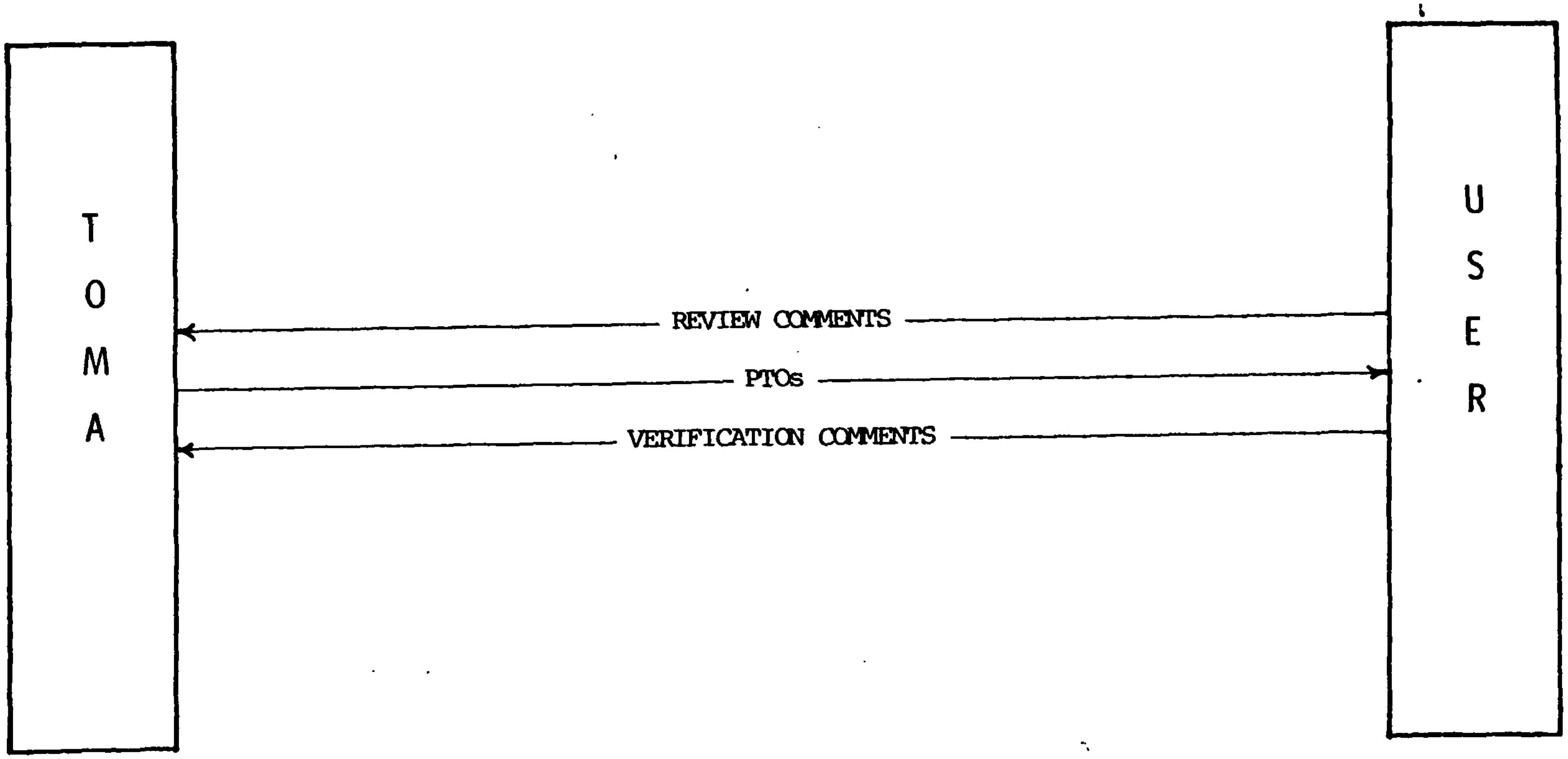


Figure 13-C

TOMA USER INTERFACE

F-15 SPO
ACQUISITION SUPPORT DIVISION (18)
TO ACQUISITION PROCESS

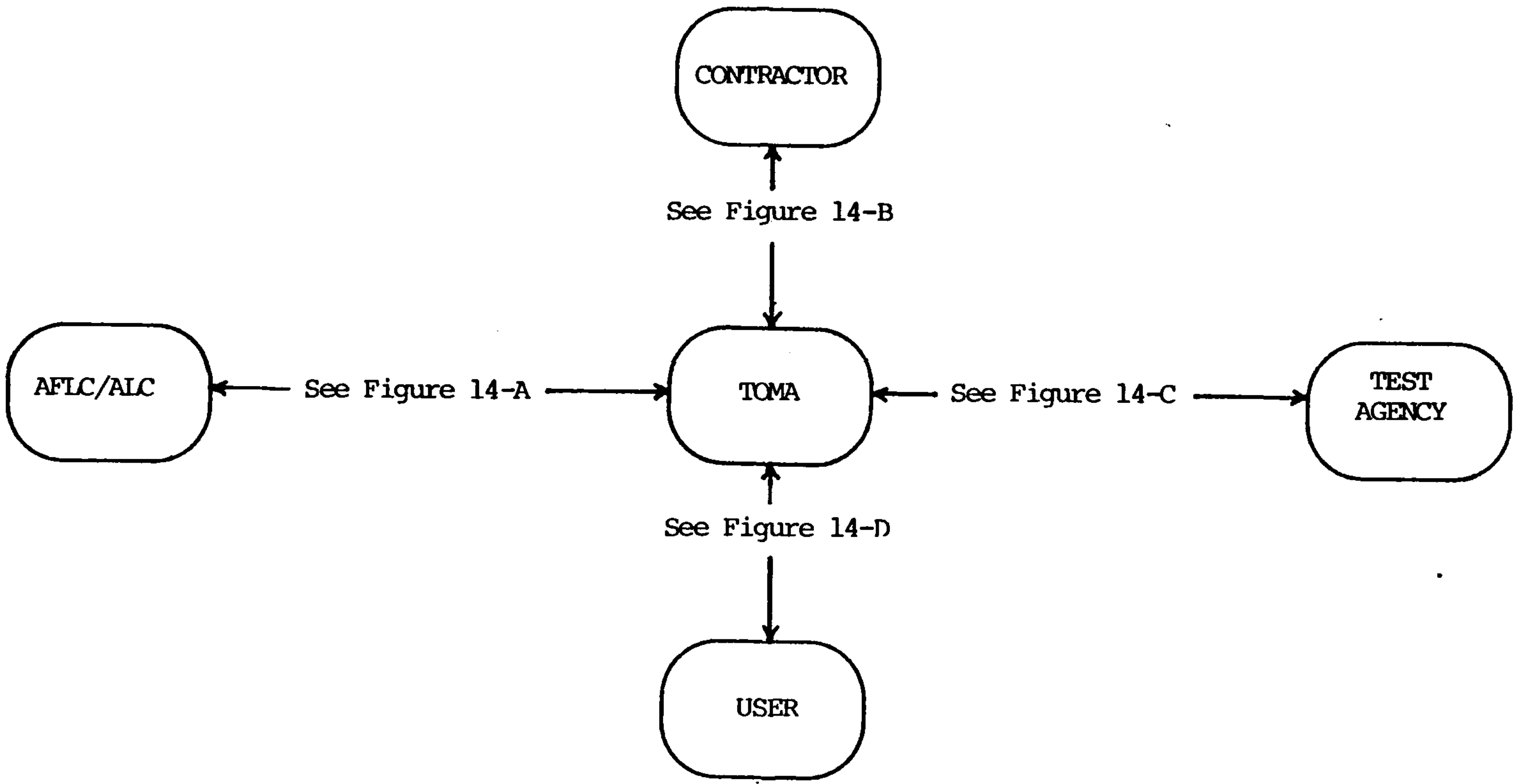


Figure 14

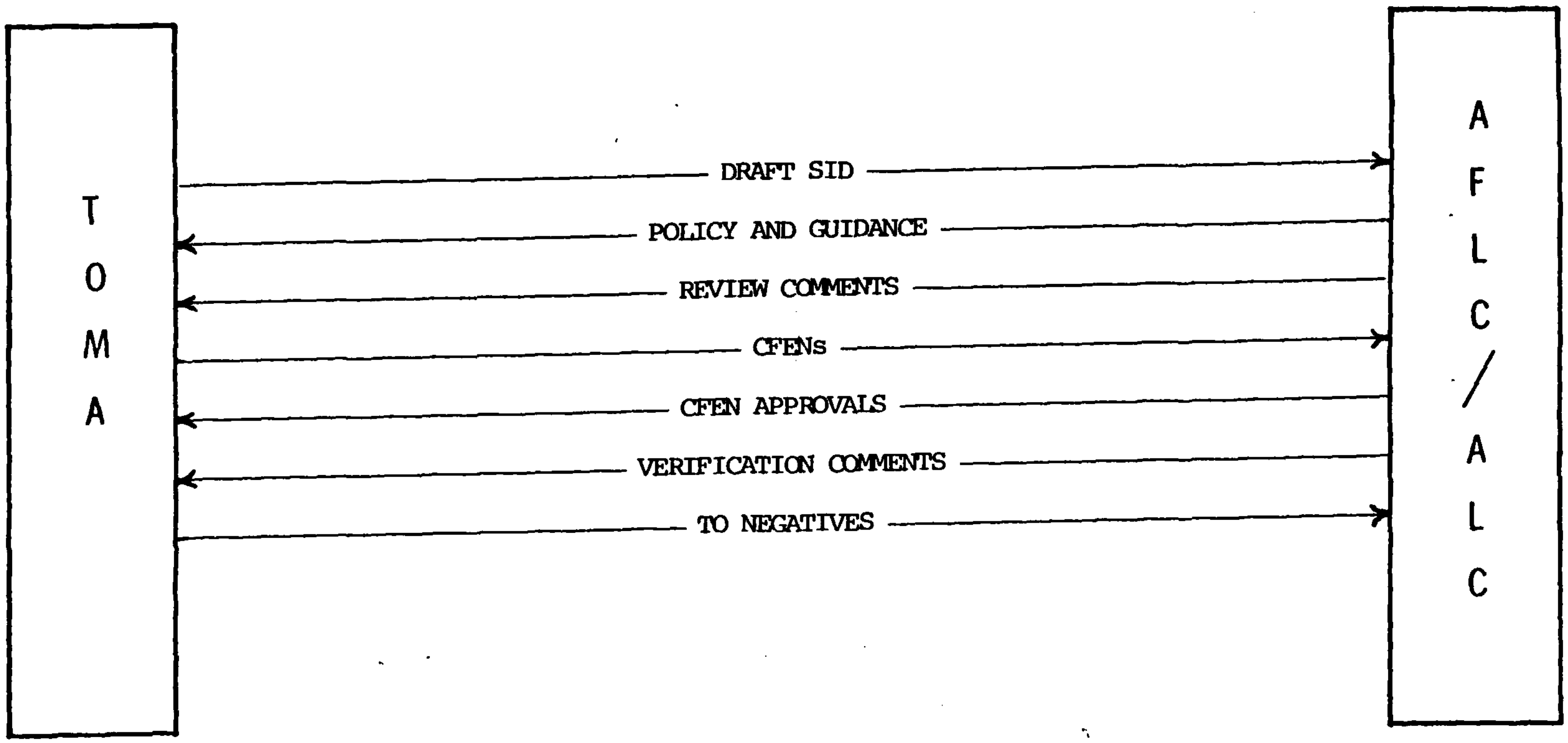


Figure 14-A

TOMA AFLC/ALC INTERFACE

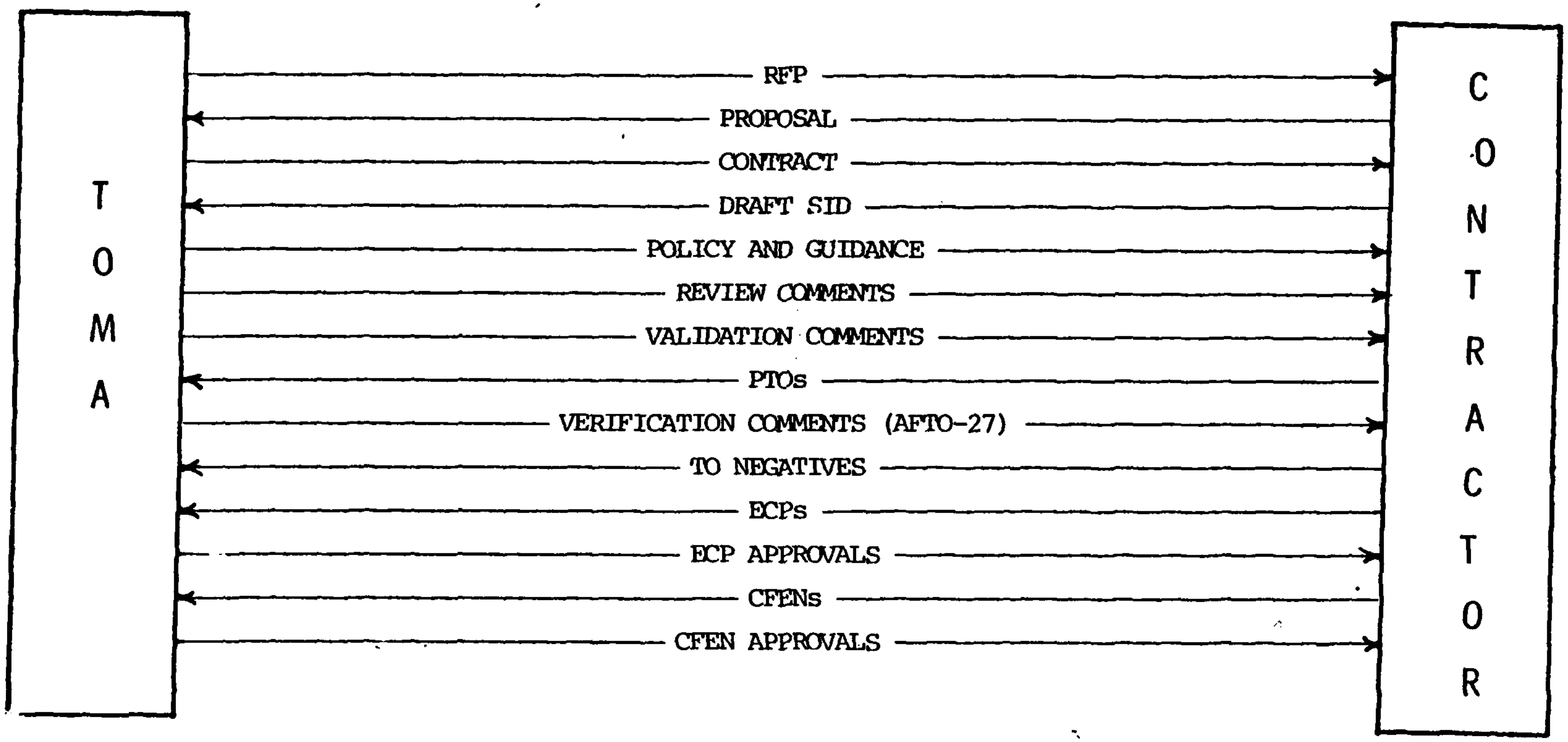


Figure 14-B

TOMA CONTRACTOR INTERFACE

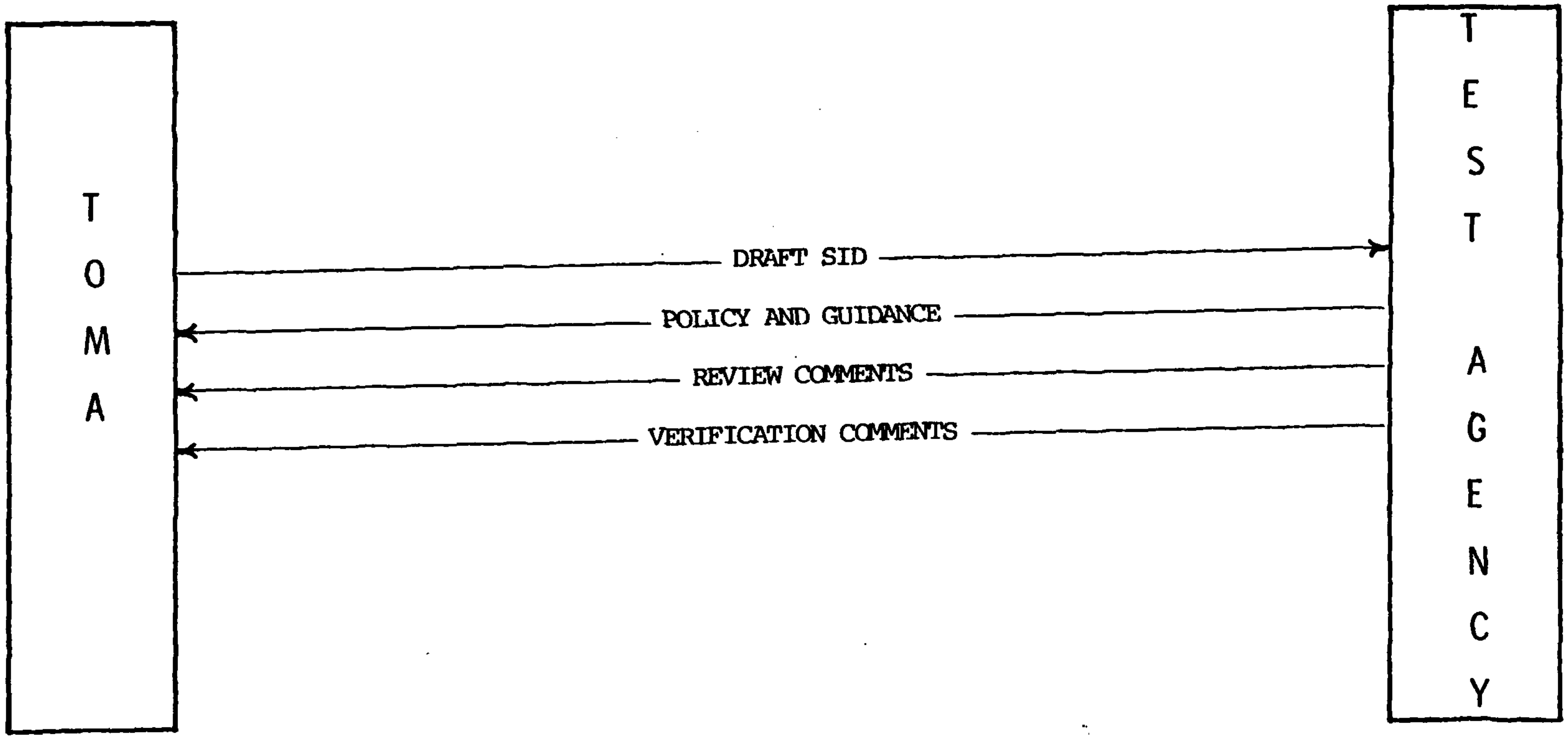


Figure 14-C

TOMA TEST AGENCY INTERFACE

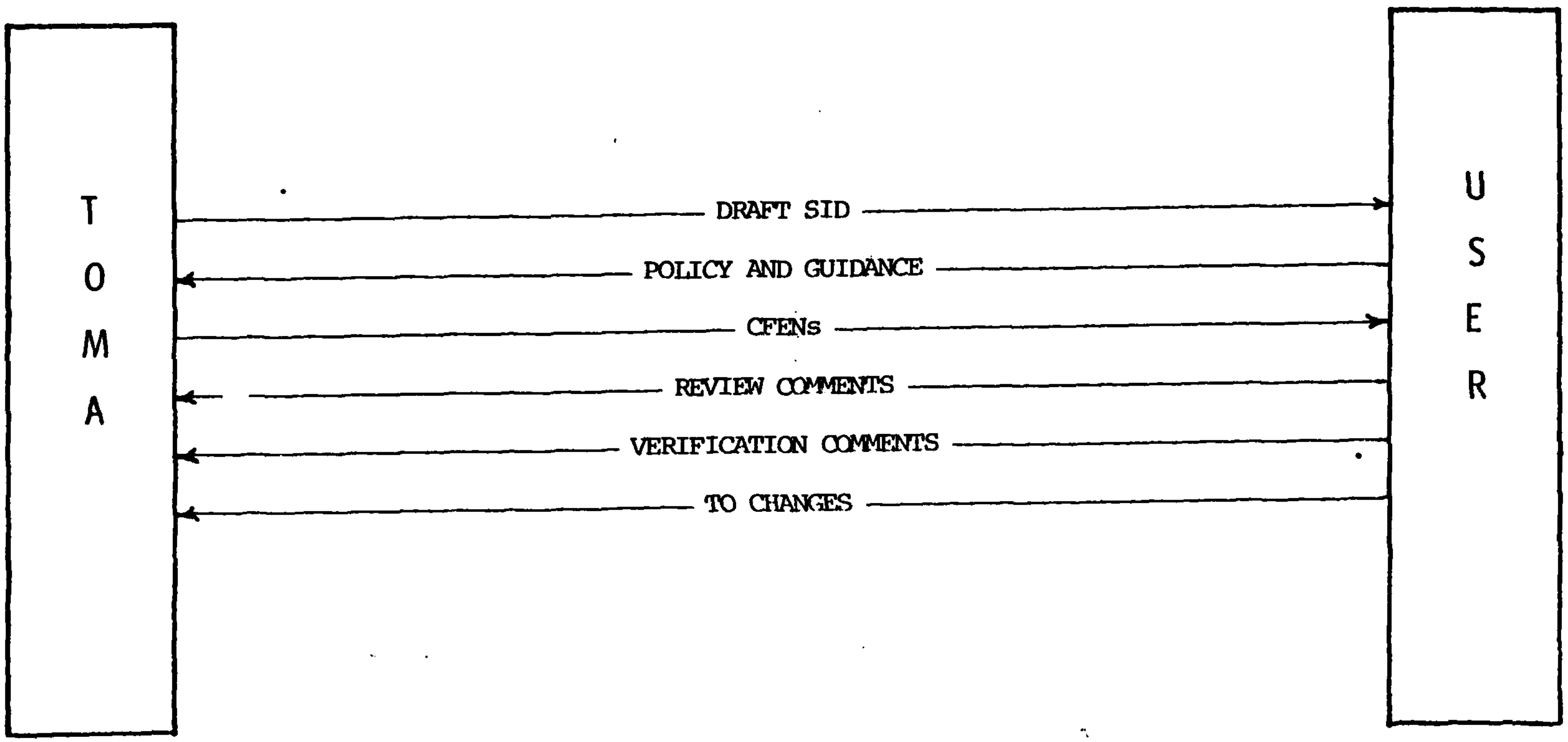


Figure 14-D

TOMA USER INTERFACE

DEPUTATE FOR AIRLIFT AND TRAINERS
T-46A TO MANAGER (3)
TO ACQUISITION PROCESS

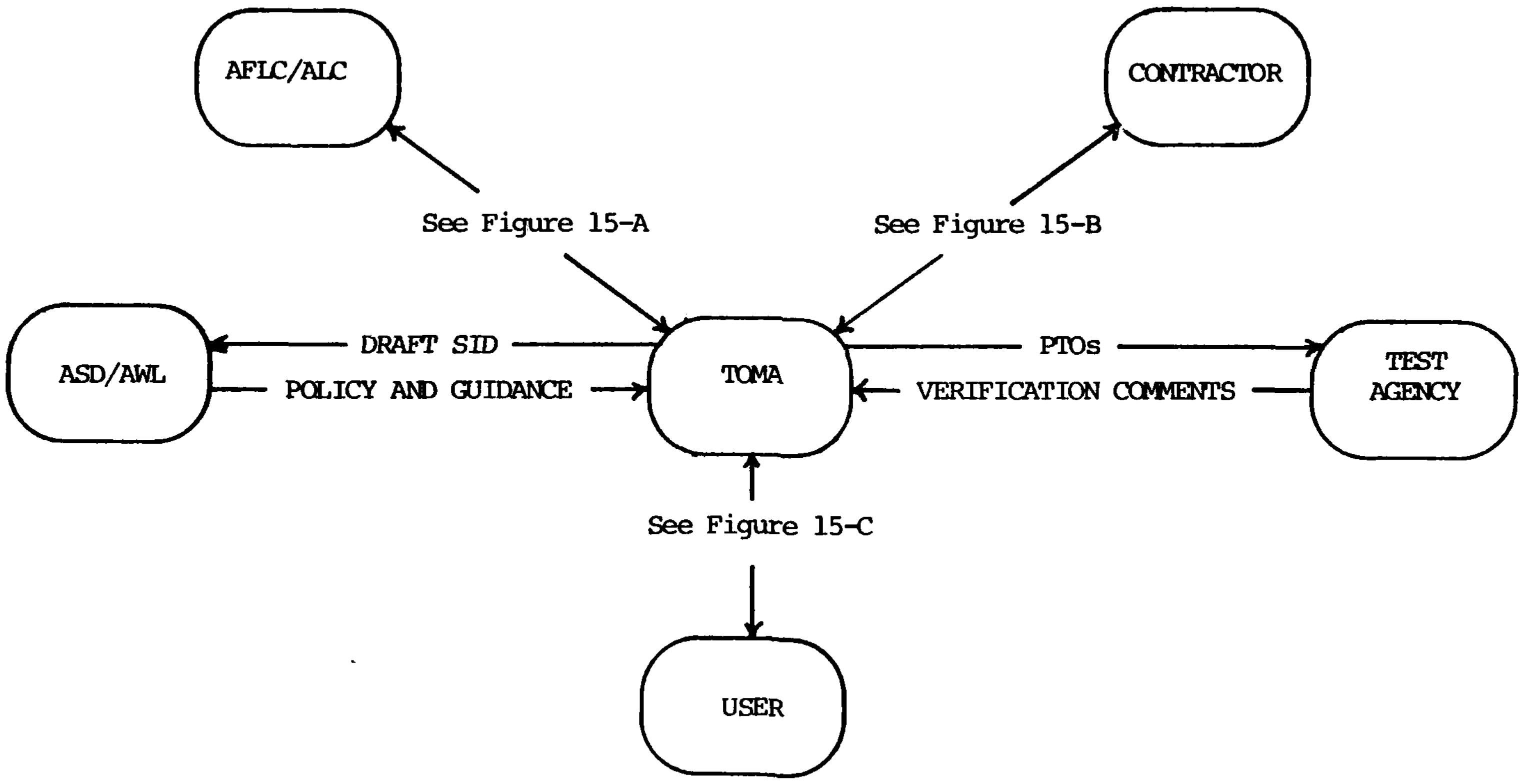


Figure 15

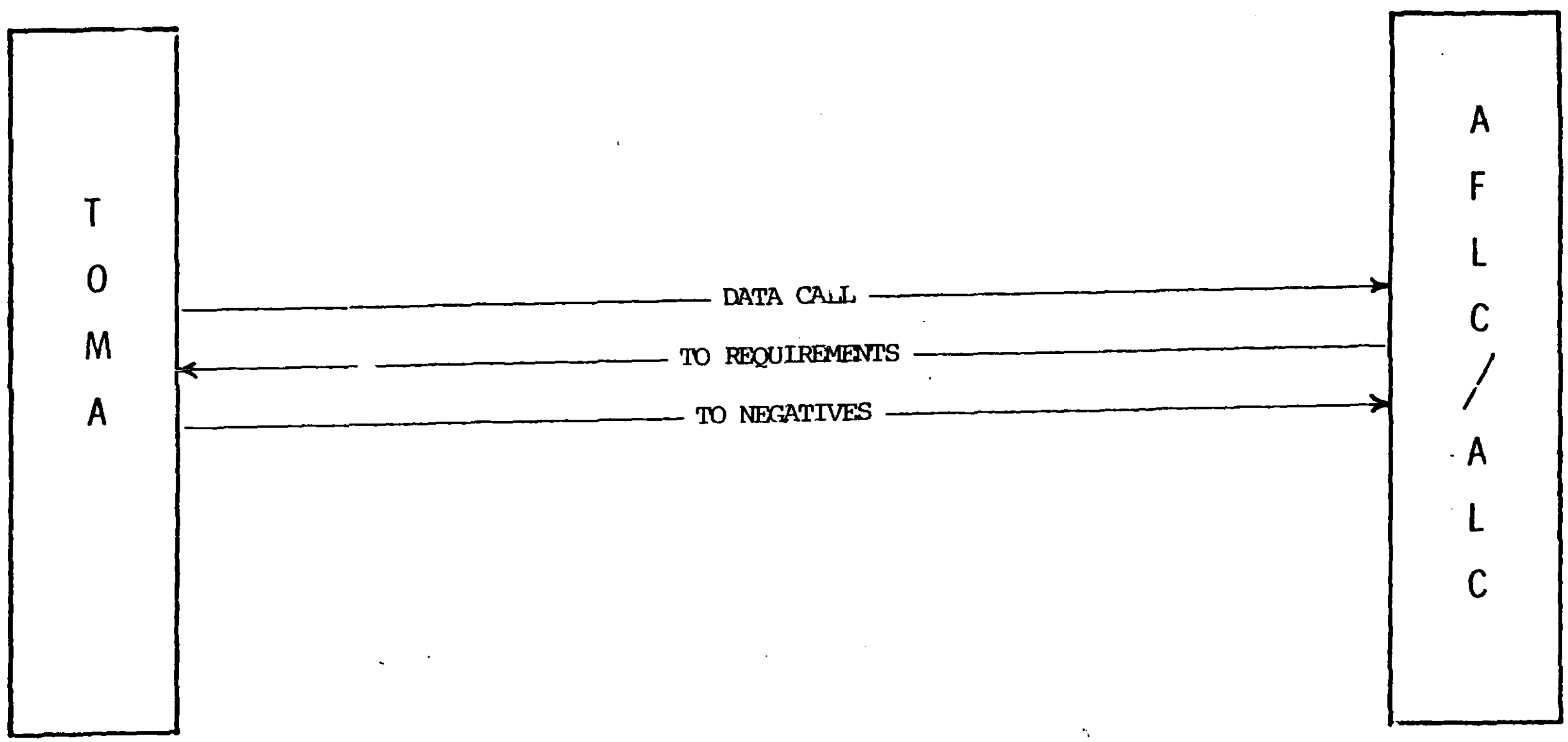


Figure 15-A

TOMA AFLC/ALC INTERFACE

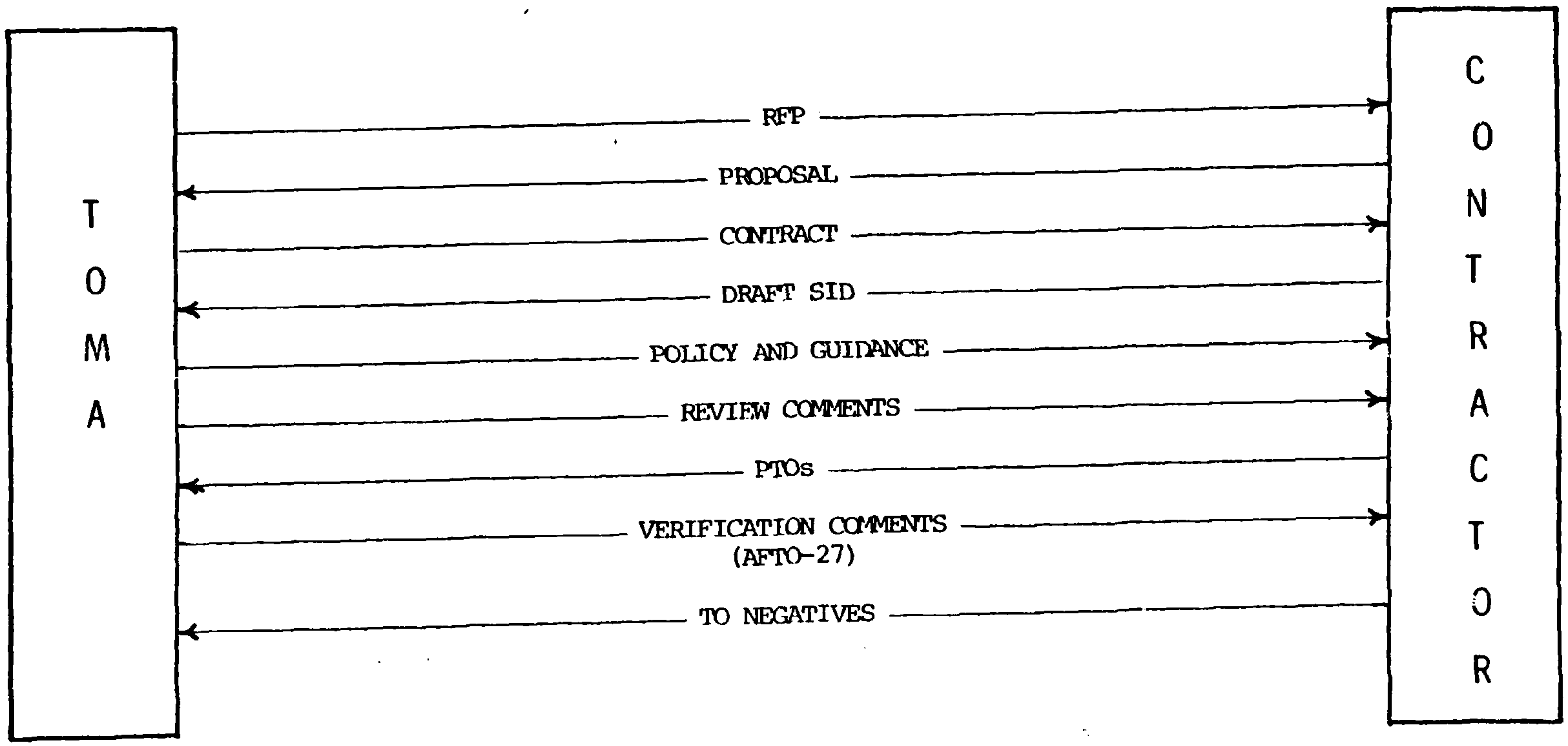


Figure 15-B

TOMA CONTRACTOR INTERFACE

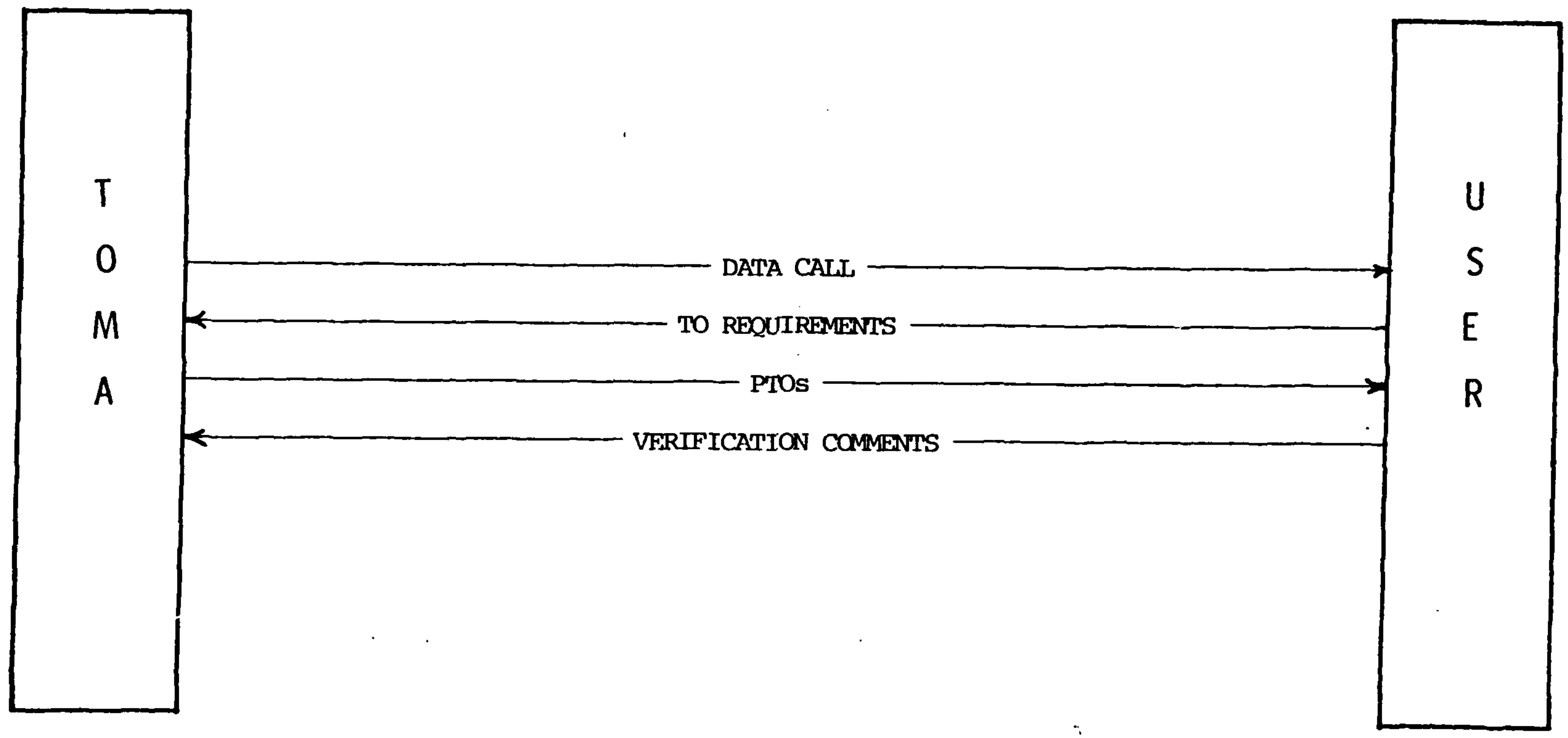


Figure 15-C

TOMA USER INTERFACE

AERONAUTICAL SYSTEMS DIVISION (ASD)
LOGISTICS SPECIALIST (23)
TO ACQUISITION PROCESS

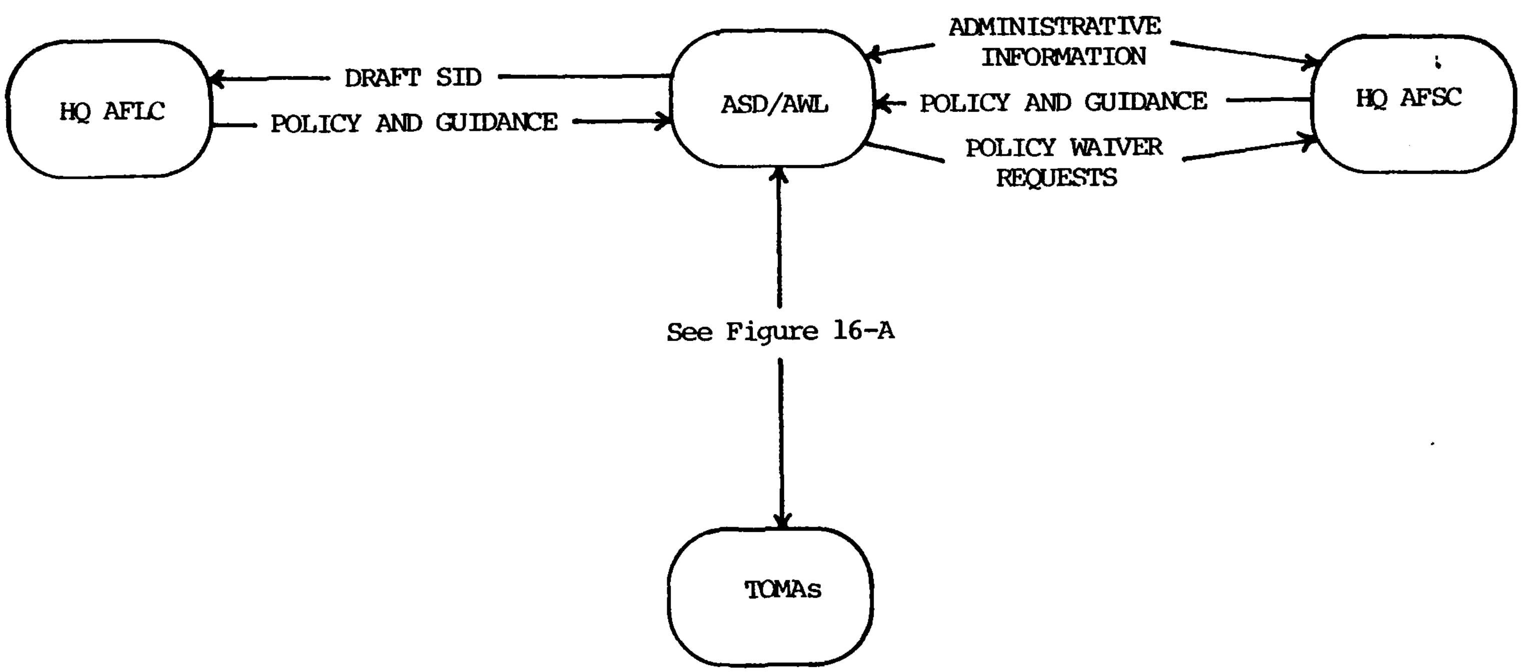


Figure 16

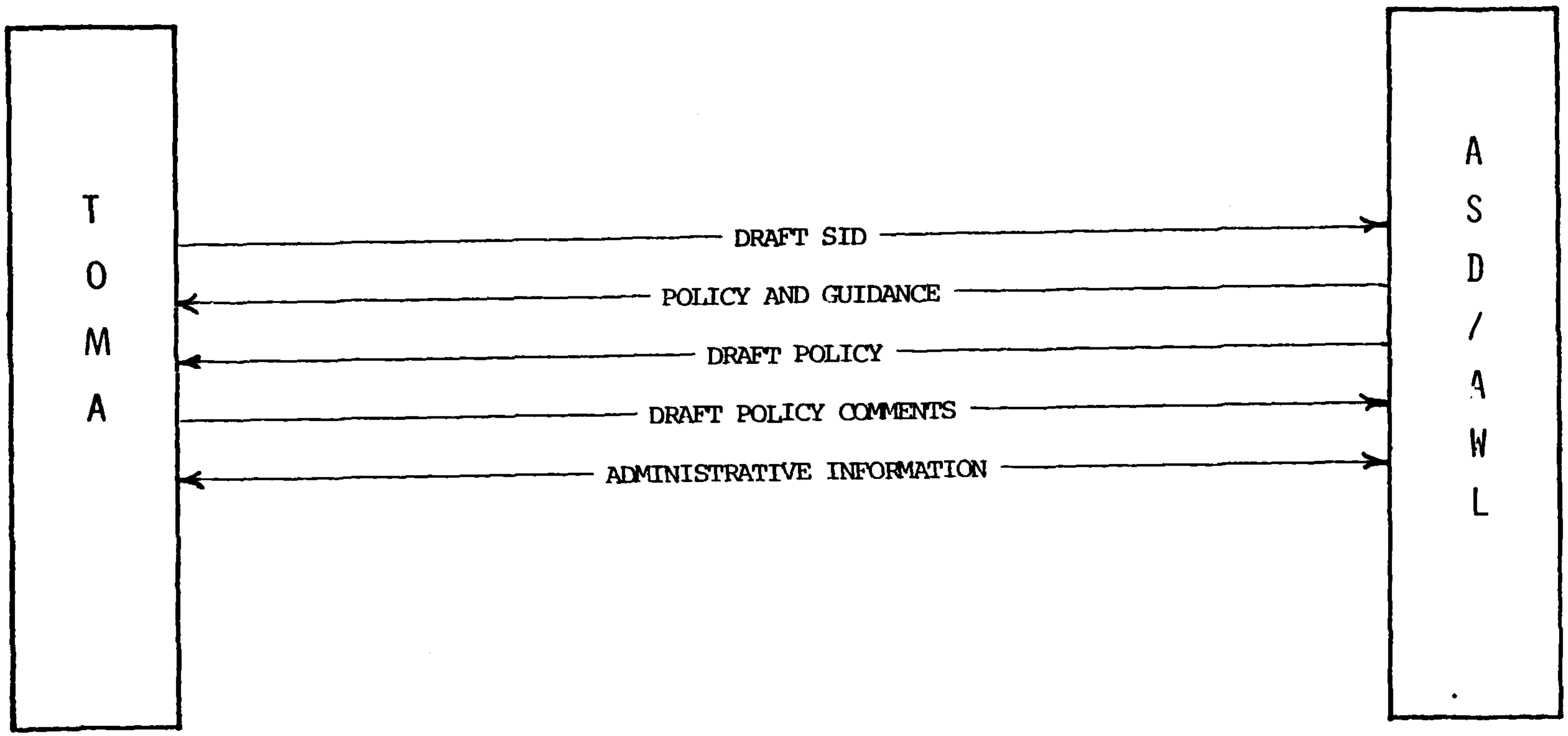


Figure 16-A

TOMA ASD/AWL INTERFACE

SELECTED BIBLIOGRAPHY

A. REFERENCES CITED

1. Aday, George. KC135, KC-10 Systems Branch Chief, Configuration & Data Management Division, Deputy for Simulators and Trainers, ASD, Wright-Patterson AFB OH. Personal interview. 27 June 1983.

2. Alpha Omega Group, Inc. Development of a User-Oriented Data Classification For Information Systems Design Methodology. Alpha Omega Group, Inc., Silver Spring MD, 30 June 1982.

3. Arney, Master Sargent Philip G. T-46A Technical Order Manager, Configuration and Data Management Division, Trainer and Specialized System Branch, ASD, Wright-Patterson AFB OH. Personal interview. 27 June 1983.

4. Burch, John G., Jr., Felix R. Strater, and Gary Grudnitski. Information Systems: Theory and Practice. 3d ed. New York: John Wiley and Sons, Inc., 1983.

5. Carver, Robert T. Technical Order Manager, Logistics Division, Simulator SPO, ASD, Wright-Patterson OH. Personal interview. 6 July 83.

6. Cheney, P., and G. W. Dickson. "Organizational Characteristics and Information Systems: An Exploratory Investigation," Academy of Management Journal, Volume 25, 1982, pp. 170-184.

7. Deputy For Acquisition, Aeronautical Systems Division, Air Force Systems Command. Defining ASD's Acquisition Logistics Information Requirements, Wright Patterson AFB OH, 11 May 1983.

8. Dickson, Gary W., and J.K. Simmons. "The Behavioral Side of MIS." Business Horizons, August 1970, pp.59-71.

9. Duverglas, Joseph. Technical Order Manager, Configuration and Data Management Division, Trainer and Specialized System Branch, ASD, Wright-Patterson OH. Personal interview. 27 June 1983.

10. Frazier, Oliver J., Technical Order Manager, Deputy Program Manager for Logistics, Life Support Program Office, ASD, Wright-Patterson AFB OH. Personal interview. 30 June 1983.

11. Hatterick, G. Richard, and Harold E. Price. Format Options and Procurement OF Technical Orders. HQ Air Force Human Resources Laboratory, Brooks AFB TX, May 1981. AFHRL-TR-80-49.

12. Hice, G. F., W. S. Turner, and L. F. Cashwell. System Development Methodology. Revised Ed. Amsterdam: North Holland Publishing Co., 1978.

13. Holland, Winford E. "Socio-Technical Aspects of MIS," Journal of Systems Management, February 1974, pp. 14-16.

14. Jefferson, David K. Information Systems Design Methodology: Overview. David W. Taylor Naval Ship Research and Development Center, Bethesda MD, May 1982. AD-A115902

15. Kemmet, Curtis W. Senior Engineer, Support Systems Associates Inc., Contractor for Stragetic SPO, ASD, Wright-Patterson AFB OH. Personal interview. 5 July 1983.

16. Materials Laboratory. Integrated Computer Aided Manufacturing (ICAM) Architecture Part II, Volume IV, Functional Modeling Manual (IDEF). AF Wright Aeronautical Laboratories (AFSC), Wright-Patterson AFB OH, June 1981. AD-B062457L

17. Orr, Ken. Structured Requirements Definition. Topeka KA: Ken Orr and Associates, Inc., 1981.

18. Pingel, C. Frederick. Technical Publication Specialist, Acquisition Support Division, F-15 Program Office, ASD Wright-Patterson AFB OH. Personal interview. 5 July 1983.

19. Robey, D. "User Attitudes and Management Information System Use." Academy of Management Journal, Volume 22, 1979, pp. 527-538.

20. ________ and D. Farrow. "User Involvement in Information System Development: A Conflict Model and Empirical Test," Management Science, January 1982, pp. 73-85.

21. Schewe, C. D. "The MIS User - An Exploratory Behavioral Analysis," Academy of Management Journal, Volume 19, 1976, pp. 577-590.

22. Senn, J. A. "Management's Assessment of Computer Information Systems," Journal of Systems Management, September 1980, pp. 6-11.

23. Wince, Bevington. Logistics Management Specialist Directorate of Logistics, Deputy for Acquisition Support, Aeronautical Systems Division, Wright-Patterson AFB OH. Personal interview. 17 June 1983.

B. RELATED SOURCES

Air Force System Command and Logistics Command. Standard Integrated Support Management System. AFLCR/AFSCR 800-24. Washington: Government Printing Office. 17 September 1982.

Dickson, Gary W., James A. Senn, and Norman L. Chervany. "Research in Management Information Systems: The Minnesota Experiments," Management Science, May 1977, pp.913-923.

Hatterick, G. Richard, and Harold E. Price. Technical Order Management and Acquisition. HQ Air Force Human Resources Laboratory, Brooks AFB TX, May 1981. AFHRL-TR-80-50.

Ives, B., S. Hamilton, and G.B. Davis. "A Framework for Research in Computer-Based Management Information Systems," Management Science, September 1980, pp. 910-934.

Lucas, Henry C., Jr. "Performance and Use of An Information System," Management Science, April 1975, pp. 908-919.

Mason, Richard O., and Ian I. Mitroff. "A Program for Research on Management Information Systems," Management Science. January 1973, pp. 475-487.

U.S. Department of the Air Force. Air Force Technical Order System. AFR 8-2. Washington: Government Printing Office. 3 May 1982.

U.S. Department of the Air Force. Air Force Technical Order System. TO 00-5-1. Washington: Government Printing Office. 15 October 1981.

U.S. Department of the Air Force. Technical Publications Acquisition Management. AFSCM 310-2. Washington: Government Printing Office. 14 May 1971.

Zmud, Robert W. "Individual Differences and MIS Success: Review of the Empirical Literature," Management Science, October 1979, pp. 966-979.

END

FILMED

DTIC