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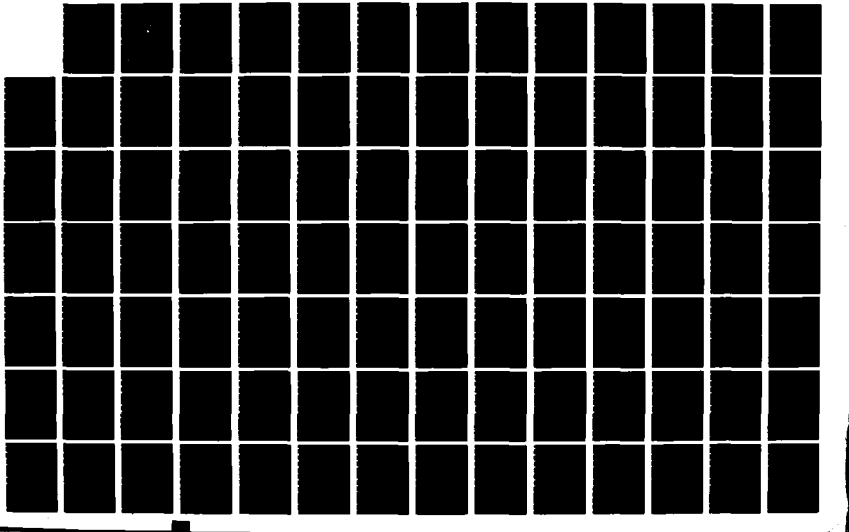

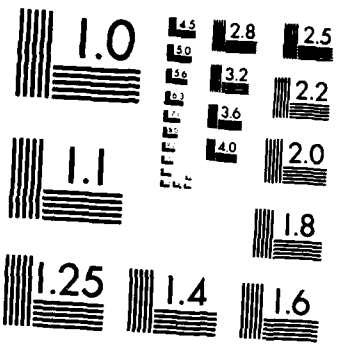

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A DATA DRIVEN DECISION SUPPORT SYSTEM (DSS) GENERATOR FOR THE EGYPTIAN PROCUREMENT OFFICE IN FOREIGN COUNTRIES

by

Mohamed H. Bassyouni

June 1986

Thesis Advisor: Daniel R. Dolk

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This thesis focuses on the development of a data-driven decision support system to assist the Egyptian procurement activities in foreign coutries. The Egyptian Procurement Office in Washington, D.C. (POW) is taken as an example to apply this research. Two areas of procurement type has been examined in POW, the Commercial Procurement and the Government Procurement activities, the later type is based on the USA Foreing Military Sales (FMS) system. The Data Flow Diagram technique have been used to analyze the system. PC/FOCUS have been used to design a prototype software for the POW Commercial Procurement subsystem to use in an IBM-XT or IBM-AT or compatible microcomputers.

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A Data Driven Decision Support System (DSS) Generator for the Egyptian Procurement Office in Foreign Countries

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Submitted in partial fulfillment of the requirements for the degree of

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from the

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ABSTRACT

This thesis focuses on the development of a data-driven decision support system to assist the Egyptian procurement activities in foreign countries. The Egyptian Procurement Office in Washington D.C. (POW) is taken as an example to apply this research. Two areas of procurement type have been examined in POW, the Commercial Procurement and the Government Procurement activities, the later type is based on the USA Foreign Military Sales (FMS) system. The Data Flow Diagram technique have been used to analyze the system. PC/FOCUS have been used to design a prototype software for the POW Commercial Procurement subsystem to use in an IBM-XT or IBM-AT or compatible microcomputers.

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I. INTRODUCTION

A. OBJECTIVES OF THESIS

The objectives of this thesis are to analyze the current procurement system of the Egyptian Procurement Office in Washington D.C. (POW) to determine:

1. Decision criteria are used to select vendors to receive the RFP's;
2. The most effective way to monitor and administer the contracts;
3. The best way to accelerate LOA's process and provide the required information in the shortest time possible;
4. The design of a prototype decision support database system using PC/FOCUS DBMS on an IBM XT or AT computer to replace the current manual POW system.

The development of such a system creates a valuable DSS tool, the database, to support the POW. This system may be considered as a DSS generator for developing a specific DSS to include all functions of POW after getting feedback from users.

B. BACKGROUND

The strategic policy of the Egyptian Government since 1973 has been to procure weapons systems and military equipment from different countries in order to modernize the

Egyptian Armed Forces. The Egyptian Armament Authority (AA) is responsible for the procurement activities from foreign countries. To effectively accomplish its job, it has front offices in those countries, called Procurement Offices (PO). The Procurement Office in Washington (POW) is one of these offices. The POW deals with two kinds of procurements, commercial procurement of the military items from the open market inside the USA, and government procurement from the Government of the USA. The POW functions are summarized below.

The following are the POW functions outlines.

1. Commercial Procurement

The POW does the following important functios: (1) receives Requests For Proposals (RFP's) coming from AA, (2) prepares vendor list of the eligible and suitable vendors to receive the RFP's, (3) calls vendors for bids, (4) receives and verifies proposals from vendors and forwards them to AA (5) Monitors and administers the active contracts inside the USA.

2. Government Procurement

All the requests for purchasing weapons from the USA Government must be submitted on a special form called Request of Offer and Acceptance; (ROA). After many procedures in the USA administration the accepted ROA becomes a Letter of Offer and Acceptance (LOA) which is a contract between the United States of America and Egypt. The LOA's

are prepared in Egypt by the AA and the specialized departments according to our needs and the weapons acquisition plan. The POW responsibilities in this kind of procurement are: (1) receive all the ROA's coming from AA and forwards them to the USA Security and Assistance Center (USASAC), "which is responsible for Foreign Military Sales to alien and friendly countries", (2) keep track of all ROA's status sent to USASAC until final acceptance as an LOA, and (3) receive and process requisitions for Purchasing spare parts needed for the weapons already purchased from the USA and in the service of Egyptian Armed Forces.

C. PROBLEMS TO BE SOLVED

Due to the continued growth of the numbers of RFP's, open contracts, and LOA's, the current manual system needed to be improved to allow better performance of the procurement process. The following are the major problems with the current POW system.

1. RFP's Function

This process requires a great deal of effort to effectively decide who are the suitable vendors to receive a particular RFP. A pre-selected criterion must be applied for each vendor. The growing numbers of RFP's coming from Egypt, the large numbers of vendors available in USA, and binding time constraints are all important factors that may be causing a delay in this process.

2. Monitor Open Contracts

A large number of contracts must be monitored for payment, shipment, and training of personnel. Invoices need to be verified and payed to prevent problems of missed or double payments of some invoices. Different kinds of payment and fund sources must be monitored too. The present manual system requires significant effort to effectively deal with these activities.(About 100 man hours per working day are needed to do these activities).

3. LOA's Functions

The USA Foreign Military Sales (FMS) procedures are very conservative and lengthy. The POW acts as a co-ordinator between the AA and the USASAC. The POW is responsible for keeping track of the status of each LOA submitted to USASAC. This process takes a long time to be completed (at least two months). Speeding up this process requires a good monitoring system to keep track of the LOA's and provide information to both sides in the shortest time possible.

D. SCOPE, LIMITATIONS, AND METHODOLOGY

This thesis concentrates on the first two phases of the DSS development life-cycle , ie. systems analysis followed by the design of a prototype database for the commercial procurement activities of POW. The software utilities of PC/FOCUS DBMS will be used to develop the prototype. The

result of this research may be easily adapted to any similar office in other foreign countries.

In the analysis phase, Structured Systems Analysis (SSA) techniques are used to analyze the POW system. In the design phase, software engineering methodology is used to design a DSS generator for the commercial procurement function. Through the analysis and design phases, the DSS approach is used. In Appendix A, we present an overview about the Data Flow Diagram conventions.

E. ORGANIZATION OF THE THESIS

The thesis is structured as follows: Chapter II describes the POW current system. Chapter III describes the detailed problems and opportunities of the current POW system. Chapter IV discusses the software requirement specifications of POW. Chapter V provides the software design to build the DSS generator, the database system for the POW Commercial Procurement System (POWCP). Chapter VI presents the conclusions and recommendations of the thesis. Appendix A discusses the Data Flow Diagram conventions. Appendix B provides the software module listings. Appendix C provides the data dictionary of the existing system.

II. THE CURRENT POW SYSTEM

A. INTRODUCTION

This chapter describes in detail the current POW information flow structure. The approach taken for this information analysis is to adopt the Data Flow Diagram techniques proposed by Gane and Sarson [Ref. 5]. A comprehensive discussion of this technique is given in Appendix A.

The POW is the most important procurement office outside Egypt, because of the heavy demands of the AA and the specialized departments to procure weapons and military items from the USA. The primary goal of POW is to provide procurement functions from the USA in the most efficient and effective ways. Officers from different major forces and specialized departments are selected to work in this office to deal with the variety of weapons and military items required by Egyptian Armed Forces.

The rest of this chapter describes the organization and the major functios of the POW in both commercial and government procurement. Data Flow Diagram techniques are used to picture the system, the Data Dictionary is used to document the system.

B. POW ORGANIZATION

POW consists of the POW Director, POW Director Assistant Officers or the Specialized Officers (SO's), Contracting Officer (CO), Financial Officer (FO), Shipment Officer (SHO), and Administrative Officers (AO),(These abbreviations will be used in the DFD and data dictionary.). All officers are selected from different Forces of Egyptian Armed Forces (EGAF) to represent the major specializations in EGAF.

1. Organization Chart

Figure 2.1 shows the organization of POW. As we can see, the POW Director has the overall responsibility for the procurement functions inside the USA. The other officers assist him in doing his job. The organization consists of sections. Five specialized sections represent the major topic areas of Egyptian Armed Forces, each one is headed by a specialized officer in the particular area. The Administration and Control section headed by a qualified officer in administration. The Financial and Accounting section headed by an officer from the Financial Affairs Authority. The Shipment section headed by a qualified officer which is responsible for monitoring shipment of contract items to Egypt.

2. The POW Procurement Responsibilities in USA:

a. Apply and follow the Egyptian defence procurement laws and regulations.

b. Implement the procurement plan of AA.

c. Use funds available in the most effective and flexible way.

d. Assure appropriate contract type.

e. Reduce the procurement cost and shorten the procurement period.

f. Improve vendor selection function and keep an up-todate information about vendors.

g. Increase competition between vendors.

h. Develop and use standard operation and support systems to perform the procurement function effectively.

i. Monitor shipment of the contract items to the country.

j. Monitor training of personnel associated with the contracts.

The POW director is responsible for proper execution of all the above functions. Figure 2.2 shows all AA requests from POW and Figure 2.3 shows POW relationships with external agencies.

3. Job Responsibility of the Specialized Officers(SO):

a. Apply all the procurement functions as stated in Item 2.

b. Follow the orders and directives of the POW Director.

c. Check the RFP's received from AA for proper specifications and style before forwarding to vendors.

d. Apply vendor selection rules and criteria to achieve full and open competition between vendors.

e. Maintain fairness and equal opportunity among all vendors by providing them with all information concerning a particular RFP.

f. Receive and verify proposals for completeness before sending them back to AA.

g. Check all received payment documents from vendors and approve them for payment.

4. Job Responsibilities of the Contracting Officer:

a. Apply Egyptian defence legislation and directives related to the procurement process.

b. Check all contract terms for correctness and completeness before signing by POW Director.

c. Check and review vendor financial status before putting them in the vendor list.

d. Keep track of all open contracts and monitor vendor performance in contract implementation.

e. Prepare a termination notice, if necessary, for inactive vendors.

f. Deal with all problems and complaints from vendors.

g. Participate in the procurement committees in POW and check that all vendors are qualified to attend a committee and have all the necessary certificates and warranty letters.

The following sections describe the POW system functions. Two types of procurements are exist, the commercial procurement and the government procurement.

C. COMMERCIAL PROCUREMENT FUNCTION

The commercial procurement function is divided into five processes, as shown in the DFD in Figure 2.4.

1. RFP's Function

2. RFC's Function

3. Fund contracts.

4. Administer contracts

5. Generate Vendor list

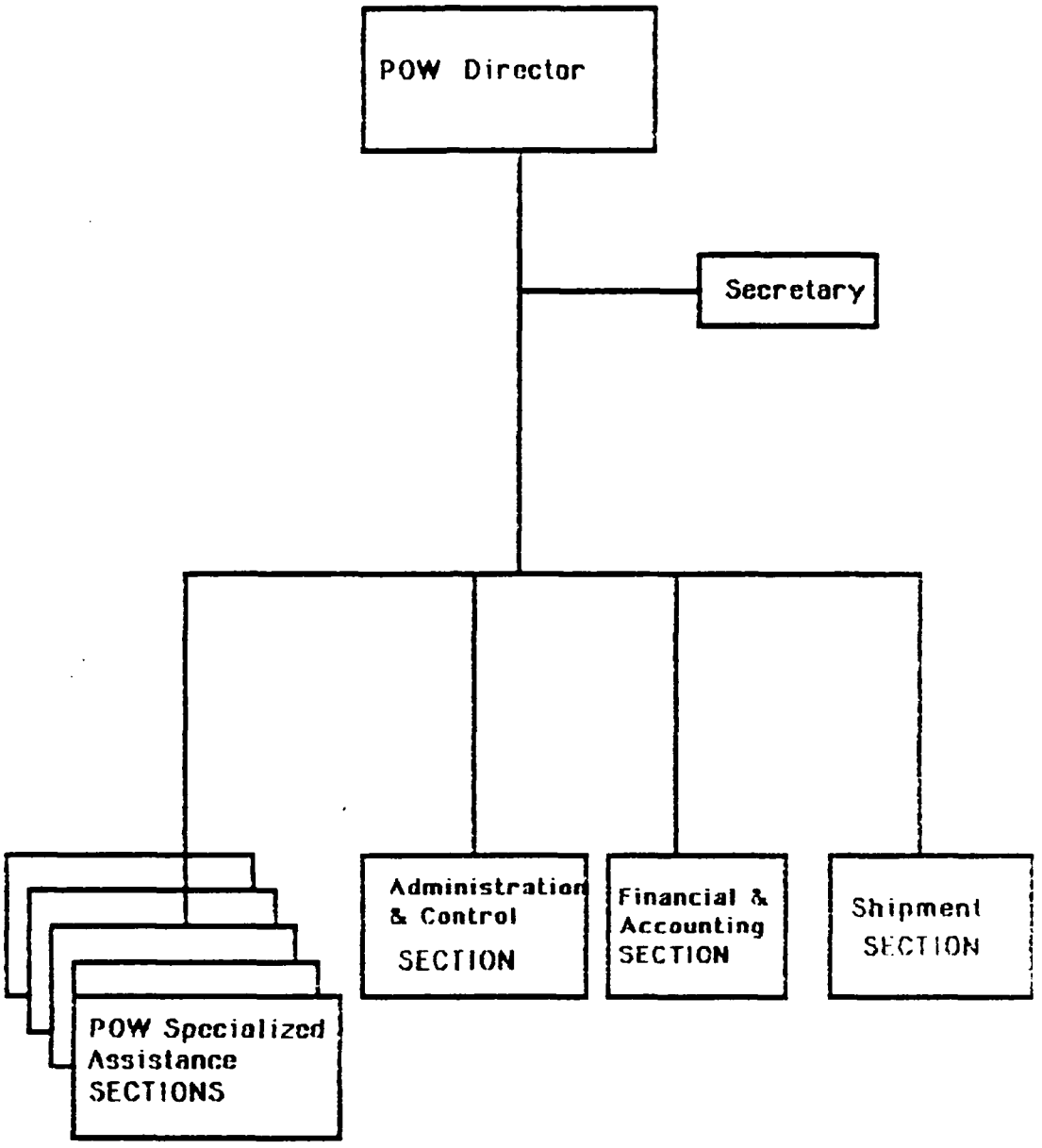

Figure 2.1 POW Organization Chart

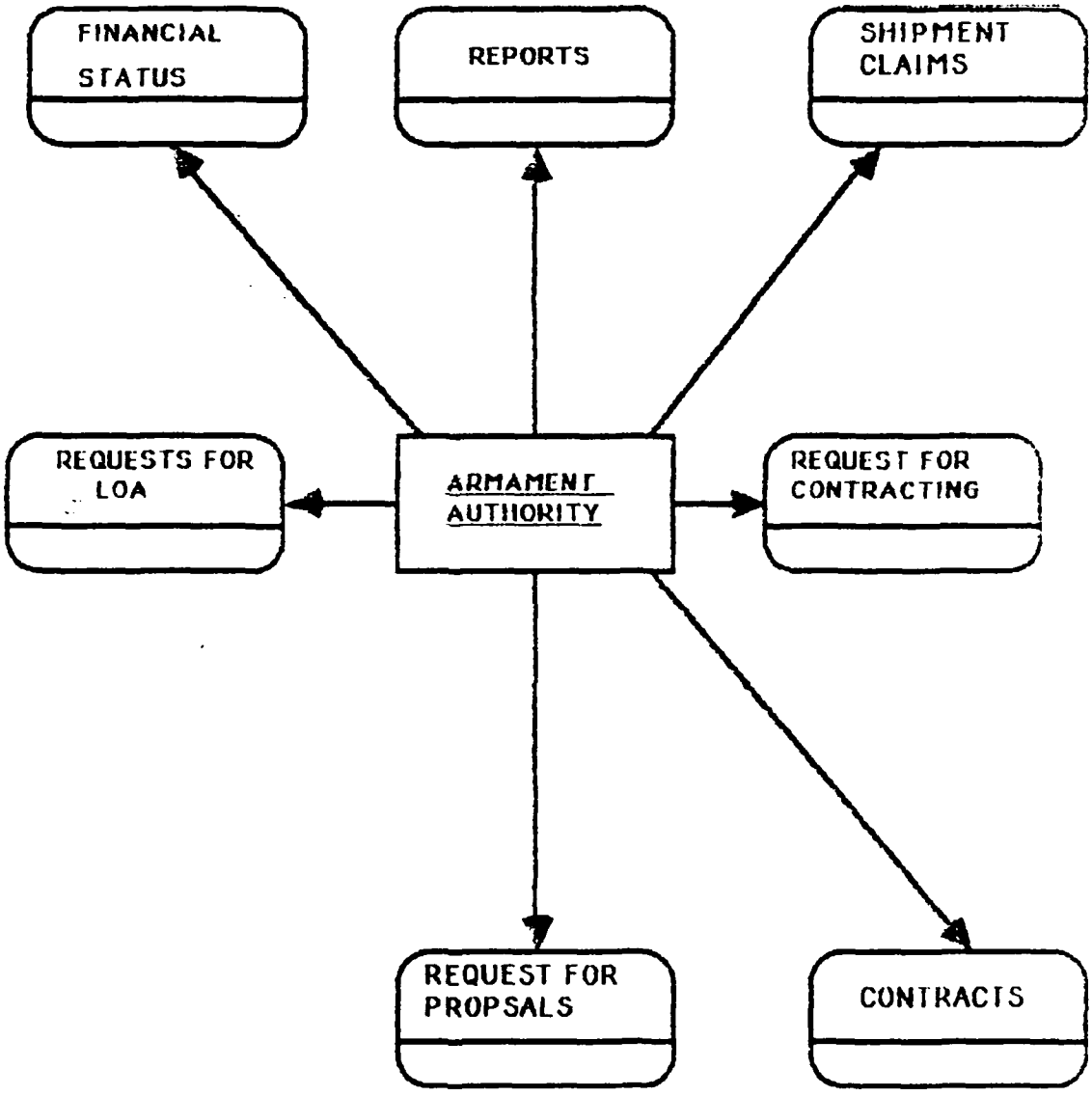

Figure 2.2 ARMAMENT AUTHORITY REQUESTS FROM POF

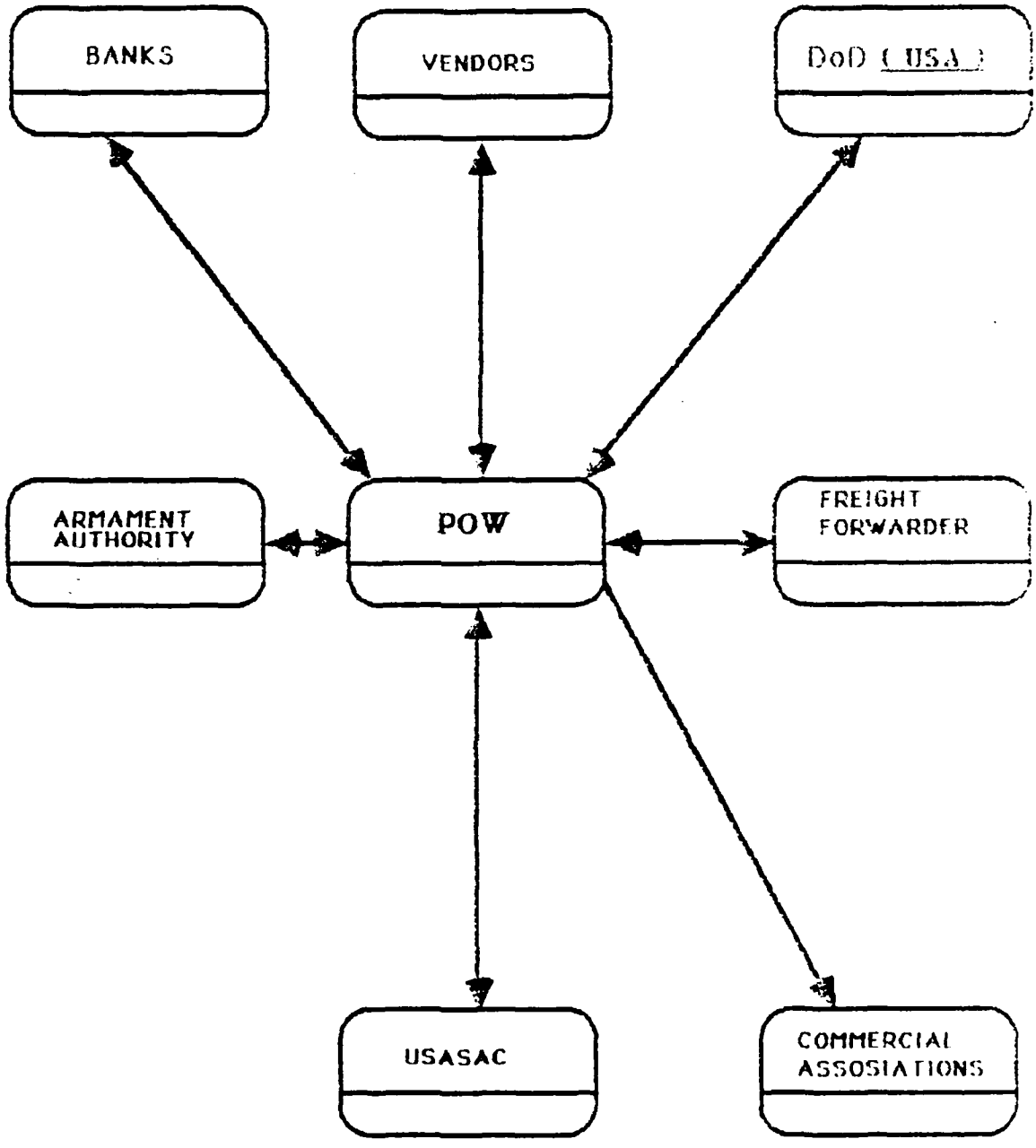

Figure 2.3 POW RELATIONS

Each one of the above processes is expanded into several other processes in a top down fashion to show more details. In each level of details, a walkthrough is presented to explain each process associated with the DFD. In the data dictionary, a detailed description of the processes is presented.

1. RFP's Function

The RFP is the official communication from the Government of Egypt to the market. For easy explanation, we take a particular RFP and follow its sequence. Figure 2.5 illustrates this process as a DFD. The process starts when a particular Force or Department of EGAF's "requester" asks the Ministry of Defense (MoD) for funding for certain kinds of military items from the USA. After receiving a fund letter from MoD, a Committee is designated to prepare the RFP. The objective of the RFP is to provide prospective vendors with adequate information and guidance, presented in a clear and logical manner. Basically, preparation of the RFP is a team effort.

a. Receive RFP by AA

After final approval of the RFP, the requester sends it to AA. Any particular RFP usually contains the following information:

(1) Terms

(2) Evaluation factors

(3) Specification

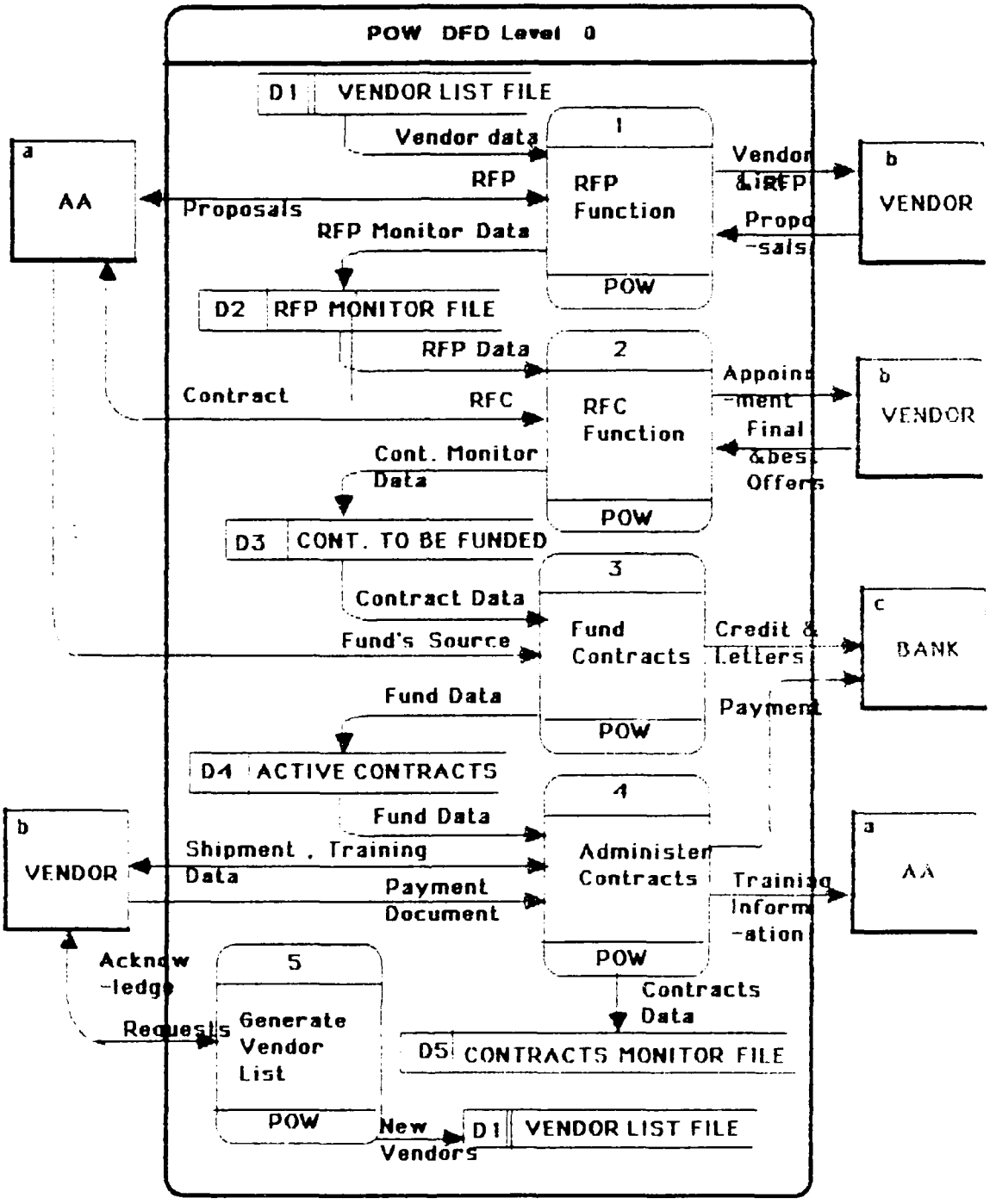

Figure 2.4 POW Commercial Procurement Functions

(4) Delivery schedule

(5) Quality assurance

b. Check RFP in AA

The RFP is checked against the annual procurement plan of the requester. The RFP must be clear, complete, and consistent with the requirement of procurement so that it provides all vendors with the same understanding. After checking, the AA sends the RFP to POW.

c. Check RFP in POW

Once received by the POW, the RFP is registered in the General Log Book by the Adminsterative section, and then routed to the Specialized Officer in the area, who reviews the RFP to be sure that the specifications are clear and complete and items are clearly identified. (Figure 2.6)

d. Select Vendors

The SO selects vendors who will receive the RFP from the vendor lists available in POW, or by using a special catalog called the Thomas Register which contains most of vendors in the USA. He prepares a list of the vendors matched with the RFP item specifications and approves it with the POW Director.

e. Issue RFP

The necessary number of copies of the RFP is prepared and mailed to the selected vendors. First time vendors must fillout a special Qualification Form. The

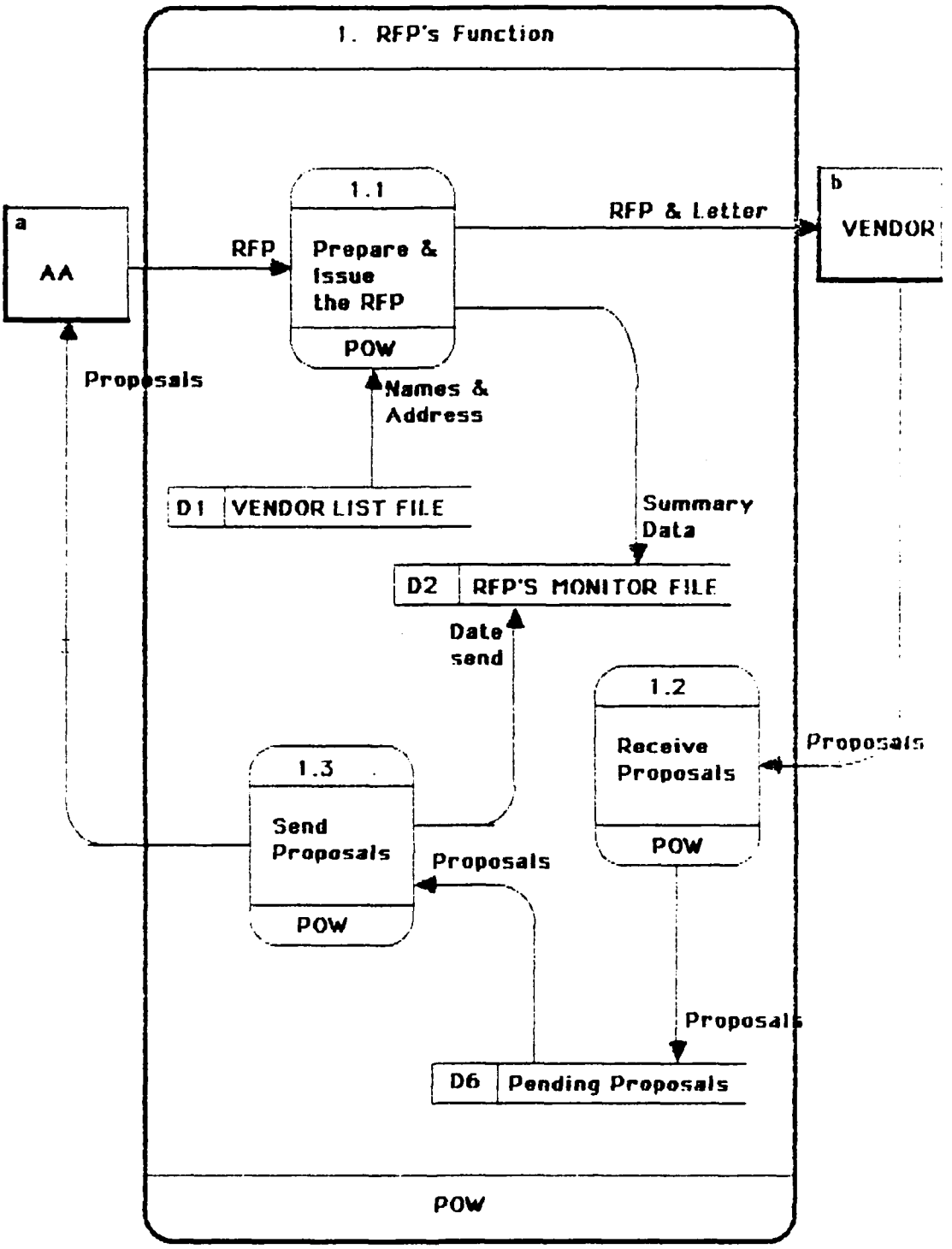

Figure 2.5 RFP's Function

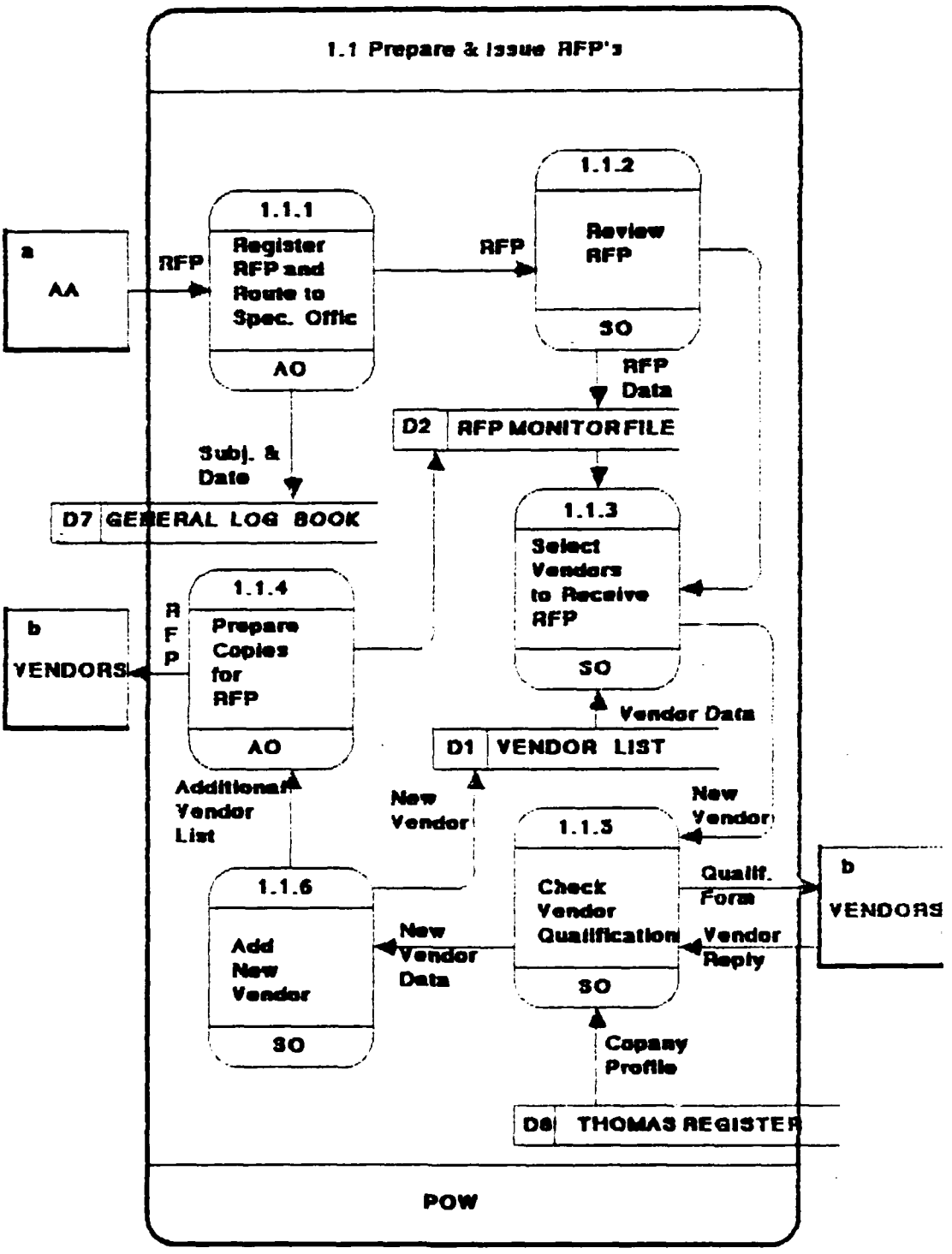

Figure 2.6 Prepare and Issue RFP's

letter sent to the vendors clarifies all the general terms and conditions that must be followed by the vendors as well as the closing date for receiving the proposals. Sometimes, for important RFP's, a pre-proposal conference may be scheduled to allow vendors to clarify sections of the RFP they may not fully understand.

f. **Check Incomming Proposals**

SO checks and reviews all incoming proposals. Only relevant and complete proposals from qualified vendors are sent to Egypt. (Figure 2.7)

2. **RFC's Function**

Sometimes, AA authorizes POW to contract with vendors. It sends a Request For Contracting (RFC) to POW. The RFC must contains all the necessary documents for doing the contract process. Two kinds of requests may be received, RFC with a specific vendor already selected by AA or a list of technically accepted vendors to choose from. The awards are generally based on cost. If two vendors have similar cost bids, previous contracts with Egypt or the USA Armed Forces are considered. The following are the procedures for a particular RFC: (Figure 2.8)

a. **The Specialized Officer (SO)**

Receive and review the RFC in the area. The most important document received with the RFC is the technical evaluation and acceptance of vendors and the best and final offers of each vendor.

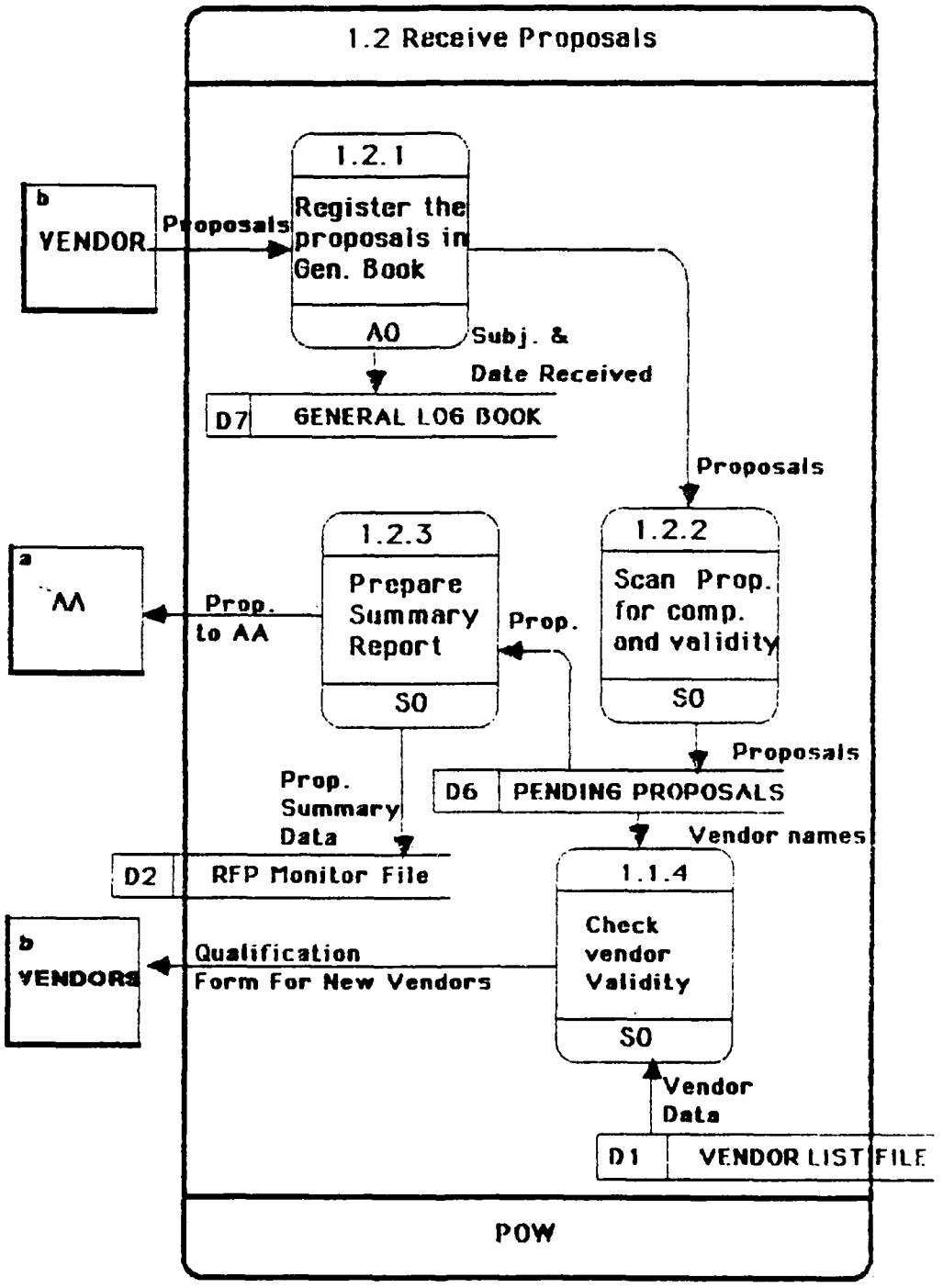

Figure 2.7 Receive Proposals

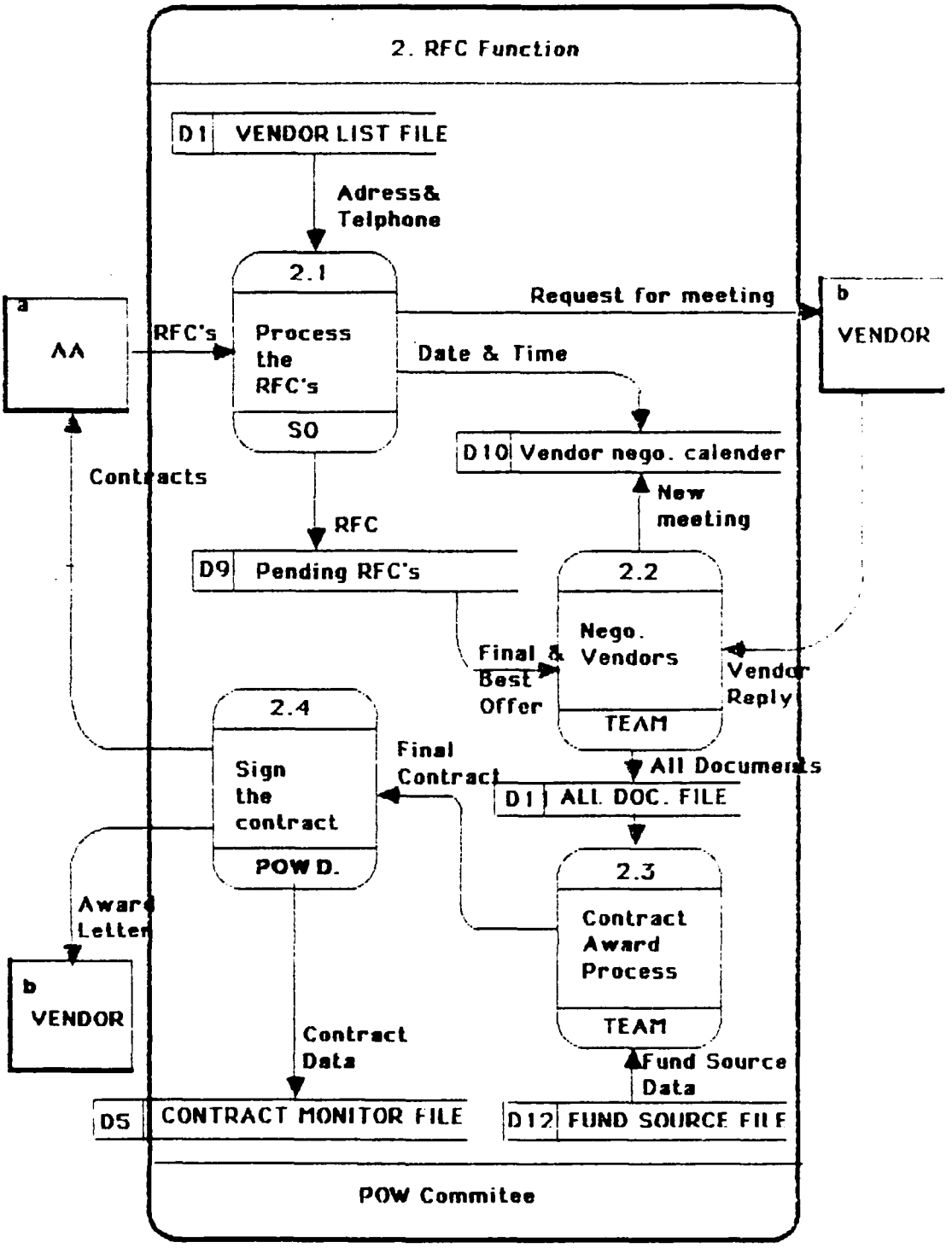

Figure 2.8 RFC's Function

b. **The Financial Officer (FO)**

Checks availability of funds for RFC.

c. **The Administrative Officer (AO)**

Prepares the Contracting Implementation Plan (CIP) and the meeting schedule with vendor(s). The AO informs vendors of the date and time of the negotiation meeting. The negotiation period should not exceed two weeks.

d. **Vendors Negotiation**

The POW Director designates a team for discussions and negotiation with vendors. The team consists of members from specialized officers, the contracting officer, and the financial officer. The negotiation issues are straightforward and consist generally of insuring competition between vendors and obtaining the best price and conditions possible.

e. **Pre-Award Survey**

This servey must be undertaken by the team. The factors to be considered for each vendor are:

(1) adequate financing,

(2) ability to meet delivery and specifications,

(3) satisfactory record of performance,

(4) satisfactory record of integrity,

(5) necessary organization, and

(6) necessary facilities and equipment.

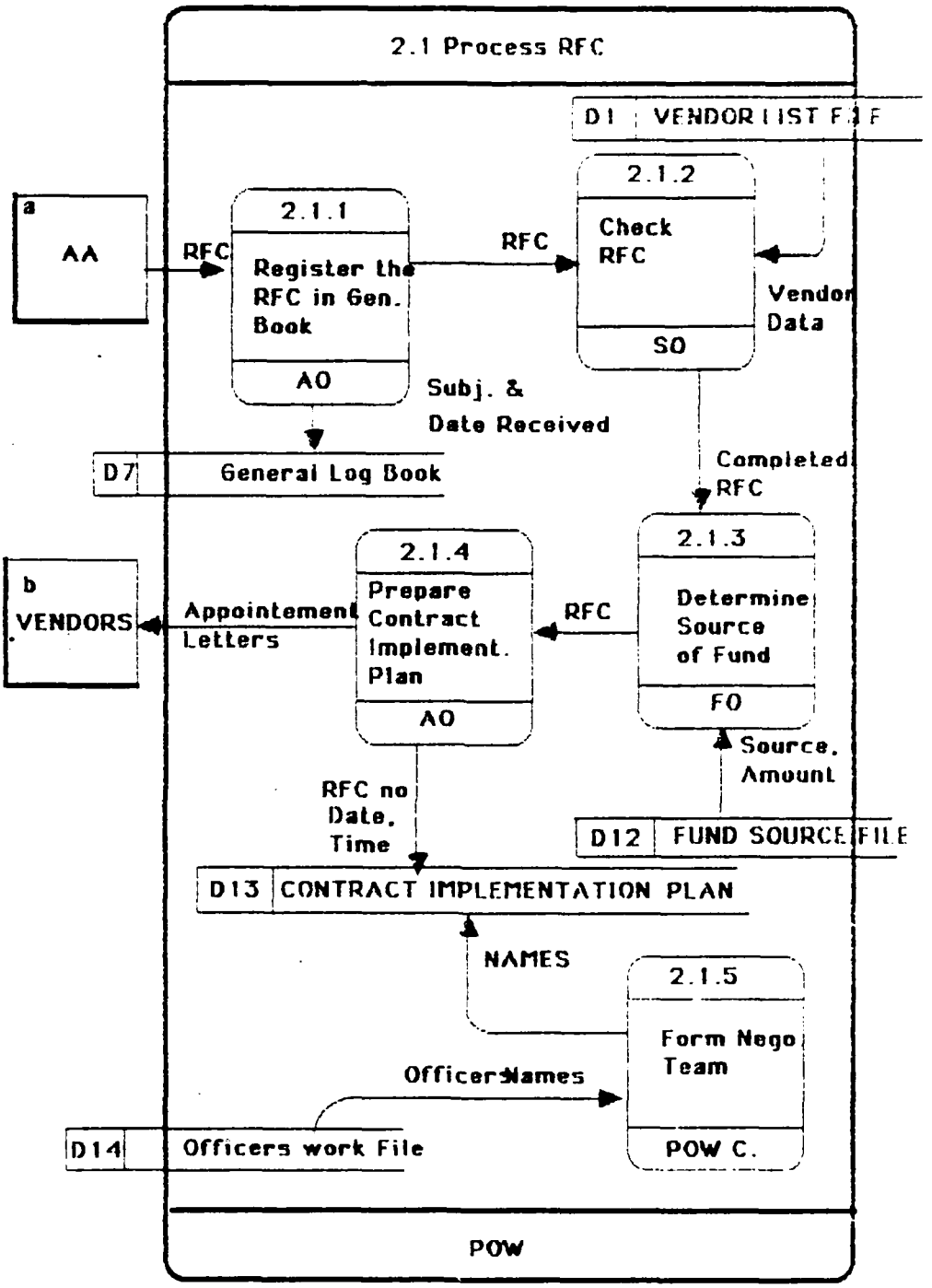

Figure 2.9 Process RFC

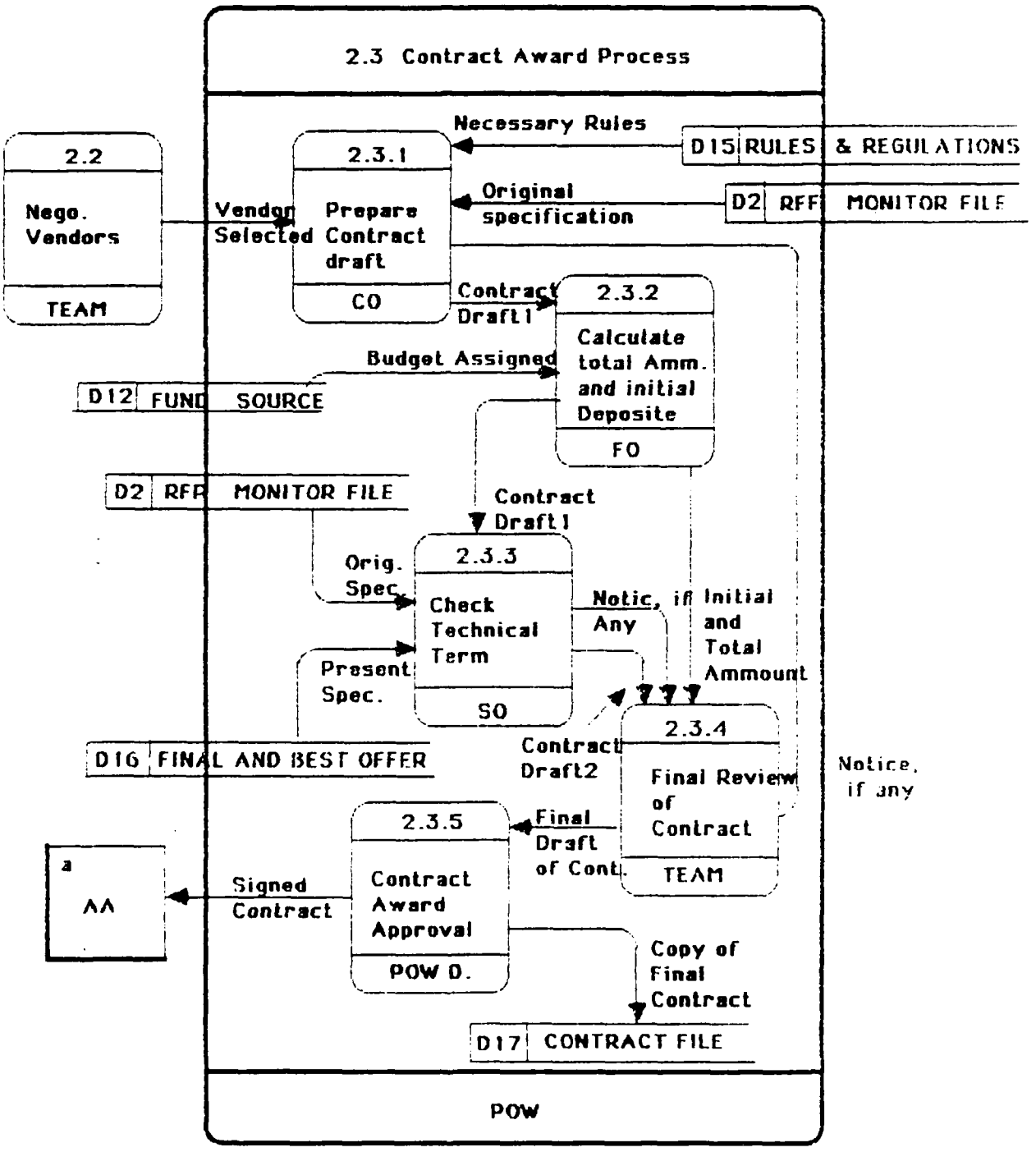

Figure 2.10 Contract Award Process

The contract is awarded to a vendor after analysis and calculation of all the above factors. Figure 2.9 shows the RFC process and Figur 2.10 shows the contract award process.

f. Team member responsibilities in RFC Process

(1) Contracting Officer. Prepares the contract draft paying special attention to the contract terms and conditions.

(2) Financial Officer. Calculates the amount of dollars needed to fund the contract and the initial deposits. He also prepare the payment.

(3) Specialized Officer. Checks all thetechnical terms of the contract e.g. item catalog numbers, warranty period,inspection plan,technical assistance,training plan.

(4) Administrative Officer. Collects and keeps all documents of the RFC and records all events in a special Log Book.

(5) POW Director. Checks and approves the contract before the final signature, and then invite the selected vendor to sign the contract in POW.

All the contract related documents are collected in a file until the implementation phase. A contract monitor record is created to keep all active information about the contract.

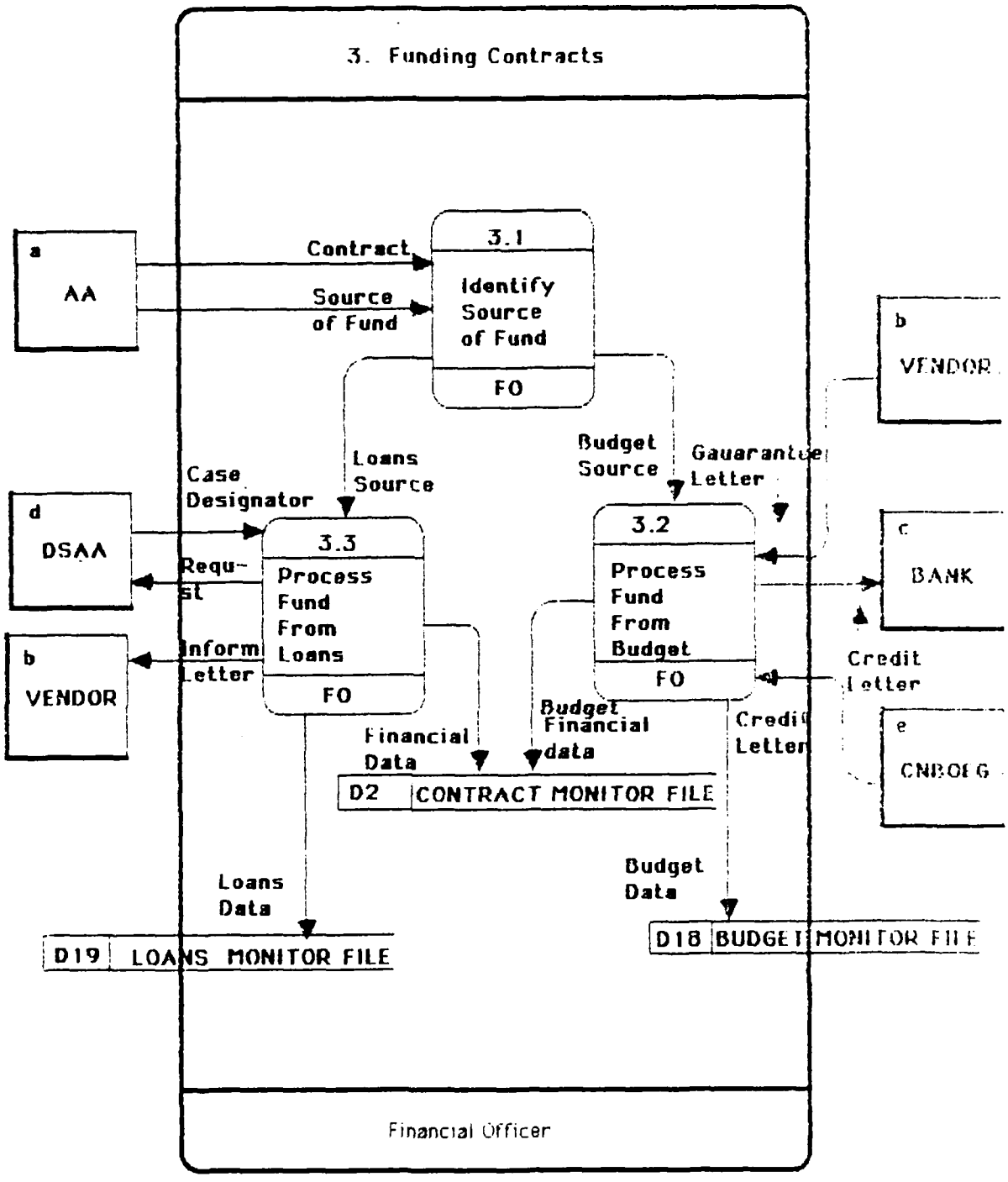

Figure 2.11 Funding the Contracts

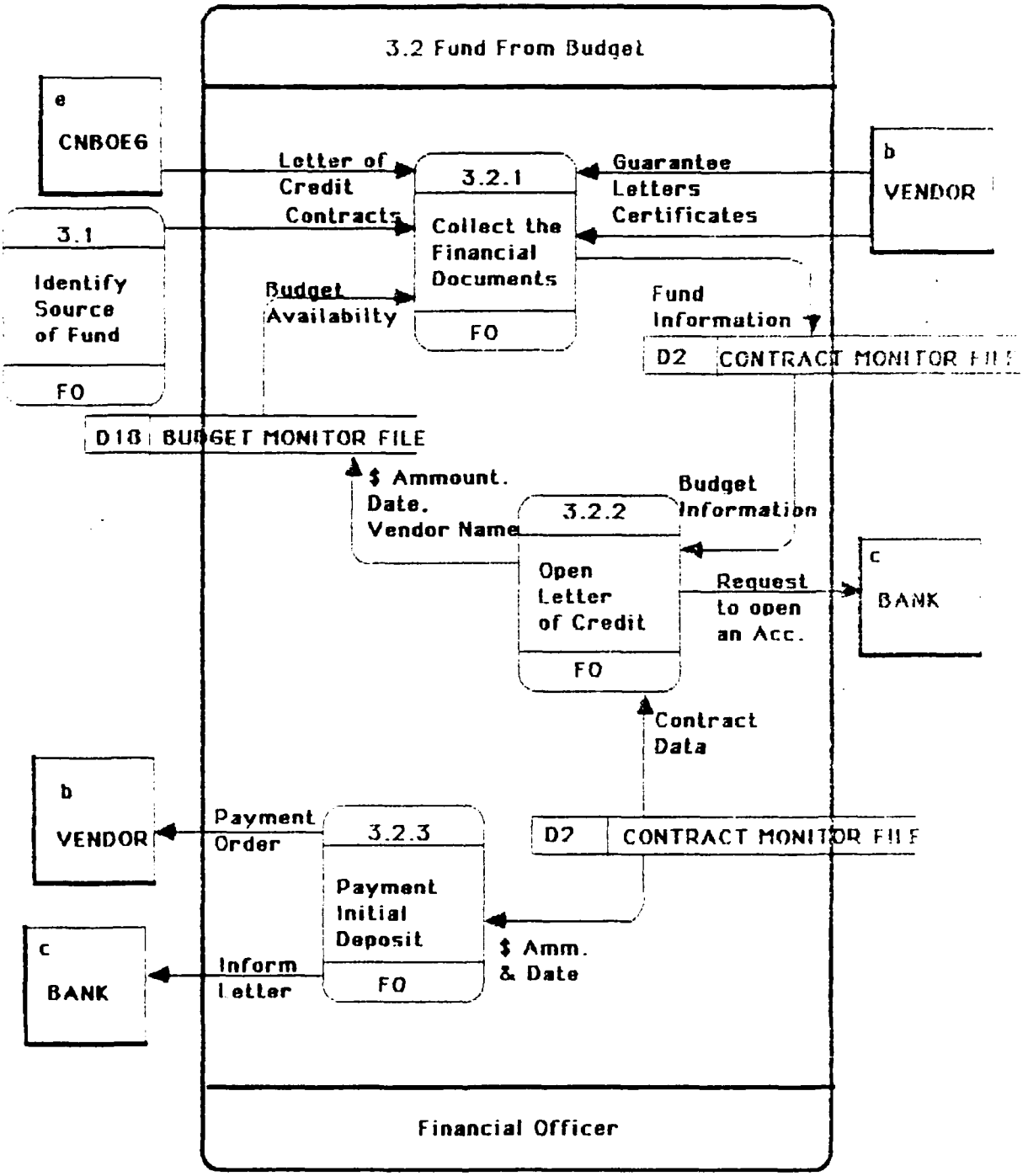

Figure 2.12 Fund From Budget

3. Fund the Contracts

Two types of fund source are available: budget and loans. Figure 2.11 shows the main process of funding contracts. Processing of any procurement activities cannot be started unless POW receives the financial letter that assigns the money value and the source of funds to be used. The preparation of defense budget and loans is beyond the scope of POW functions. The POW responsibility is to effectively manage funds dedicated to new or currently active contracts. The cash needed over a period of time must be carefully calculated. Monitoring the cash flow and bank status is one of POW's major functions. The following are the procedure to fund the contracts.

a. Funding from Budget

(1) The Needed Documents are (Figure 2.12):

- FUNDING LETTER--Received from AA.
- LETTER OF CREDIT--Received from the Central National Bank of Egypt (CNBOEG) amounting to the total value of contract and the advance deposit to be paid to the vendor.
- LETTER OF GUARANTEE--Received from vendor for the security of contract execution from vendor.
- LETTER OF GUARANTEE--Received from vendor for the amount of advance deposit he receives after signing the contract.
- OTHER DOCUMENTS AND CERTIFICATES--These documents are related to the contract e.g. warranty, inspection, source manufacture certificate etc.

(2) Open Letter of Credit. Send letter to the specified bank to open in favor of the vendor a confirmed

and irrecoverable letter of credit, in a prepared form letter.

(3) Activate the Contract. The contract is activated and implemented upon the agreement date.

b. Funding from Loans

(1) Determine the Source of Fund. The initial funding letter with the RFP determines the source of funds and whether or not it's funded from USA loans. POW considers that when preparing the vendor list for the RFP.

(2) Use the Loans. The loans are already approved and available for withdrawal. One loan may serve many contracts. Loan-based procurements are constrained by many factors such as: vendor selection, manufacture product, and limited amount of dollars. AA understands these constraints and follows its rules accordingly.

(3) Process Funding from Loans. After finishing the contracting phase, POW sends a letter to the Defense Security and Assistance Agency (DSAA) asking them for funding the contract from a loan, (Figure 2.13) shows the procedures of loan funding. Two documents must be supplied with this letter: a copy from the signed contract and the Justification Sheet which is prepared by DSAA to assist the procurement. The request is processed by DSAA and, if accepted, a letter is sent with the Case Designator number for the contract, which serves like the credit letter from NBOEG in the budget base procurement. POW informs the

vendor by that number to start the implementation phase of the contract.

4. Administer Open Contracts

Each specialized officer is responsible for monitoring a group of contracts in his area. The contracts are divided into groups according to specialized areas. The major functions of contract administrations are shown in Figure 2.14. The following are the description of each function.

a. Payment

Much effort and time are needed to do this function. The following are the payment procedures as presented in Figure 2.15:

(1) Receive the Payment Document. POW receives the payment documents from vendors which include: The original invoice, the original receipt from Freight Forwarder (FF), who is responsible for shipment of items related to contracts, and the original certificate of origin for the items.

(2) Register the Payment Document. All incoming documents must be register in the central register book and routed to the responsible specialized officer (SO).

(3) Checks the Payment Document by SO. The SO checks the document with the contract monitor file to ensure that all the documents are original and correct. He

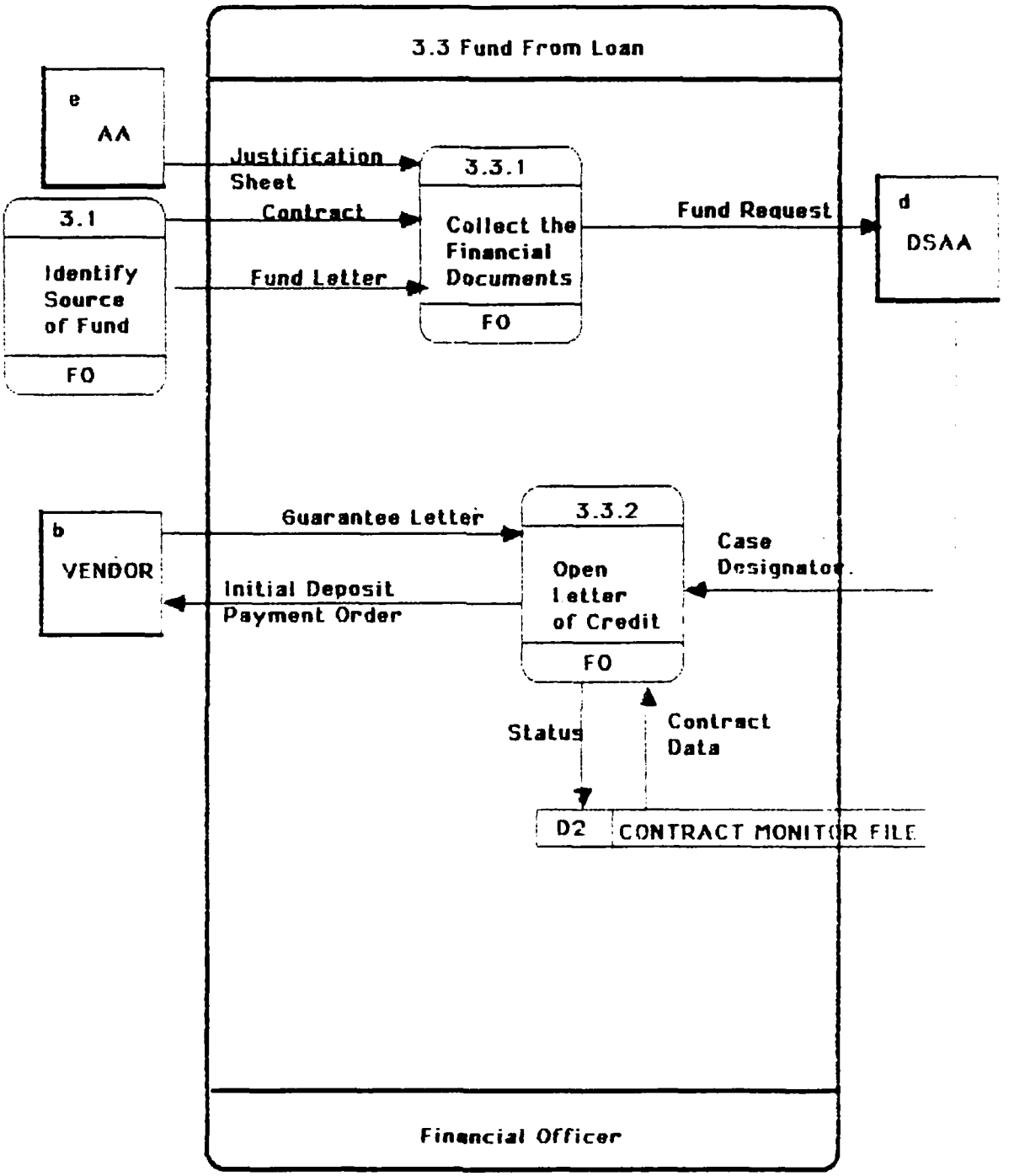

Figure 2.13 Fund From Loan

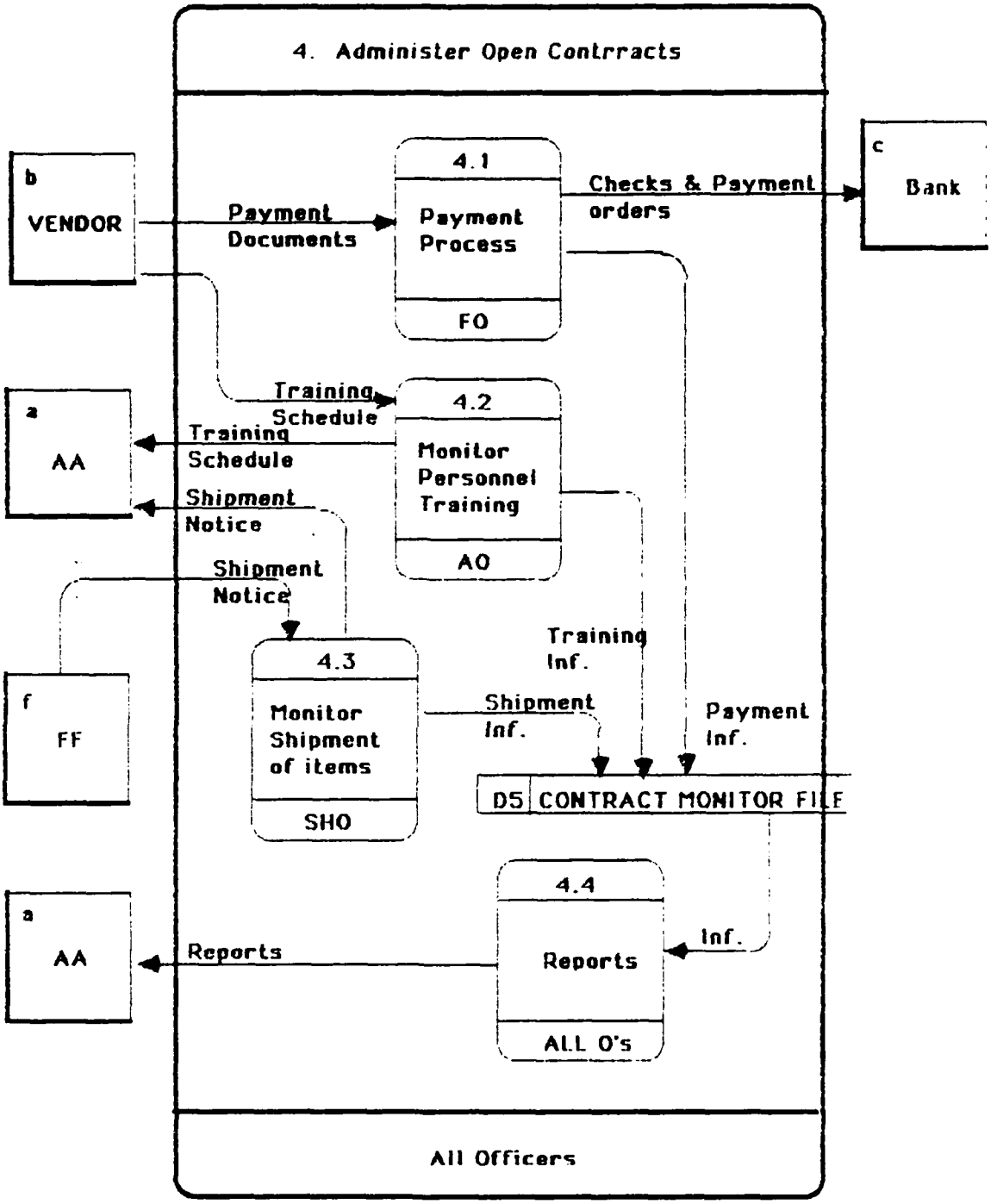

Figure 2.14 Administer Open Contracts

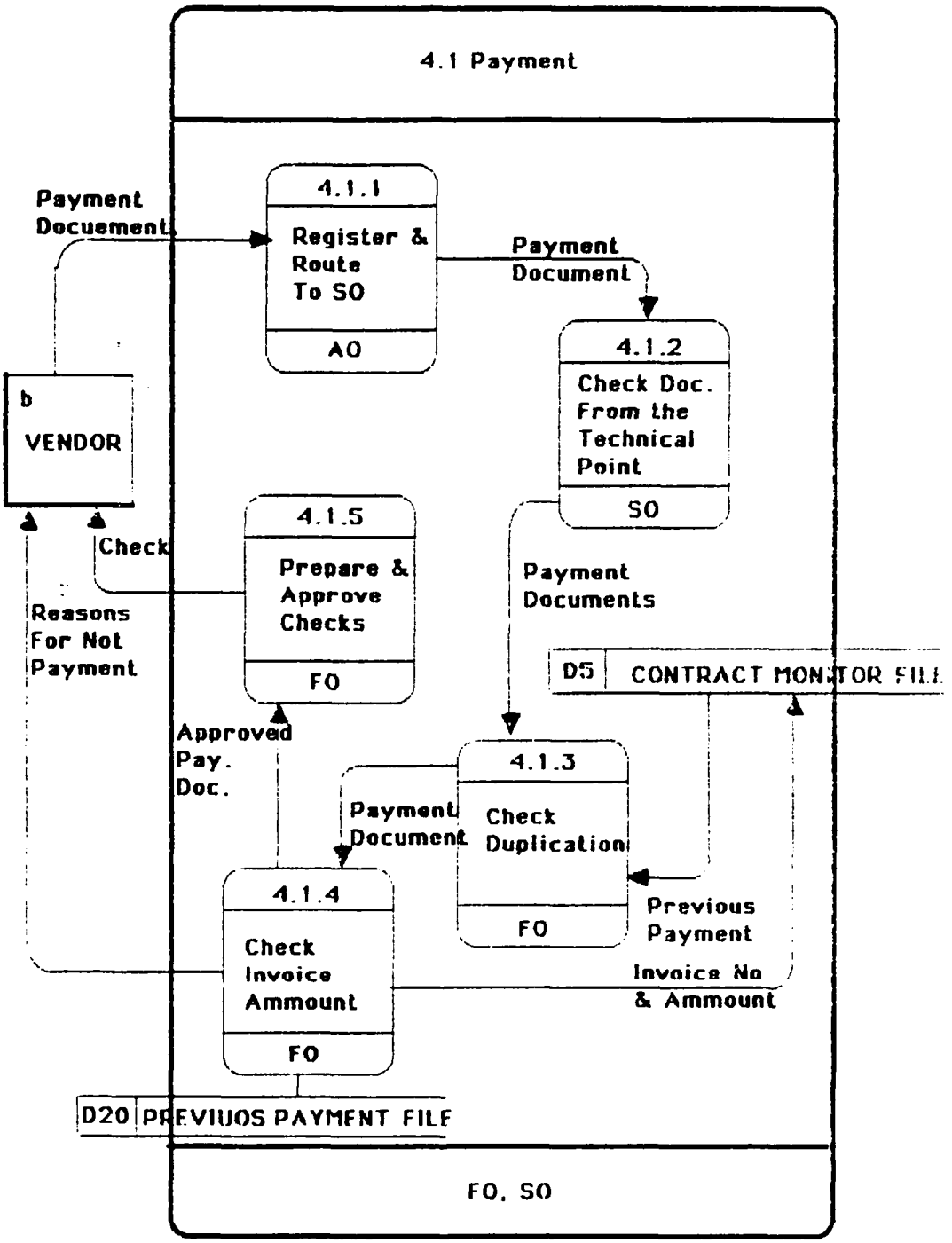

Figure 2.15 Payment

compares the invoice with the shipment notice from FF to see that they match. He checks the previous payment documents to make sure there is no duplication. He then approves the payment from the technical point of view and routes the payment documents to the Financial Officer (FO).

(4) Check the Documents by FO. The FO checks the invoice amount, the source of funds, the previous payments, and the approval of the SO. He prepares the check or the money order and approves the payment from the POW Director.

b. Monitor Personnel Training

Figure 2.16 shows the training procedures. The training may be done in Egypt or in vendor training center in USA. In the first case, the vendor must inform the POW at least two months before the training date of the names of expertise who will train our personnel. A special enquiry form is sent to the vendor to supply this expertise information. The second case, when training must be done in USA, vendor must inform POW six month before the training date of the date, duration, and locations of the training center, and the number of personnel who will train.

c. Monitor Shipment of Items to the Country

A Freight Forwarder (FF) company is contracted to do the shipment of all items related to contracts. This company is responsible for safe and timely transportation of

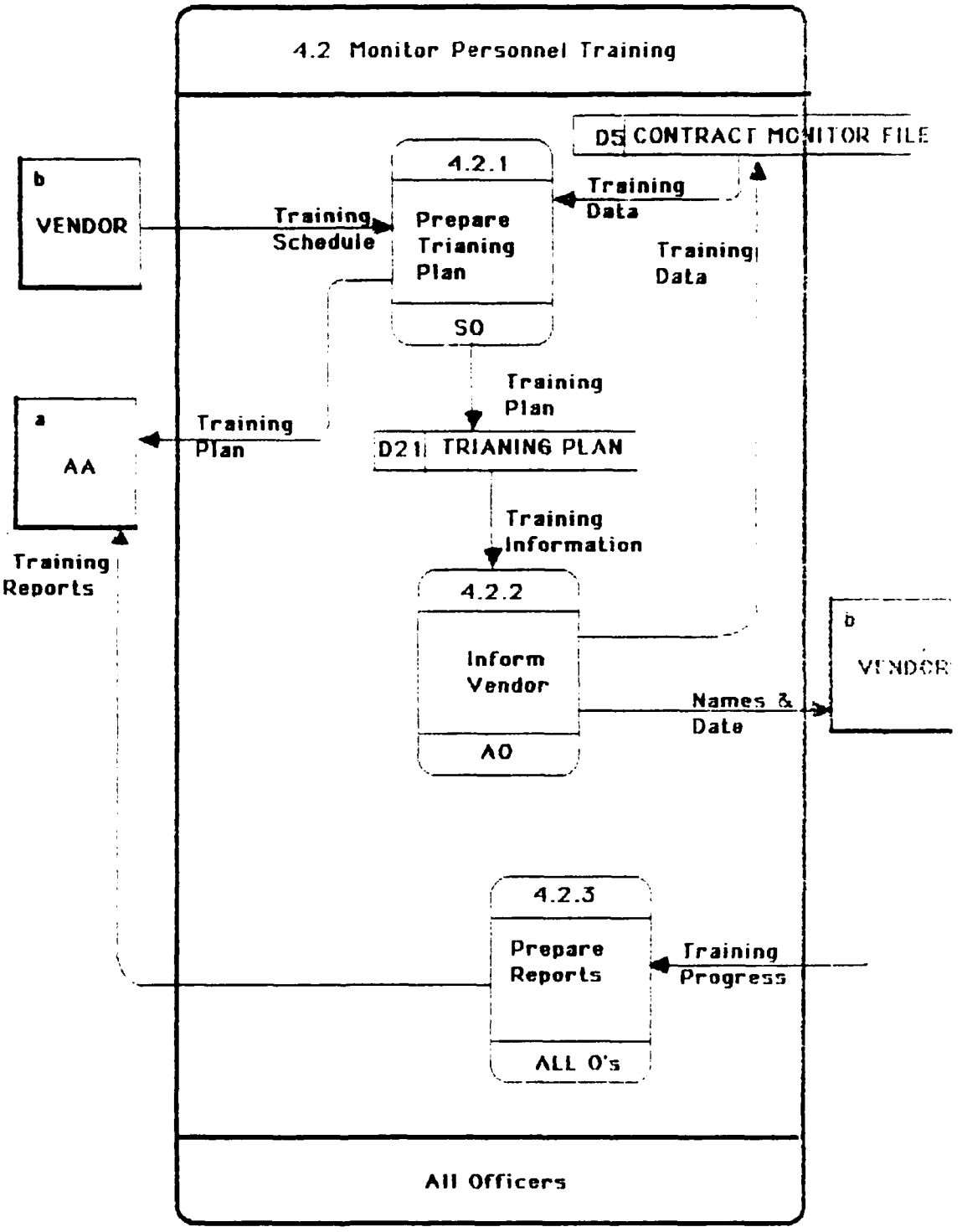

Figure 2.16 Maintor Personnel Training

contracts items to Egypt. It keeps all the documents and information related to the contents of packages delivered from all vendors to the front door of the FF company. Figure 2.17 shows the shipment main functions. The shipment officer sets the priority of shipment to the country according to AA demands and informs FF to take the necessary actions. The normal shipment is done by the FF. The shipment officer receives a weekly progress report from FF. This report contains the quantity shipped during the week and the inventory level inside the FF store and any problems to be solved. FF receives the delivered items from the vendor and signs a receipt to the vendor. This receipt must be included with the payment document when delivered to POW.

POW is equipped by a computer terminal connected to the FF computer center to access the information about the shipping status and the inventory level.

d. Reporting

In general, the POW is the information link between AA and USA government and market. Good communication between POW and AA is essential to properly accomplish the procurement function. Reports can be classified under the following kinds of categories (Figure 2.18): status reports, analysis reports, progress reports , comparison reports, evaluation reports , technical reports, market research report, etc. In the next chapter we present details of all reports used and needed by POW.

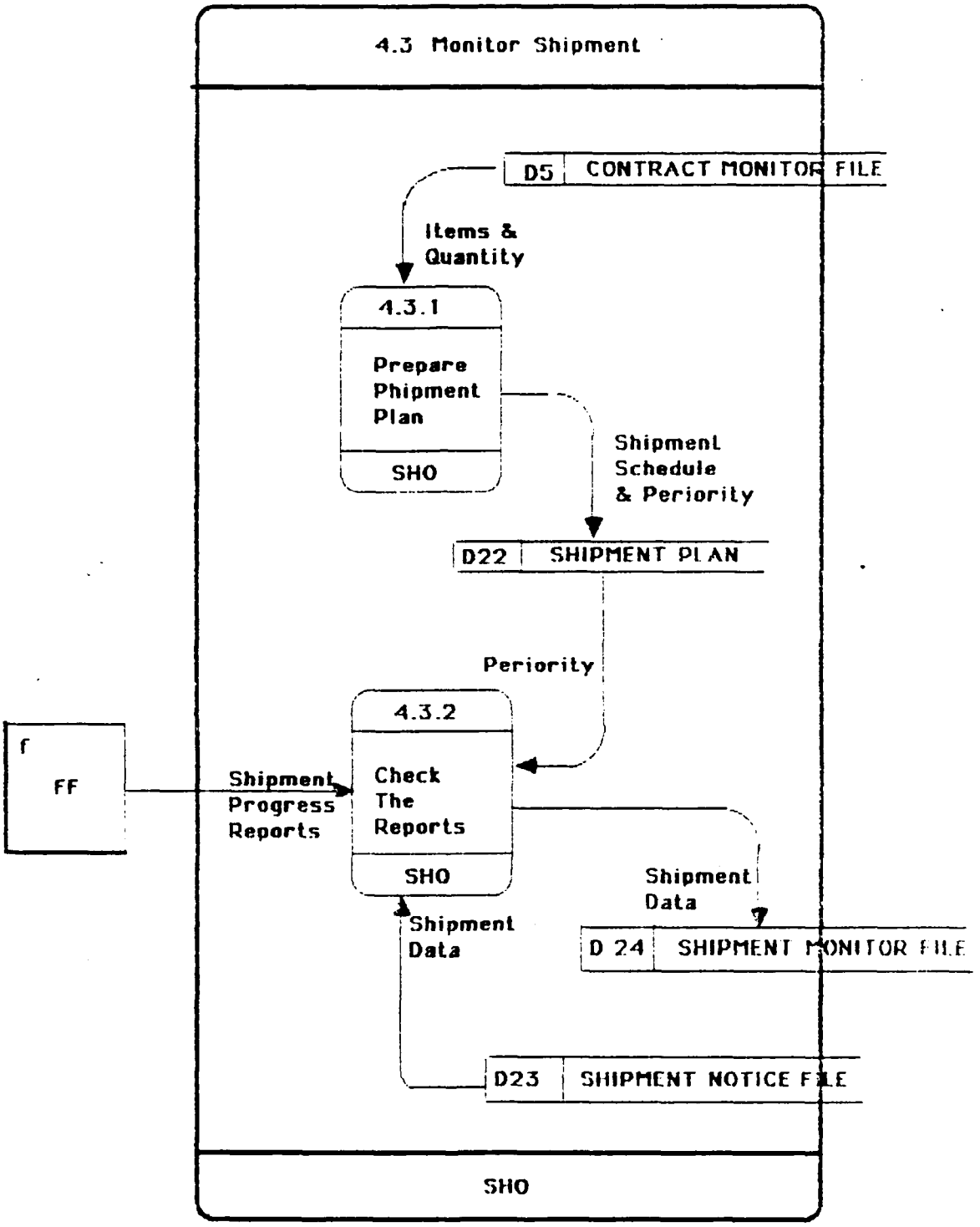

Figure 2.17 Monitor Shipment

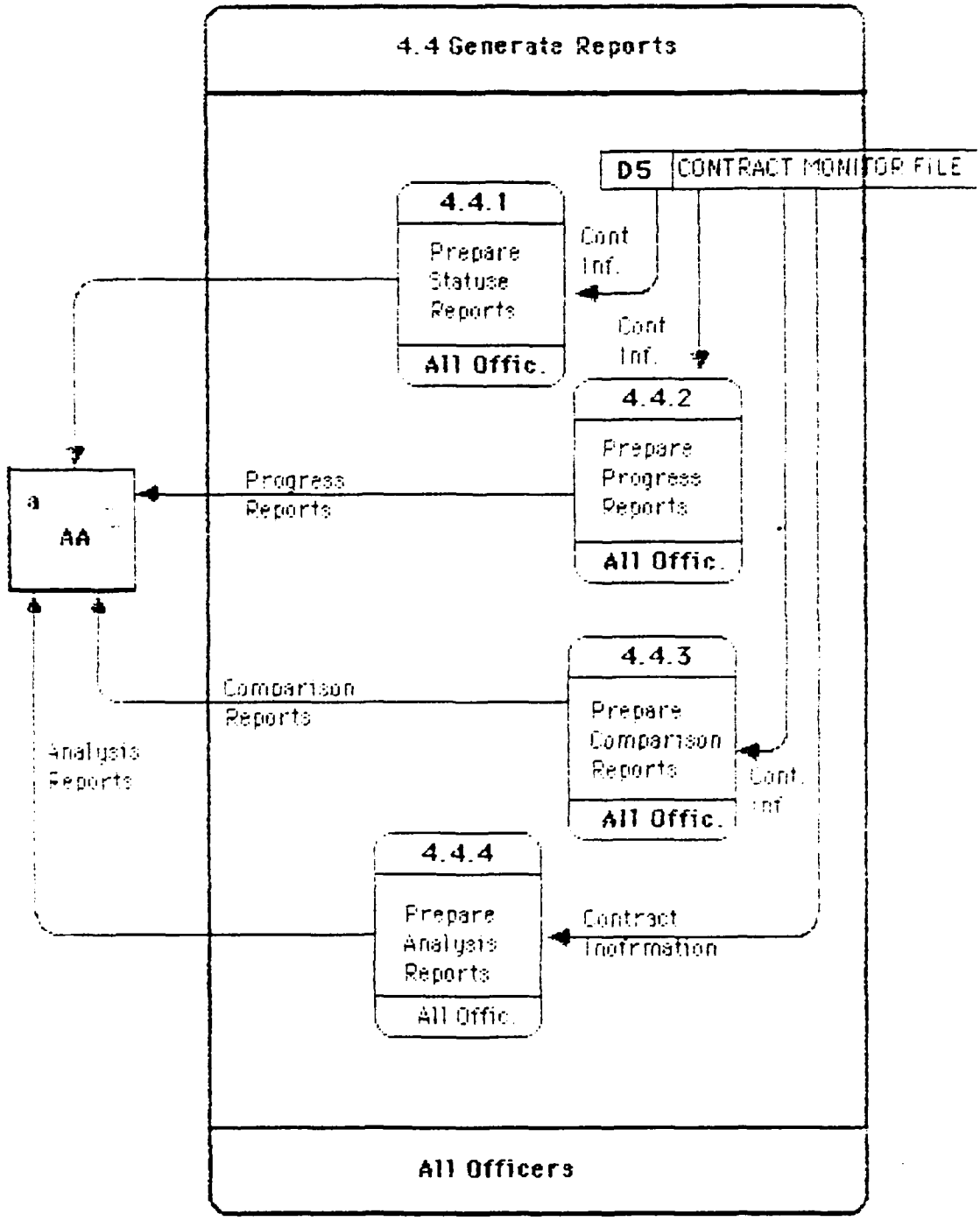

Figure 2.18 Prepare Reports

5. Generate Vendor List

The procurement function in the USA must be based on competition between vendors. The Manual of Acquisition Topics in the Navy Acquisitions [Ref. 5], states:

> Competition received widespread attention during 1984. President Reagan stated that competition "is the single most important source of innovation, efficiency and growth in our economy.
>
> Rear Admiral Giordano, SC,USN, Chief of the Supply Corps, further stated that: [Ref. 5]
>
> Competition makes good business sense, and I want to make it clear that increasing competition must be a primary objective of all personnel involved in logistics management.

Commodore Stuart F. Platt, SC, USN, as the first Competition Advocate General (CAG) of the Navy. He stated:

> Competitive procurement represents the extension of the principle of fairness into the defense acquisition process. The public trust placed in those who obligate public funds includes the assurance that a fair opportunity will be provided to all who can meet the government's needs. One effective way to significantly reduce costs, and thereby be able to afford our defense requirements, is to increase the use of competition. The navy is now emphasizing competitive procurement strongly.

POW should apply the competitive procurement as well Figure 2.19 shows the Vendor List source schema and Figure 2.20 shows the main processes of generating the Vendor List. Building and maintain a good database about vendors is essential. We call it the vendor list in the manual system. Bad selection of vendors may seriously affect our Armed

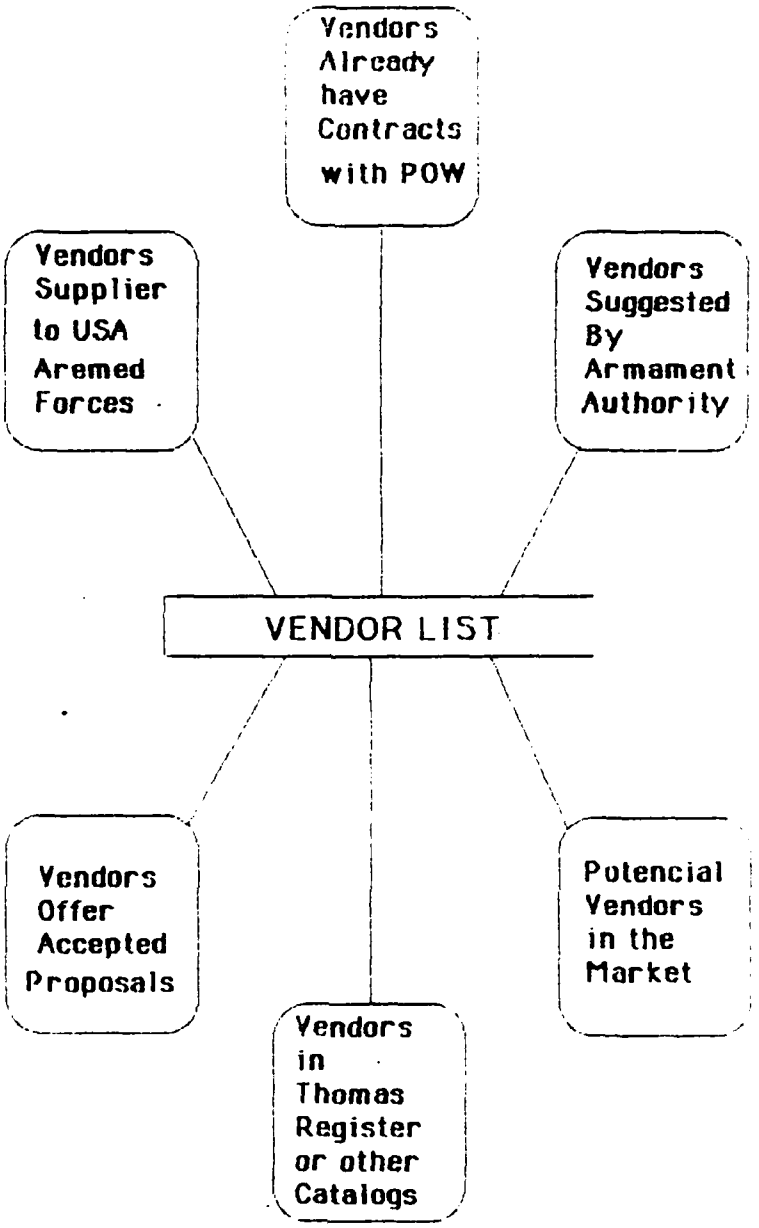

Figure 2.19 Vendors Source Schema

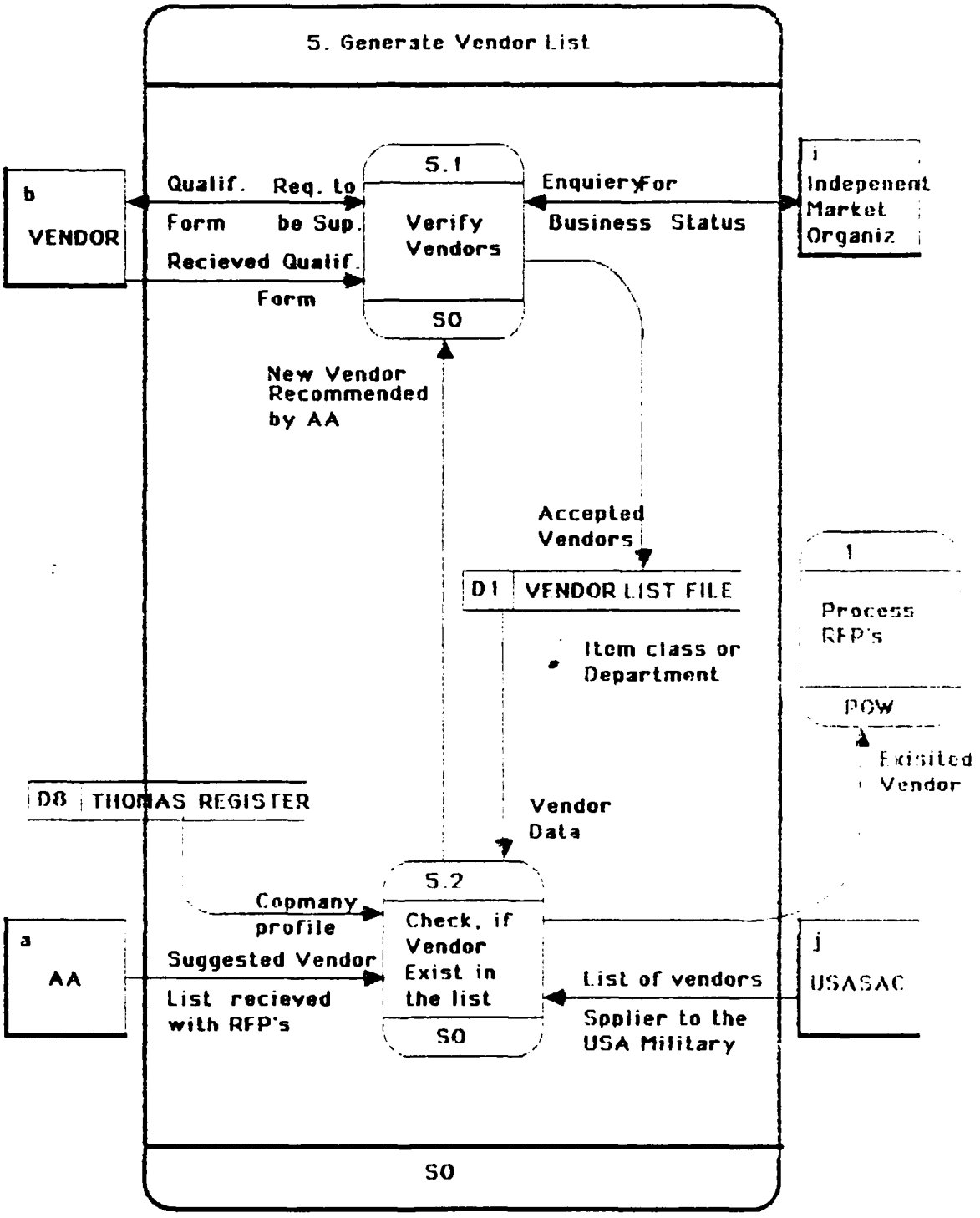

Figure 2.20 Generate Vendor List

Forces. A number of different factors can be measured to provide a basis for evaluating vendors. However, depending on the type of military items to be purchased and the past experience, factors may vary in their degree of importance.

Any new vendor to POW must pass through extensive investigation to be sure that they have the qualifications to be included in our vendor list. Figure 2.21 shows the procedures of evaluating new vendors. The following factors are taken into consideration when evaluating vendors: (Figure 2.21)

- Business Assets Value (BAV)
- Business Start Date (BSD)
- Source Manufacturer, Distributor, or Broker
- Quality
- Supplier to USA Army/Navy/Air Force
- Level of Satisfaction of Previous Contracts
- Business Activity (BA)

After recording the above information in a Qualification Form, POW validates this information by asking a market research and consumer association to assess the financial capability of the vendor. This validation is always done for a new vendor or in Pre-Award Surveys. The following are some quantitative and qualitative Figures that should be considered to review vendor status.

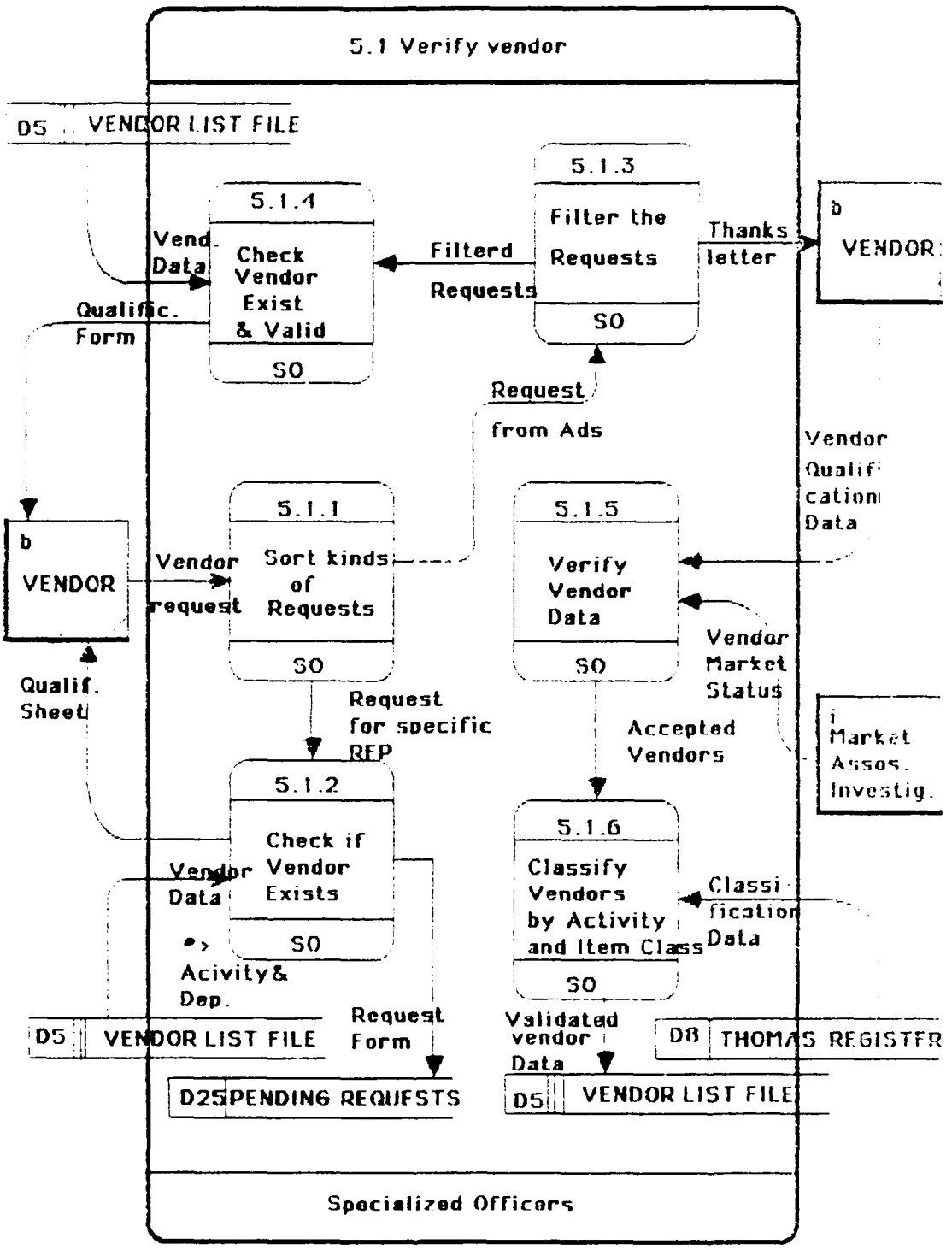

Figure 2.21 Verify Vendors

a. **Quantitative Items**

Trends in:

- Gross margin ratio
- Sales
- Debt/equity ratio
- Return on investment
- Cash flow/debt
- Working capital needs
- Current ratio
- account receivable/payable turnover
- Inventory turnover

b. **Qualitative Items:**

- Credit ratings
- Notes to financial statements
- Market share
- Capital asset stability

The type of evaluation required to determine vendor capability varies with the nature, complexity, and dollar value of the purchase to be made.

POW is responsible for processing only the proposals of qualified vendors. The first filter to catch the non-qualified vendors is during the RFP process. The second filter is during checking and verification of new vendors, and the third filter is during the Pre-Award Survey.

D. GOVERNMENT PROCUREMENT

1. Foreign Military Sales (FMS)

a. Background

The United States has been assisting friendly countries in establishing adequate defensive forces for their national security and for resisting external aggression. This policy is essential to the security of the USA itself.

b. FMS Important Issues:

(1) No commercial export license may be issued for the sale of major defense equipment valued at $25 million or more, except through an FMS case.

(2) The President of the USA, 30 days prior to giving his consent for sales, must submit to the Speaker of the House of Representatives and Committee on Foreign Relations of the Senate , a written certification of the proposed arms sale. The Congress may veto this proposed transfer. Furthermore, the certification submitted to the Congress shall be unclassified (classified information submitted separately) to permit public disclosure.

(3) The cost and interest to be charged to the foreign country will include administrative services, plant and production equipment cost, and a proportionate amount of any nonrecurring cost of R & D.

(4) Commercial sales, through export licenses,of major defense systems are limited of the value of $25 millions. [Ref. 6]

c. FMS Authority Distribution

Figure 2.22 shows the inter-relations between the USA authority in FMS. The following are the role of the main USA authoroties envolved in this system.

(1) Congress. Their are various laws for the purpose of guiding and controlling the FMS process. One of the key laws is that the President of the United States must submit to the Congress, 30 days prior to his consent, every proposed sale that exceeds $25 million. Moreover, the Congress requires annual reports from the President on the status of FMS [Ref. 14].

(2) State Department. The State Department is primarily concerned with U.S. security policy all over the world, and so established the Bureau of Politics - Military Assistance [Ref. 7]. This Bureau generates policy guidance and procedures concerning the issues of USA security, FMS and arms control. Within the bureau their are three offices that maintain constant contact with the DoD and other departments as necessary for the approval of military exports. The three offices are:

- Office of Security Assistance and Sales (SAS)
- Office of Munitions Control (OMC)
- Office of Planning and Analysis for International Security.

(3) Department Of Commerce. The Department of Commerce is primarily responsible for the overall economic growth and technical development of the USA. Within the department, the office that maintains inter-departmental discussions affecting the international trade is the office

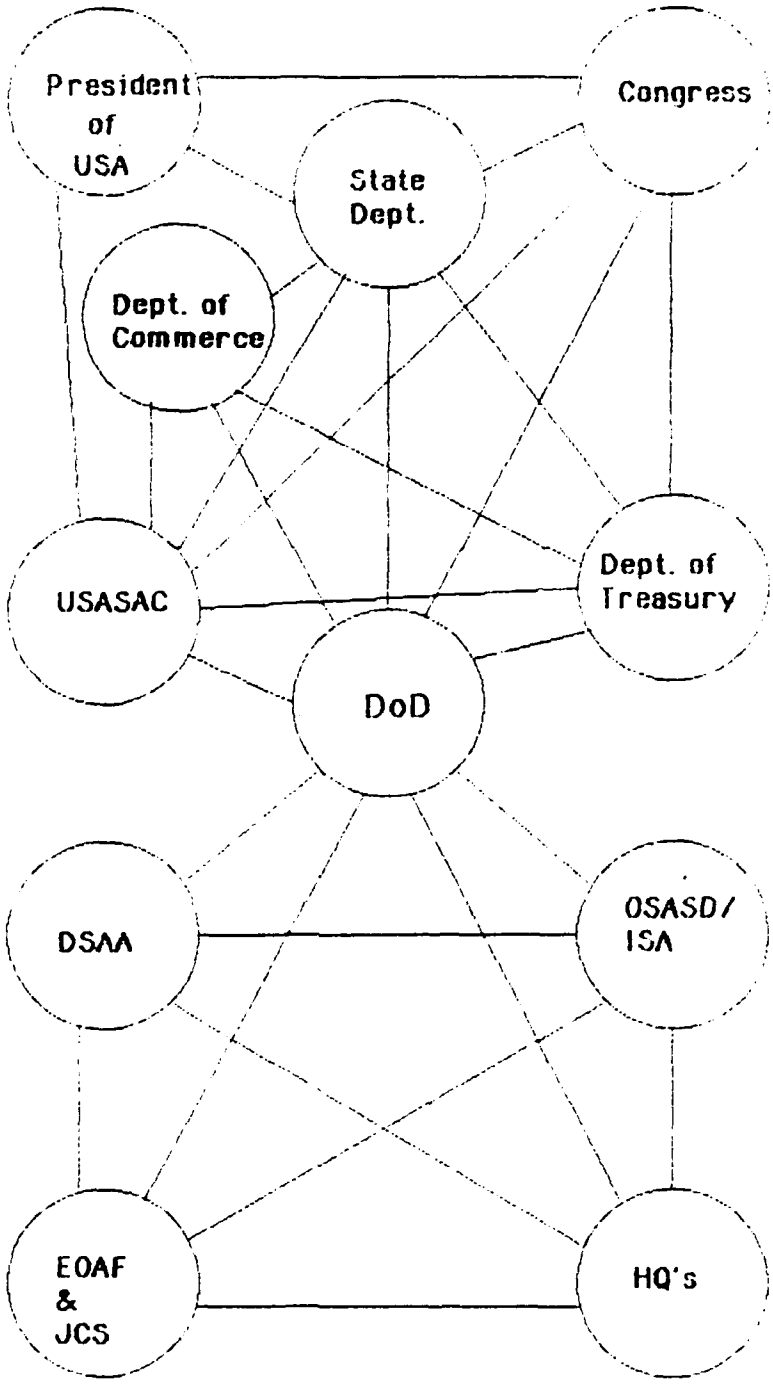

Figure 2.22 Inter-relations Between the USA Authorities in Foreign Military Sales System

of Domestic and Business Administration (DIBA).This office is concerned especially with: [Ref. 14]

- Competitive assessment of US industry in domestic and world markets.
- Expansion of export and export control administration.
- Federal recognition and participation in international exposition and trade fairs.

(4) Department of Treasury. The Department of Treasury, in the area of foreign trade, participates in the financial negotiations between the US and foreign countries. It exercises broad control over military and commercial export programs, assuring that they are compatible with the US trade and security policy. It also reviews trade agreements for credit risk evaluation, assuring the best utilization of US Government backing to credit institutions [Ref. 21].

(5) Department of Defense (DoD). The DoD is the principal actor involved in FMS. The DoD serves as the main co-ordinator for all the objectives of the other departments concerning FMS. There are four major offices involved in military assistance and/or the sale of military items: [Ref. 14]

- Defense Security Assistance Agency (DSAA) DSAA Serves within the DoD as the responsible office for Government to Government FMS, performed under the control of the Secretary of Defense. It was established in 1971 and has been responsible since then for the generation. and

maintenance of procedural guidance according to the Military Assistance and Sales Manual, DoD Manual 5105.38-M [Ref. 7]. In addition to participation in top level planning, programming, and reviewing of FMS. DSAA performs the following functions: [Ref. 7]

* Conducting negotiations with the customers.
* Interfacing with and assisting US industry, in its effort to receive export licenses from the State Department for doing business with foreign countries.
* Managing FMS credit arrangement and guarantees of private financing of FMS.

- Office of Assistance Secretary of Defense for International Security Affairs (OASD/ISA). The OASD (ISA) develops policies concerning international security through a mutual agreement with the State Department. Within ISA the Deputy Assistance Secretaries (Regional desks), provide and prepare for their regions a threat analysis for a specific country based upon its potential enemies and the military capabilities of both sides. The Director of Strategic Trade and Disclosure within ISA provides official DoD positions on any proposed military or commercial exports that has possible military application. This is accomplished in coordination with Department of Commerce and the State Department. The review of any export license is done by the Inter-agency Board consisting of representatives from the Department of State, Department of Commerce, Department of Treasury and the Director of Strategic Trade and Disclosure.

- Elements of the Armed Forces and JCS. The State Department's Office of Munitions Control (OMC), submits the export application of the foreign country to the concerned service Army (Director of International Logistic), Navy (Security Assistance and Sales). Each service has major functions to achieve related to FMS: [Ref. 14]

  * Upon receipt of the export application, through the DoD Director of Strategic Trade and Disclosure, it formalizes and presents its position.
  * It provides the detailed analysis and evaluations that are necessary for the negotiation proc ss.
  * It assists DSAA in the process of the negotiations.
  * It manages and administrates the sales activity during its performance.

2. Egyptian Government Procurement from USA

The major two kinds of military procurement from the USA are the Government procurement of Major Defense Items and the Spare Parts Procurement for Weapons already in service and purchased from the USA. Both kinds of procurement must be processed according to the USA FMS rules and regulations. Major defence items procurement such as aircraft, tanks, and air defense weapons is lengthy procedure. POW must be alert and responsive to speed up this process during its performance.

The POW acts as a co-ordinator between AA and the USA Security Assistance Center (SAC), which is the

responsible organization inside the USA Government for administrating the requests of friendly foreign countries to purchase major defence items and military equipment. The FMS policy procedures must be well understood to speed up this kind of procurement. A network of interrelation responsibilities starting from the President of USA, Congress, Department of State, Department of Treasury, Department of Commerce, and Department of Defense are all involved in processing the requests of major defence items purchases. Many factors must be considered in doing this kind of procurement. The political issues also have a great effect on this kind of procurement.

The following details the steps in the two kinds of Government procurement. (Figure 2.23)

a. Major Weapons Systems Procurement Steps

The basic document in this kind of procurement is the Letter of Offer and Acceptance (LOA) (DD FORM 1513). The LOA is also known as a "Request Of Sale" or "Request For Price and Availability". After the acceptance of the LOA by the USA Government, it becomes a contract between the two countries. The Government procurement consists of eight steps initiated by submitting the Request for Letter of Offer (RLO). All USA Forces have similar procedures for the FMS. The following procedures are based on the Air Force FMS (U.S. Department of the Air Force, " logistics - Foreign Military Sales" AFM 400-3, 17 Feb 1976), [Ref. 6].

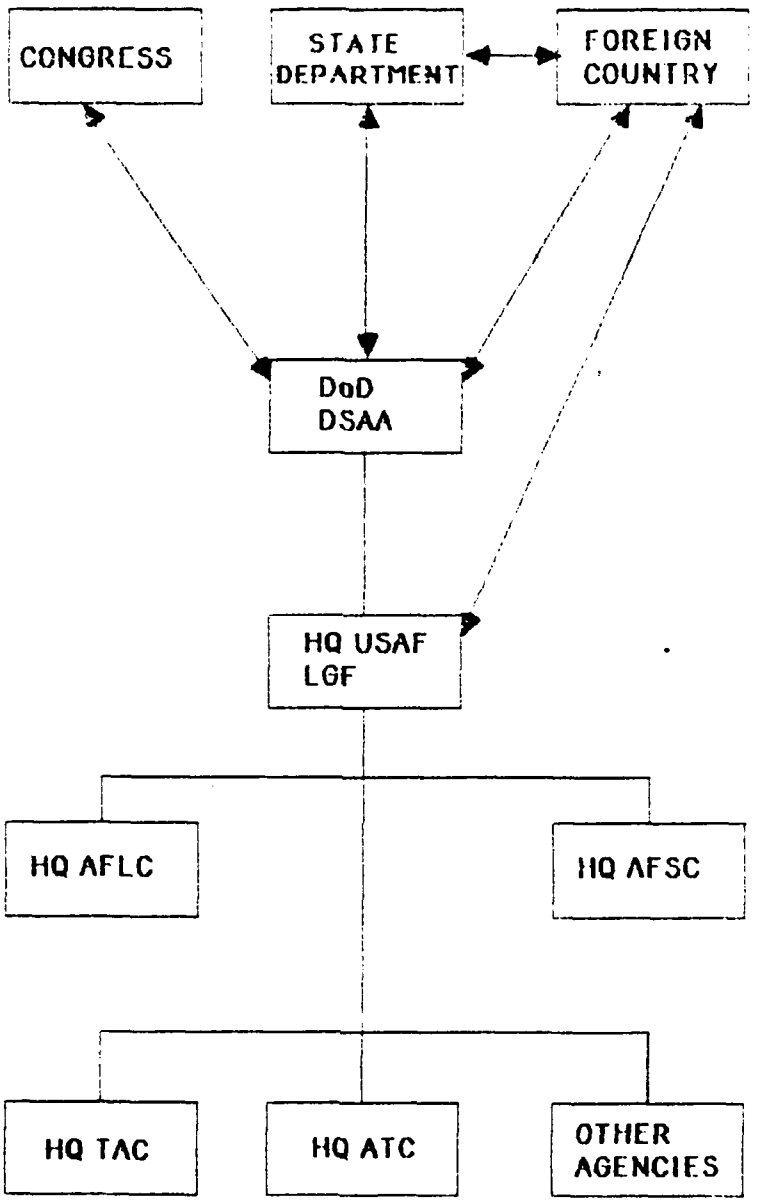

Figure 2.23 Organizational Structure for Receiving and Processing a Request for Offer and Acceptance [Ref. 21]

The RLO must be prepared and reviewed very carefully by the Top Level in Egyptian Minister of Defense (MoD), AA, and the Major Armed Forces. A special Forms of RLO must be prepared known as a " Checklist for weapons system sale request.

The following are example of the USA Air Force Checklist Main subjects:

* Country
* Aircraft Model/Designator/Series/ (MDS)
* Quantity
* Basic Configuration
* Source Data
* Delivery Data
* Missiles/ECM Pods/Bombs/Ammo
* Anticipated LOA Acceptance
* Operational Concepts
* Maintenance Concepts
* Supply Concepts
* Contractor Engineering and Technical Services (CETS)
* Weapons Systems Logistics Officers (WSLO)/System
* Acquisition Officer (SAO)
* Training Concept
* Insurance
* Quality Assurance
* Other Pertinent Remarks

SOURCE of this checklist is: AFM 400-3(R), Attachment 3, 17 February 1976.

Negotiations and discussions are held between the representatives of the two countries to clarify the requirements of Egyptian Armed Forces and the assessments for the acquisition request. The POW Chief officer participates in these meetings.

The final form of the RLO is submitted to the Defense Security Assistance Agency (DSAA).

The following are the steps for procuring the major Defence Items:

(1) Submit the RLO to DSAA. The DSAA requests the Related H.Q. for its position on the request.

(2) Assign Case Designator and Request Price and Availability. POW receives acknowledgment of receipt from the related H.Q., at the same time the H.Q. asks the Various commands for their Price and Availability (P & A). [Ref. 6].

(3) Determination of P & A and Submission to the related H.Q. The various commands prepare the P & A within 30 days and submit it to the H.Q.

(4) Preparation of the Offer and Acceptance. Upon receipt the P & A from the various commands of the related H.Q. prepares the complete LOA. Any LOA in excess of $25 million or sales of major defense item in excess of $7 million must be submitted to the director, DSAA, who in turn must notify the Congress. If the Congress does not adopt a concurrent resolution objecting to the sale within 30 days, the DSAA authorizes the H.Q. to sign and issue the LOA to the requesting country [Ref. 7].

(5) Review, Acceptance and Funding of the Offer and Acceptance. POW receives the LOA and sends it to AA for reviewing which must sign it within 30 days from the date of receiving the offer. If AA accepts the offer, the signed LOA is returned to the POW who in turn sends it to the DSAA.

(6) Provide Case Directive. Upon receipt of the acceptance of the LOA, the H.Q. issues case directives to the participating Major Commands and implementing agencies. The case directives include: [Ref. 7]

- Financial aid
- Delivery term code
- Force Activity Designator (FAD) or priority
- Purchaser's service code
- Nonrecurring cost
- Asset use charge
- Sales commissions and contingent fees
- Any special instructions

(7) Furnish Material or Services and Notify therelated Force accounting And Finance Center. (Air Force Example) The major commands and the implementing agencies that take actions based on the regulations in AFM 400-3 are [Ref. 6]:

- Air Forces System Commands (AFSC)
- Air Force Logistics Command (AFCTC)
- Air Force Training Command (AFTC)
- Tactical Air Command (TAC)
- Air Force Accounting and Finance Center (AFAFC)

Following these actions, procurement and budget authorizations are obtained.

(8) Billing the Customer. This is the last step in the processing of the foreign military sales, concerning the billing and terms of payments. Like the commercial procurement, there are two sources of funding the

government procurement: Budget and Loans. The procedure for payment is very similar to the commercial procurement.

Conclusion. The FMS procedures are complex and lengthy but nevertheless logical and structured. The Congress has full control over the procurement requests which exceed $ 25 million or for Major Defense items that exceed $7 million.

DoD implements the FMS through major services using the LOA D.D. Form 1513 as a contract document between the USA and the foreign country. This document specifies the terms and obligations concerning the two governments in processing and implementing the procurement system.

b. Spare Parts Procurement

This kind of procurement is oriented towards weapons already purchased and in the service of the Egyptian Armed Forces. The FMS system for this kind of procurement is divided into two parts: FMS1 and FMS2

(1) FMS1. Represents an amount of money paid by the Egyptian Government to participate in sharing the cost of the inventory of spare parts to serve all countries which have purchased weapons from USA. The FMS1 system keeps track of inventory of all kinds of spare parts ready on the shelf to serve all participating countries. It uses advanced scientific technique to prevent any shortage of spare parts.

(2) FMS2. Represents an amount of money to cover the yearly requisitions of the spare parts needed by

the EGAF's. Requisitions from the system may be done on a daily basis in a precisely structured computer format that allow processing of every single item separately. POW has nothing to do with the implementation of the system, except receiving and sending any related system documents to both sides. Charges to the system are done by the POW upon receipt of an authorized payment letter from the AA.

III. PROBLEMS AND OPPORTUNITIES IN THE POW CURRENT SYSTEM

A. INTRODUCTION

This Chapter identifies the problems and opportunities of the POW relevent to developing a data driven DSS. In the problem part, we address the system wide problems first and then describe any problems in each particular function, if any. In the opportunities part of this section, we describe in some details what computers and databases can do for improving the existing functions of the POW current system. It should be noted that the solutions for all of these problems will not be covered in this research because of the time constraint; rather we will emphasize the detailed design of the commercial procurement functions . The intention is to present all the problems and opportunities of the POW uncovered during interviews with the POW specialized officers.

B. SYSTEM WIDE PROBLEMS

The POW is the central point of receiving all the requests of EGAF's for procurement of military items and weapon systems from the USA. Because of continued increasing demands from the USA, the workload in POW is now increasing

exponentially. The system is designed to deal with much smaller demand than currently exists.

The existing manual system needs to be developed and supported by computer tools to enhance its capability. The system wide problems with the manual system are:

1. Too much effort and time needed for the manual tasks.
2. Some functions cannot be done in a reasonable length of time.
3. Generating status reports is getting more difficult without computer tools.

We follow exactly the structure of Chapter. II to describe the problems and opportunities of each system function presented in that chapter.

C. COMMERCIAL PROCUREMENT FUNCTIONS

1. RFP's Function

a. Problems

Too much effort and time needed for the preparation of vendor list for a particular RFP.

b. Causes:

(1) Large number of RFP's

(2) The RFP received is not in a standard format to allow easy accessing to the vendor data.

(3) Large number of vendors available in USA to select from.

c. Opportunity

Building a database for vendor information allows better processing of the RFP's and decrease the vendor selection time for a particular RFP.

2. RFC Function

a. Problems

No problems are addressed in this function.

c. Opportunity

A DSS can be used as a tool for evaluating proposals and vendor selection. The guidelines to the system are:

(1) Multiple evaluation factors are established and weighted.

(2) Each proposal is scored by the technical committee using these factors .

(3) The system should allow presentation of information to the evaluators in different formats including graphs and utility analysis.

3. Fund the contracts:

This part include the both budget and loan funding.

a. Problems:

Too much effort needed to manage the funding functions.

b. Causes:

(1) All contracts with vendors in USA must be funded via POW, a large volume needs to be funded, over 500 contracts.

(2) Monitor all credit and guarantee letters associated with contracts; it represents large volume, over 1500 of different letters with different banks and different vendors interacting in this process.

c. Opportunity:

(1) This process has a potential for automation. An automated system will allow better control of this process by producing status reports of all the credit and guarantee letters . Warning reports can be produced for renewal validity dates of the guarantee letters

(2) Establish Financial management system to monitor funds from loans, especially unused loans which may have a limited time of validity. Effective use of funds from loans depends on timely decisions concerning use of this fund. The decision process related to the effective use of available loans is very important to the EGAF's. POW, as a front office can assist the AA by producing status and comparison reports of the fund availability from loans. Passing this information to AA ahead of time to take the necessary actions before the end of validity date is very important. This one benefit of the system may cover many times the cost of building the system.

4. Administer open contracts

a. Problems

All the problems of any manual system are figured in this system to some degree or another. High volume of paper work, slow, data redundancy , spending more time and effort to do the function, etc.

b. Causes

The problems in this function are due to the fact, that the manual system lacks the capability of the computer system with respect to the routine and repetitive work. The POW staff tries to keep the system running by spending more effort and time. The four sub-functions of the open contract adminstration, payment, shipment monitoring personnel training, and reporting form four sub-systems which have a great potential for automation.

c. Opportunity

(1) Payment. The payment process involves the technical and financial checking and validation based on the contract, invoice, shipment receipt, necessary certificates, vendor performance etc. Everything must be checked before payment is made. To speed up the decision related to this function, a computer tool is a must. By developing such a system, the specialized officer can easily validate the payment documents. In the design chapter we present a proposed system for these functions.

(2) Monitor Shipment of Items to the Country. POW has an access terminal to the Freight Forwarder computer. This system can be improved by allowing transfer of the summary data about the shipment status to the FOCUS database. This function is included in this research and may be expanded later.

(3) Monitor Personnel Training. A considerable amount of work needs to be done by the POW to monitor the training of personnel. All open contracts, commercial or government procurement, have a training part which needs to be scheduled on time. POW must inform AA ahead of time of the training plan associated with each contract to have enough time for selecting and preparing personnel who will attend the training programs in the USA. On the other hand, all personnel affairs in the USA are the responsibility of POW e.g. monthly salary, traveling reservation and tickets,

and medical. This function can also be automated. The database allows easy system development of such functions to monitor and control all training in USA.

(4) Reporting. A database system is a powerful tool for generating different kinds of reports. In PC/FOCUS, the reporting facility is excellent. It allows user to generate any kinds of reports they need from the database in seconds without programming. The reporting and graphics facilities in PC/FOCUS provide a valuable DSS tool for presentation of information.

5. Generate Vendor List

This function is necessary for the RFP's function. We separate it here because of its special importance. We have to deal only with potential vendors in the USA industry.

a. Problems

The manual vendor list is time consuming, for example, 135,000 US manufactures are exist in Thomas Register, over 500 vendors have contracts with POW.

b. Causes

Many sources are used to generate a vendor list: vendors who already have contracts with POW, vendors suggested by AA for a particular RFP, vendors responding to an advertisment in the newspaper, vendors responding to RFP's, vendors supplier to the USA Army/Navy/Air Force, and vendors

from Thomas Register catalog. The investigation process requires much time to check the Qualification Form and verify it from market research associations.

c. Opportunity

The potential for automation is very high. Putting vendor information in a database is essential for the POW function. The cost of selecting bad vendors is much higher than the expected cost to develop any system to keep and maintain information about vendors. POW has a major responsibility in selecting and validating vendors before passing their proposals to AA, even those suggested by the AA with a particular RFP. vendor selection criteria must be applied in all the procurement phases. Creating a database for vendors will allow the specialized officer to prepare the vendor list in a fraction of time needed for the manual system.

D. GOVERNMENT PROCUREMENT

As we mentioned in describing this process, POW acts as a co-ordinator between AA and USA administration.

1. <u>Procurement steps for the major Weapons system</u> The Government procurement cycle is mainly done inside the AA and the USA administration. POW serves essentially as a communication link between the two.

a. **Problems:**

(1) How to speed up the process from submitting the RLO until we get the LOA ?

(2) How to monitor the performance of the Egyptian Major Weapons System Contracts (EGWSC) managed by the USA?

b. **Causes:**

(1) The FMS procedures are complex.

(2) A network of interrelationships are involved in the FMS process including the President of USA, Congress, and many Departments.

(3) Inside DoD, many H.Q. commands are involved in processing a particular RLO. Many rules and procedures must be followed.

c. **Opportunity**

Weapons Acquisition is very critical function to Egypt. Getting the necessary defense weapons is of vital importance. The time to process the RLO is far toolong. Monitoring implementation of weapons system projects is very important. Building a decision support and monitoring system will be of a great help in answering the above two questions. POW is the most suitable organization to do this function, because of its position as a co-ordinator or link between the EGAF's and the USA administration. Two database may be needed, one for the acquisition phase i.e. the activities starting from submitting the RLA until getting the LOA. The other is for the implementation phase to monitor all the current projects managed by USA administration for the benefit of Egypt. These two sub-systems will be of great help in speeding up the acquisition process by pointing up any delay, and by providing the data needed by

USA rapidly. By building an information system to monitor Government procurement from USA, we put a foundation of the DSS in the Weapons Acquisition System (WAS), itself. Knowing the FMS policy and procedures are very important in building this system. All the technical References related to the FMS system must be available. Technical support from USA may be needed to build that system.

2. Spare Parts Procurement

No Problems and Opportunities related to POW are perceived by the author in this study.

IV. SOFTWARE REQUIREMENT SPECIFICATION OF POW

A. INTRODUCTION

The objective of this chapter is to analyze the information flow as presented in chapter II, and create the software requirement specifications for the POW Commercial Procurement (POWCP) system. The specification presented in tnis chapter will emphasize on the creation of the DSS generator for the POWCP database.

> The DSS generator is a set of of interpreters and data creation utilities. DSS tools are used to build and modify the interpreters. [Ref. 1]

B. REQUIREMENT ANALYISIS OF POWCP PROPOSED SYSTEM

The following are the primary objectives of the POWCP proposed system :

- Increase functional performance efficiency of the POWCP system.
- Assist decision making process in the POWCP system.

We recognized from chapter II and chapter III that the POWCP has a high-payoff area for decision support. To capture the benefits of this high-payoff, we are going to use the Iterative Design approach 'Staged Development' for building a prototype DSS for the POWCP. The following are the expalanation of the approach as presented in [Ref. 1]:

> DSS need to be built with short, rapid feedback from users to ensure that development is proceeding correctly. They must be developed to permit changes quickly and easily. The result is that the most important four steps

> in the typical systems development process (analysis, design, construction, implementation) are combined into a single step which is iteratively repeated. The essence of the approach is that the user and the builder agree on a small but significant problem, then design and develop an initial system to support the decision making that it requires. After a short period of use (a few weeks), the system is evaluated, modified, and incrementally expanded. This cycle is repeated three to six times over the course of few months until a relatively stable system is evolved which support decision making for a cluster of tasks. The word relatively is important, because although the frequency and extent of changes will decrease, it will never be stable. The system will always be changing, not as necessary evil, but as a conscious strategy on the part of user and builder.
>
> The advantages of using this approach are: Leads to development of DSS Generator, gives early success and visibilty, Allows overlapping of different staged DSS and integration between them, ability to assimilate evolving technology. [Ref. 1]

To realize the benefits of this approach, we must be concerned about the time of development. It should be as short as possible (2-3 months maximum for the first version) prepare an action plan, for development, divided into phases, build the DSS generator, use the structure approach in analysis and design of DSS to be able to maintain and adapt the system during each stage, finally we should use available software as we did in PC/FOCUS.

The approach used to describe the proposed system is to follow the logical sequence for each function and describe each process associated with the improved DFD. The secondary process for a particular function is described at the end of the function. Because our priority is to build the DSS generator first, i.e. the database, we first apply the data

analysis technique (See data dictionary section, chpter V.) to derive the database structure in third normal form before designing the database file as described in the following chapter. The disk media symbol used to indicate the proposed database files. Only the functions or processes to be automated are explained in the following sections.

1. RFP Functions Description. The fuction is divided into sub-fuctions and process, expalanation of each one are presented as necessary .

- Process 1.1:Prepare & issue the RFP. Figure 4.2 shows the details of the process.

- Procsess1.1.1 Receive & review the RFP. Figure 4.3 shows the premitive level of DFD. The following are a walk-through for each process. The same sequence of will be used to explaine the other functions

- Process 1.1.1.1 Register RFP. The purpose of this function is to register each particular RFP in the General Log Book (GLB)and the RFP Control Book (RFPCB). he code used to register the RFP, or any incoming documents to POW consists of a six digit serial number starting at one at the beginning of the year and incremented by one for each incoming document. This number will be used as a key when recording the information about the major documents received or issued from POW. The information items kept in the GLB are:

* Registration Number * Date Received
* Source and subject

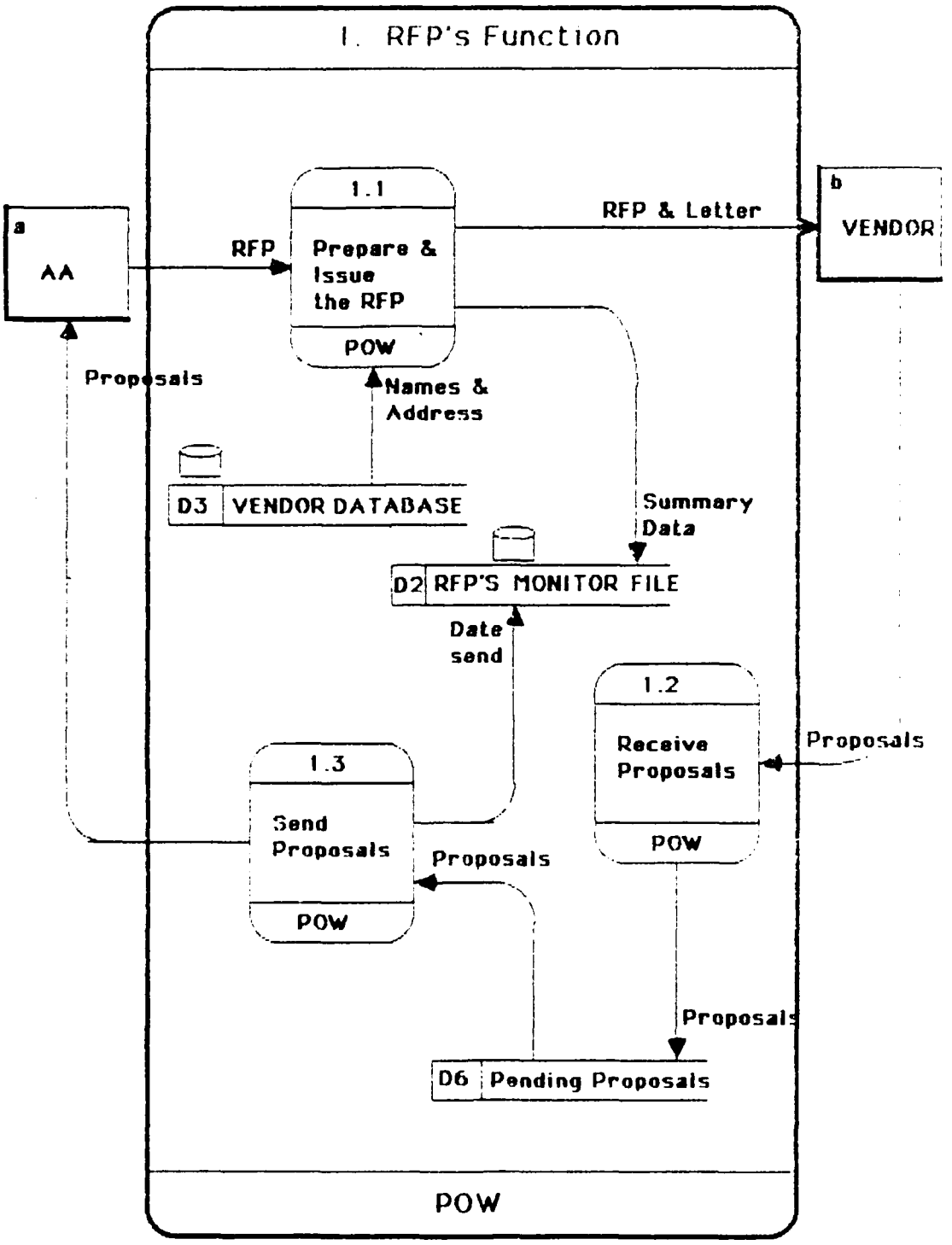

Figure 4.1 RFP's Function

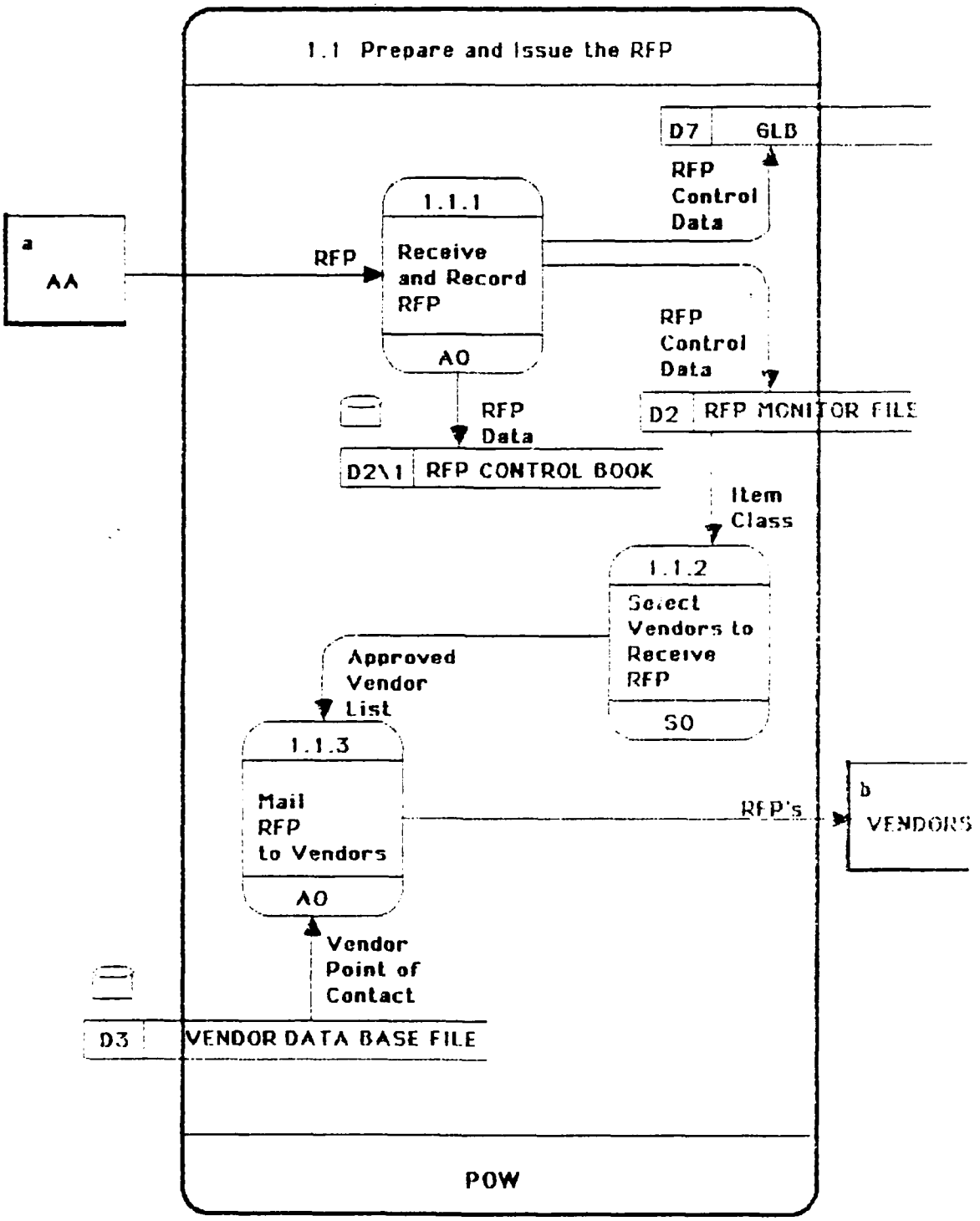

Figure 4.2 Prepare & Issue the RFP

The RFP is then routed to the Specialized Officer (SO) in the area of specialization.

- Process 1.1.1.2 Review and Checks RFP. The SO reviews and checks the specification. This process is subjective and relies on the capabilities of the SO.

- Process 1.1.1.3 Enter RFP in the Database. Enter the RFP data in the database through screens. The following are the data related to a typical RFP:

  * RFP Number
  * Received date
  * Requester (Force or Department)
  * RFP subject
  * Items needed
  * Item description
  * Unit of Issue
  * Quantity
  * Estimated Dollars value
  * Terms and conditions
  * Vendors who receive the RFP
  * Vendors who send Proposals data.

(Normalization of data will be done in next chapter.)

- Process 1.1.2 Select Vendors to Receive RFP. Selection of vendors to receive the RFP are done only from the qualified vendor in the Vendor Database. Creation of the vendor database is described at the end of this section. (Figure 4.4)

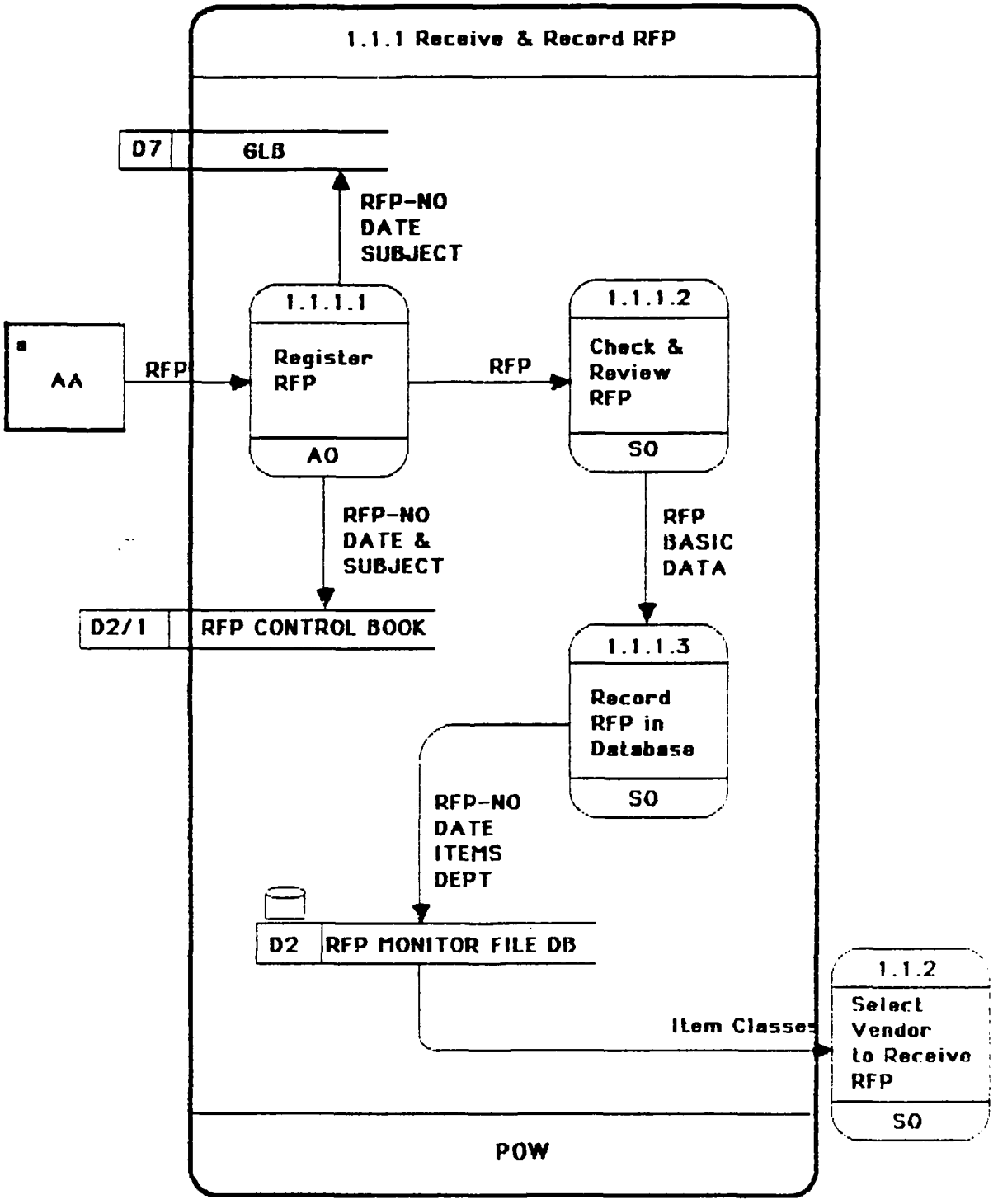

Figure 4.3 Receive & Record RFP in Database

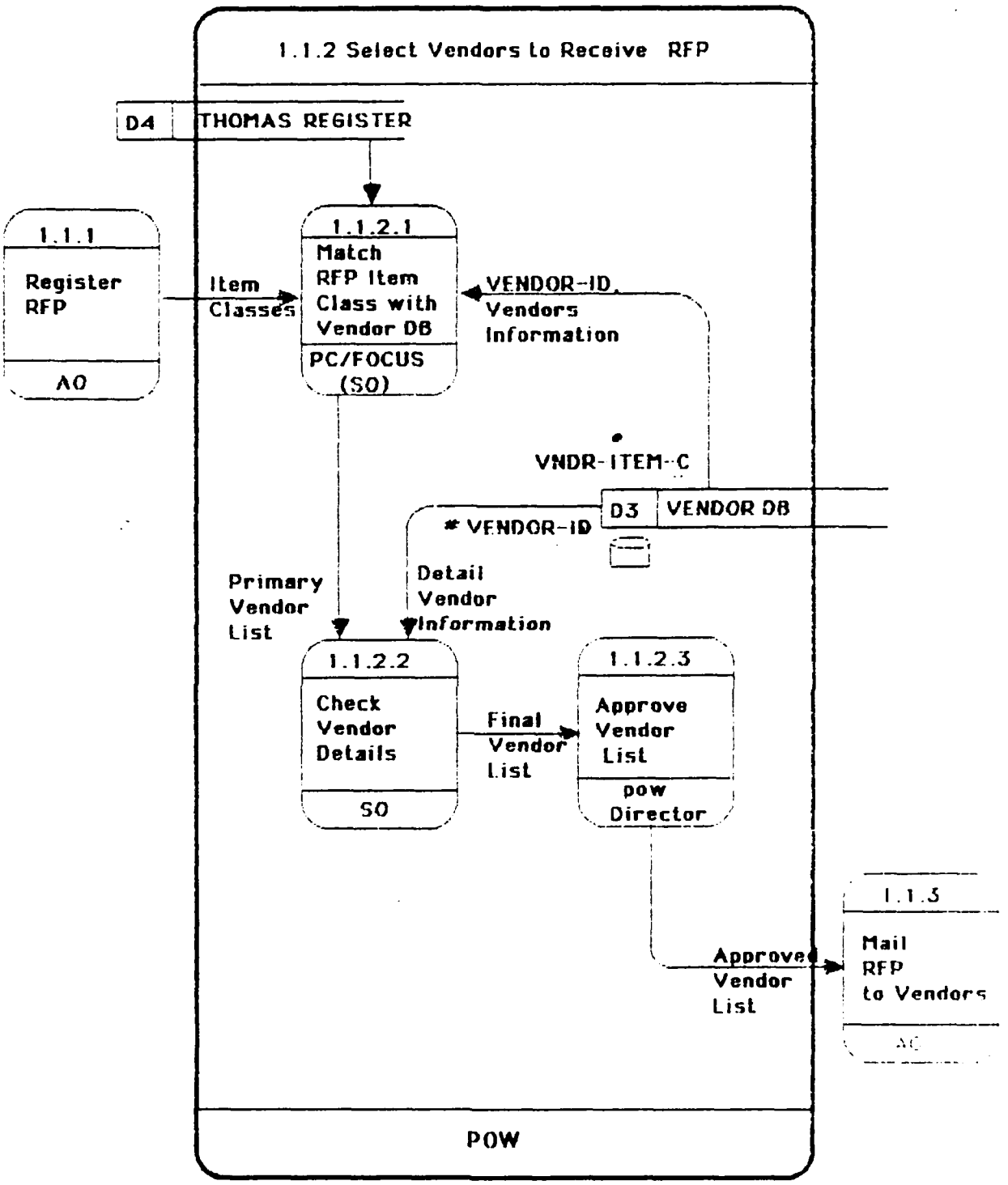

Figure 4.4 Select Vendors to Receive the RFP

- Process 1.1.2.1 Match Item Classes. Match a particular RFP's item classes with the item classes in the vendor database. This process is done by the computer to produce a primary list of vendors who are relevant to the RFP. The SO may repeat this process using other item classes until he is satisfied with the vendor list produced. The vendor list may look as follows:

VENDOR LIST

RFP-NO:

VENDOR ID	VENDOR NAME	POINT OF CONTACT	VENDOR ADDRESS	PHONE NO	ITEM CLASS

- Process 1.1.2.2 Check Vendor Details. The SO may wish to access the detailed data about a particular vendor. He can do that by retrieving the vendor record using the vendor ID. If he wants more details about the vendor company such as its profile or brand names etc., he may refer to the Thomas Register or any other reference.

- Process 1.1.2.3 Approve the Final Vendor List. The SO's must approve all vendor lists generated by any means (computer or manual) from the POW Director before mailing it to vendors with the RFP copies.

- Process 1.1.3 Mail RFP to Vendors.

- Process 1.1.3.1 Produce Vendor Mailing List. This process may be done either manually or by computer to prepare the mailing label of vendor address and point of contact. (Figure 4.5)

- Process 1.1.3.2 Issue the RFP to Vendors. A number of copies of the RFP are produced using electronic copier machine and mailed to the vendors. The information about vendors who get the RFP is recorded in the computer and the RFPCB. The following is the data structure of the RFPCB to be recorded:

  * RFP Number
  * RFP Copy Number (a serial number within RFP
  * Vendor ID
  * Vendor Name
  * Date of Issue to Vendors

- Process 1.2 Receive Proposals.

- Process 1.2.1 Receive and Record Proposals.

- Process 1.2.1.1 Register Proposals. All incoming proposals are registered in the GLB and RFPCB. A register number is given to each proposal in the GLB. The data elements to be recorded are:

  * RFP Number
  * Proposals Serial Number
  * Vendor Name
  * Date of Received
  * Proposals description

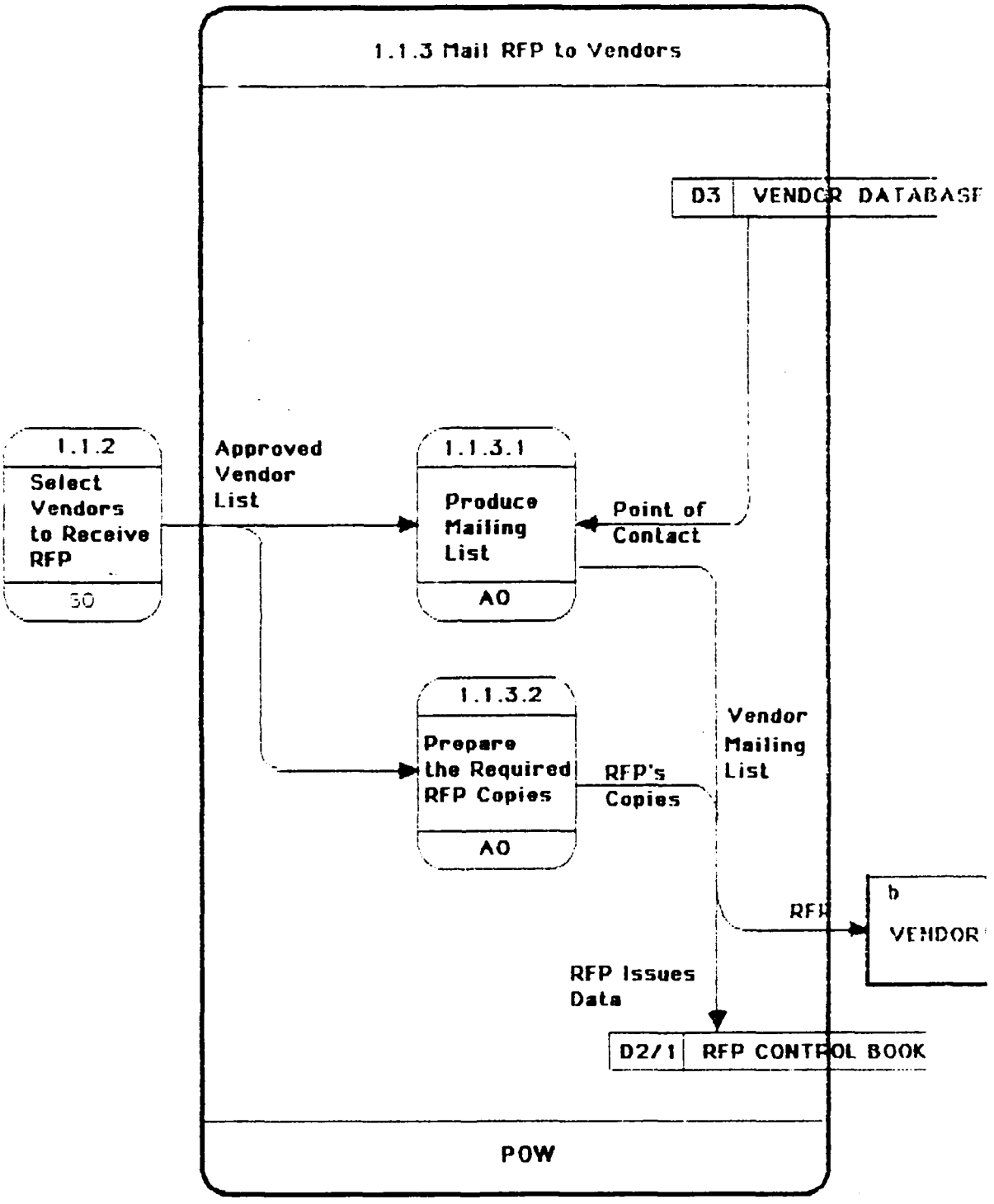

Figure 4.5 Mail RFP to Qualified Vendors

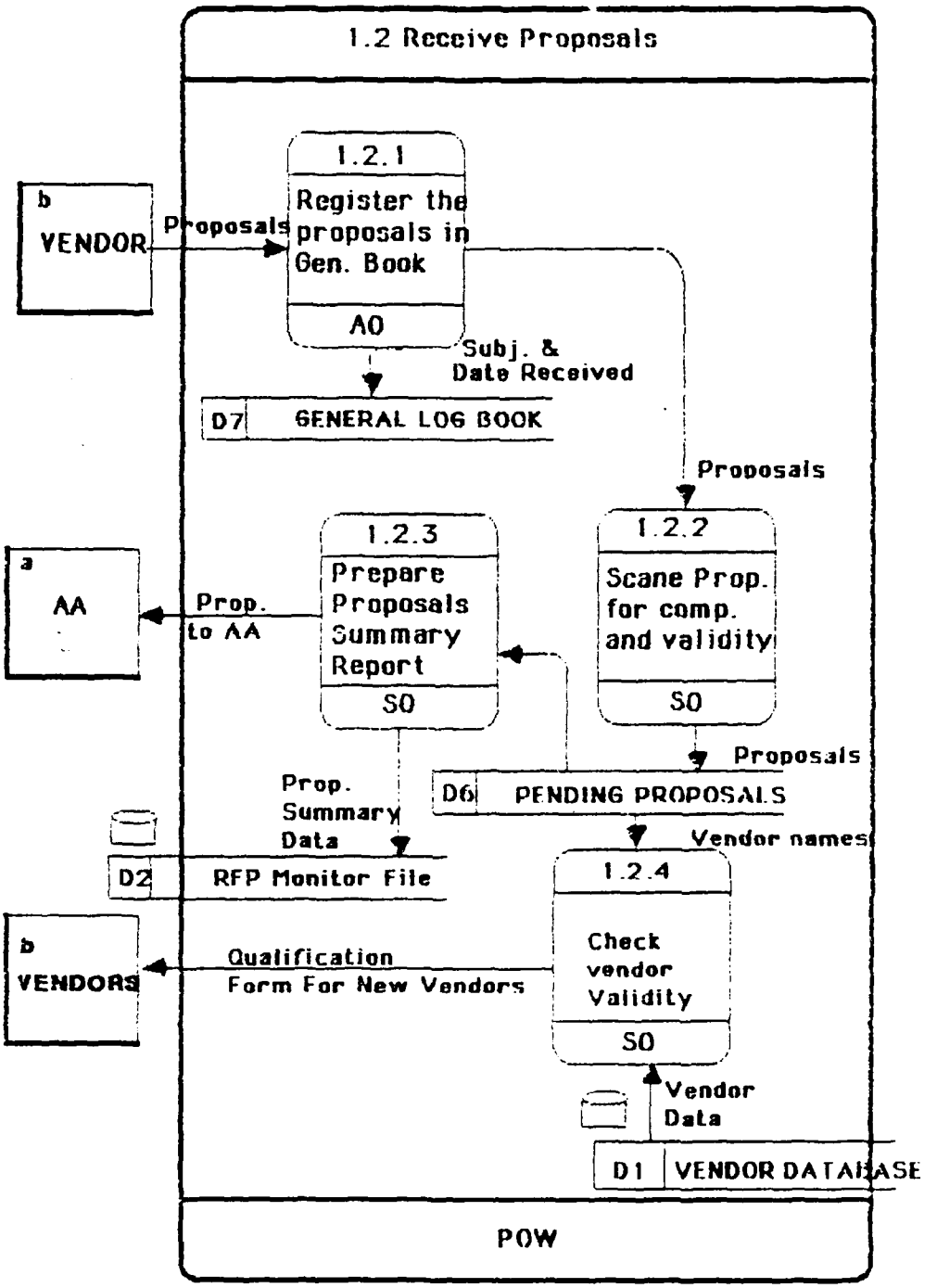

Figure 4.6 Receive Proposals

- Process 1.2.1.2 Check and Review Proposals. The SO reviews and checks all the incoming proposals. The proposals from new vendors are put in a pending file until the qualification process is done. The non relevant proposals and the non-qualified vendors proposals are discared. The relevant proposals from the qualified vendors are put in a pending file until closing date of RFP is over.

- Process 1.2.1.3 Record Proposals. The basic proposals data are recorded in the Proposals Monitor File (PMF). The data to be recorded are:

  * RFP Number
  * Proposals Serial Number (within the RFP number)
  * Vendor Name
  * Vendor ID
  * Proposals Received Date
  * Total Value Of Proposals

- Process 1.2.2 Issue Qualification Form. (QF) QF's are issued to new vendors. Their proposals are put in a pending file until the investigation is completed.

- Process 1.2.3 Produce List of Received Proposals. After the closing date is over, a certain program in the computer is triggered to match the RFP Monitor File with the Proposals Monitor File and produce a report of all received proposals. The matching key is the RFP Number in both files. This list with the physical copies proposals are forwarded to AA.

The following is the suggested list produced by the computer:

PROPOSALS LIST

RFP NUMBER	PROPOSAL NUMBER	VENDOR NAME	DATE RECEIVED	TOTAL VALUE

2. RFC Function Description

The potential for automation of this function is not too high because it is not the common case for the POW to do the contracting with vendors, except for small contracts. This function has high potential as a future DSS application for evaluating proposals and vendor selection, but the volume of RFC is not big enough in POW to be included in this thesis.

The manual system of the RFC function will not be changed, except recording basic RFC data to produce status reports. Figure 4.7 shows how the RFC function.

The data structure of the RFC is:

* RFC Number (Register number)
* Date Received
* RFP Number
* Requester (Force or Department)
* RFC Subject
* Fund Letter Number
* Fund Dollar Amount

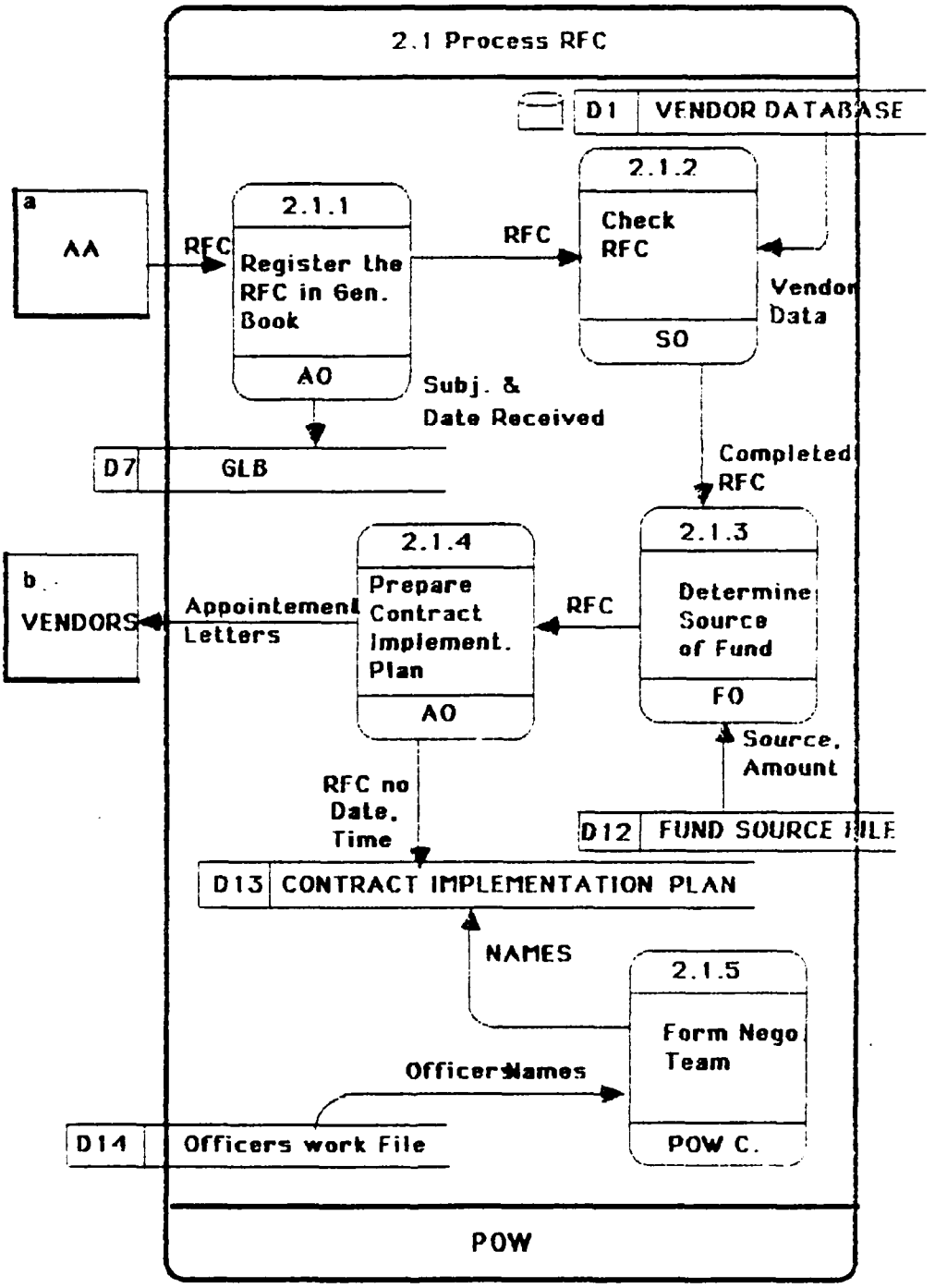

Figure 4.7 RFC Function

* Vendor(s) Best and Final Offers

* Technical Evaluation Ranking

* Negotiation Base (Least Cost or Price Performance Ratio)

3. Funding Contracts

The funding contract function is also small because it is limited only to commercial contracts signed in POW. Like the RFC it is not big enough to be automated. For that reason this function will not be changed, except the management of the guarantee letters of all contracts signed withUS vendors either in Egypt or in POW, currently about 1500. This sub- function has great potential for automation because the Guarantee Letters must be monitored by POW. This sub- function will be developed as a part of the Administer Contract function.

4. Administer Open Contracts

By developing this function we could increase the efficiency of POW. The basic data about a particular contract must be recorded in the Contract Database File (CDF). The data structure of the contracts is:

* Department Code (2 Characters)

* Contract Number (Serial number within department code)

* Contract Name (Heading of 50 characters)

* Contract Description (TEXT of 50 characters)

* Contact Vendor Name

* Contract Vendor ID
* Contract signed date
* Contract Total Value
* Contact Items (Repetitive group)
    * Unit of Issue UI
    * Quantities
* Contract Summary
* Inspection Schedule
* Payment Schedule
* Shipment Schedule
* Training schedule
* Basic Attached document
* Guarantee letters
* Source of fund letter
* Case designator (for the loan funded contracts)
* Certificates

The following are the sub-functions to be automated:

a. Payment

b. Monitor shipment

c. Monitor Personnel Training related to contracts

d. Monitor Guarantee letters

e. Reporting

a. Payment

The contracts are sorted into groups according to the specialized area. Each specialized officer is

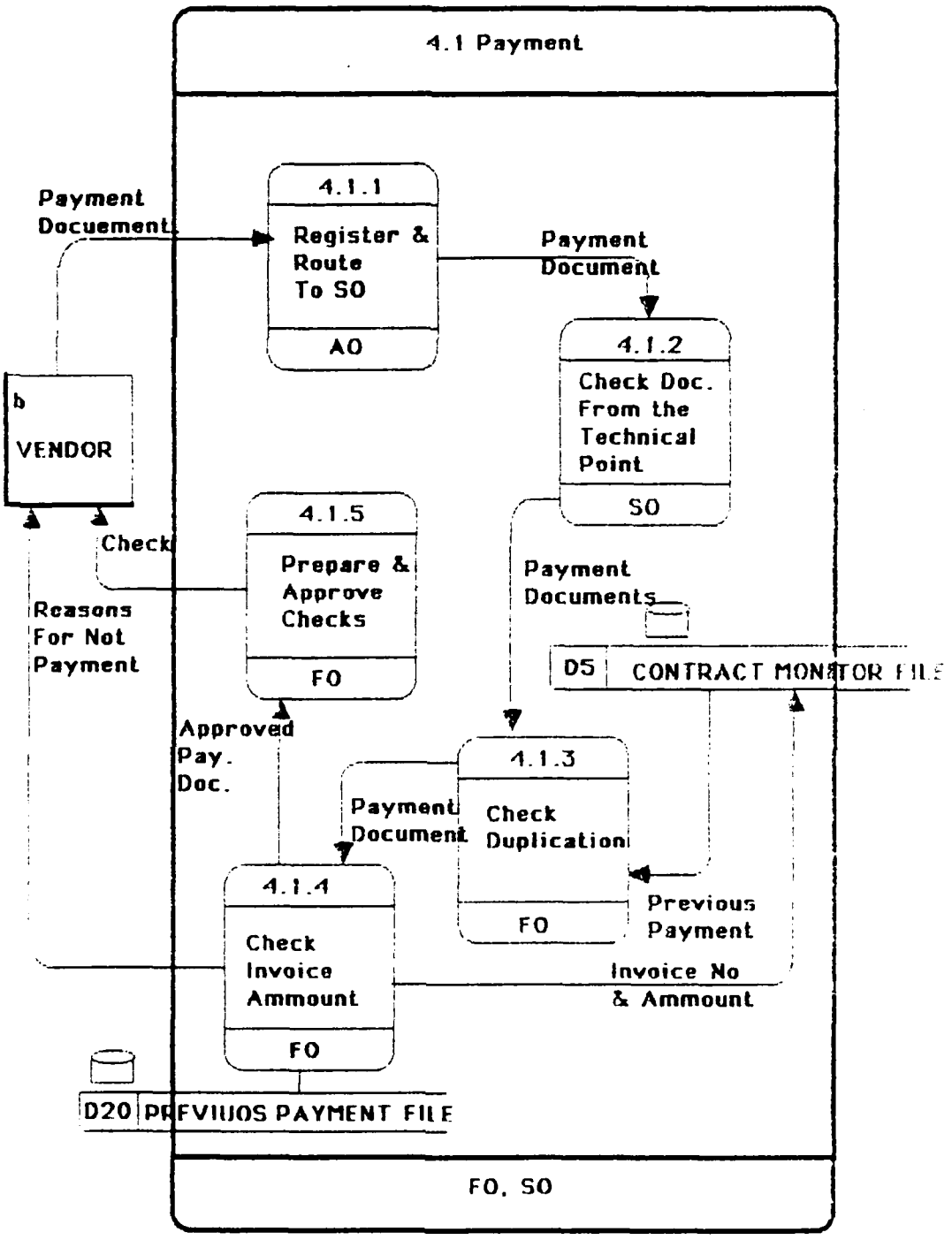

Figure 4.8 Payment

responsible for one or more groups. The database for the contracts must be centralized. The data about contracts can be retrieved and updated through the computer terminal. The following are details of the payment process: (Figure 4.8)

- Process 4.1.1 Register the Payment Documents. The payment documents are received and registered in the GLB then routed to the specialized officer. The payment documents consist of the original invoice, the shipment receipt from the Freight Forwarder (FF), and the certificates of manufacture and warranty.

- Process 4.1.2 Review and Check The Payment Documents. The specialized officer accesses the contract database and contract monitor file to check the documents against the previous payments, shipment schedule, etc. to be sure of meeting the requirements of contract. A pre-defined report may be produced to assist him in doing his job. The following is the suggested report format:

SHIPMENT HISTORY			
CONTRACT NUMBER	SHIPMENT NUMBER	TOTAL VALUE	DATE RECEIVED

The specialized officer can also retrieve detailed information about a particular contract or vendor to assist him in making his decision to approve the payment.

The SO will be authorized to record the data about shipment notice and the certificates related to his

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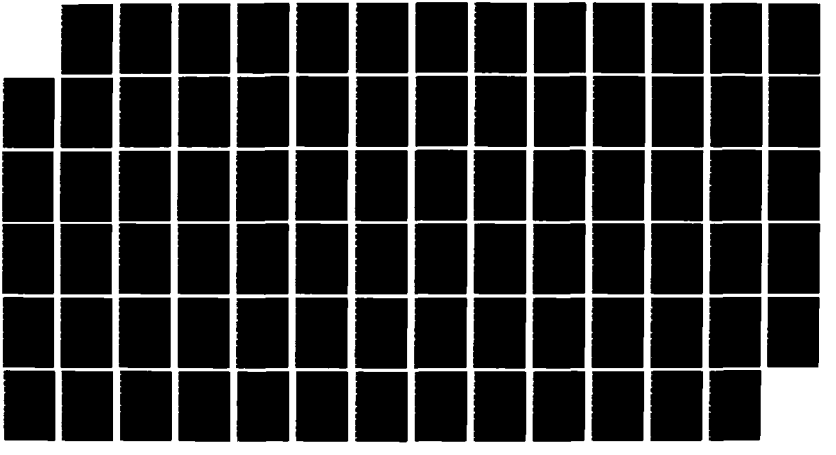
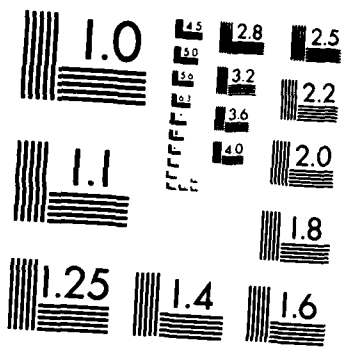




contract group area. The following is the data structure of the shipment notice:

* Contract Number
* Shipment Number
* Shipment Date
* Shipment Value
* Shipment Items (Repetitive group)
  * Name
  * Unit of Issue
  * Quantity
* Vendor ID
* Shipment data

The SO approves the payment and forwards the payment documents to the Financial Officer (FO).

- Process 4.1.3 Check The Payment Documents By The FO

.The FO checks all the payment documents paying special attention to the validity of the invoice. He will be able to produce reports of all the payment information about a particular contract or vendor. He can also produce reports about the status of fund availability. The following is the suggested report format:

PAYMENT HISTORY

CONTRACT NUMBER	INVOICE NUMBER	DATE RECEIVED	TOTAL VALUE

The FO is the only officer authorized to record the Invoice information in the computer database. The data structure of the invoice is as follows:

* Invoice Number
* Contract Number
* Vendor Code
* Date Received
* Due Date
* Total Value
* Invoice Items (Option)
    * Name
    * Unit of Issue
    * Quantity

- Process 4.1.4 Prepare The Payment Check. The FO prepares the payment checks after validation of all payment documents using the database to assist him in making his decision. The FO records the checks data in the database after getting the approval of payment from the POW director. The following is the data structure of the check:

* Check Number
* Date of Issue
* Invoice Number
* Bank
* Value
* Vendor Company Name
* Check Contract Number

b. Monitor Personnel Training

- Process 4.2 Monitor Personnel Training. The personnel training sub-function is very important. Two processes are related to the training: preparation and implementation of the training plan and following up of personnel during the training period in USA.

- Process 4.2.1 Pepare Training Plan. After signing the contract the training information is extracted from the contract and recorded in training database. The data structure for the training data are:

  * Contract Number
  * Line number related to training in the the contract
  * Number of personnel to be trained
  * Pre-request for training (repetitive group)
  * Training Period (repetitive group)
  * Location(s) (repetitive group)
  * Estimated Date of training (Repetitive group)
  * Actual Date of Training

- Process 4.2.4 Personnel Affair in Training The POW becomes responsible for all officers under training along the period of staying in the USA. The Administrative Officer in POW is responsible for preparing the monthly payment for all officers, mailing them the checks every month, travel reservations, internal transportation during check in/out in USA, and medical care.

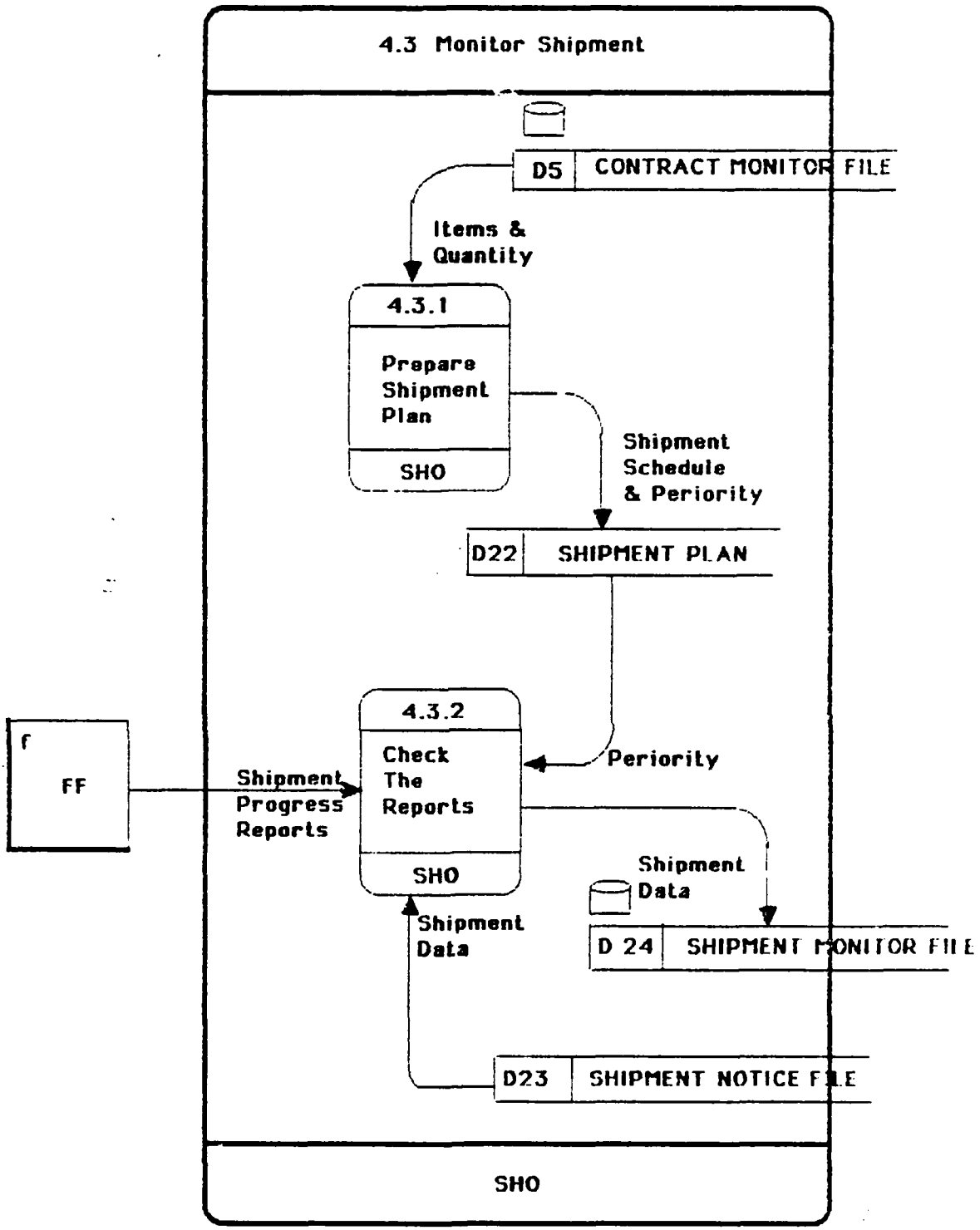


Figure 4.9 Monitor Shipment

The following is the suggested data structure for personnel monitoring file:

* Person Military Number
* Rank
* Name
* Related Force/Department
* Date Arrived
* Date Leave
* Training Location
    * Address
    * City
    * State
    * Zipcode
    * Phone Number
* Point of Contact in the Training Center
* Home Address during Staying in USA
    * Address
    * City
    * State
    * Zipcode
    * Phone number
* Contract Number
* Course Number

* Course Description
* Training Period
    * Start Date
    * End Date
* Monthly payment rate

The number of personnel may not exceed 200 officers on average any time during the year. The automation of this function is not included in this thesis because of the time constraint.

c. Monitor Shipment

Process 4.3 Monitor Shipment of Items to Egypt. The Freight forwarder (FF) is contracted to do this function. The POW shipment officer has an access terminal to the FF computer. No potential for automation is recognized for this function. The manual function will stay without change as presented in chapter II.

d. Monitor Guarantee Letters

Process 4.4 Monitor Guarantee Letters. The total number of active guarantee letters may exceed 1000 with a total value over $10 million. Keeping track of these letters is very important. The proposed system is a warning system to prevent losing the guarantee letters after they exceed their validity periods. The software requirement for this function is simple. All the Guarantee letters are recorded in a database file. A printed list is produce every week of the guarantee letters that need to be renewed. This list

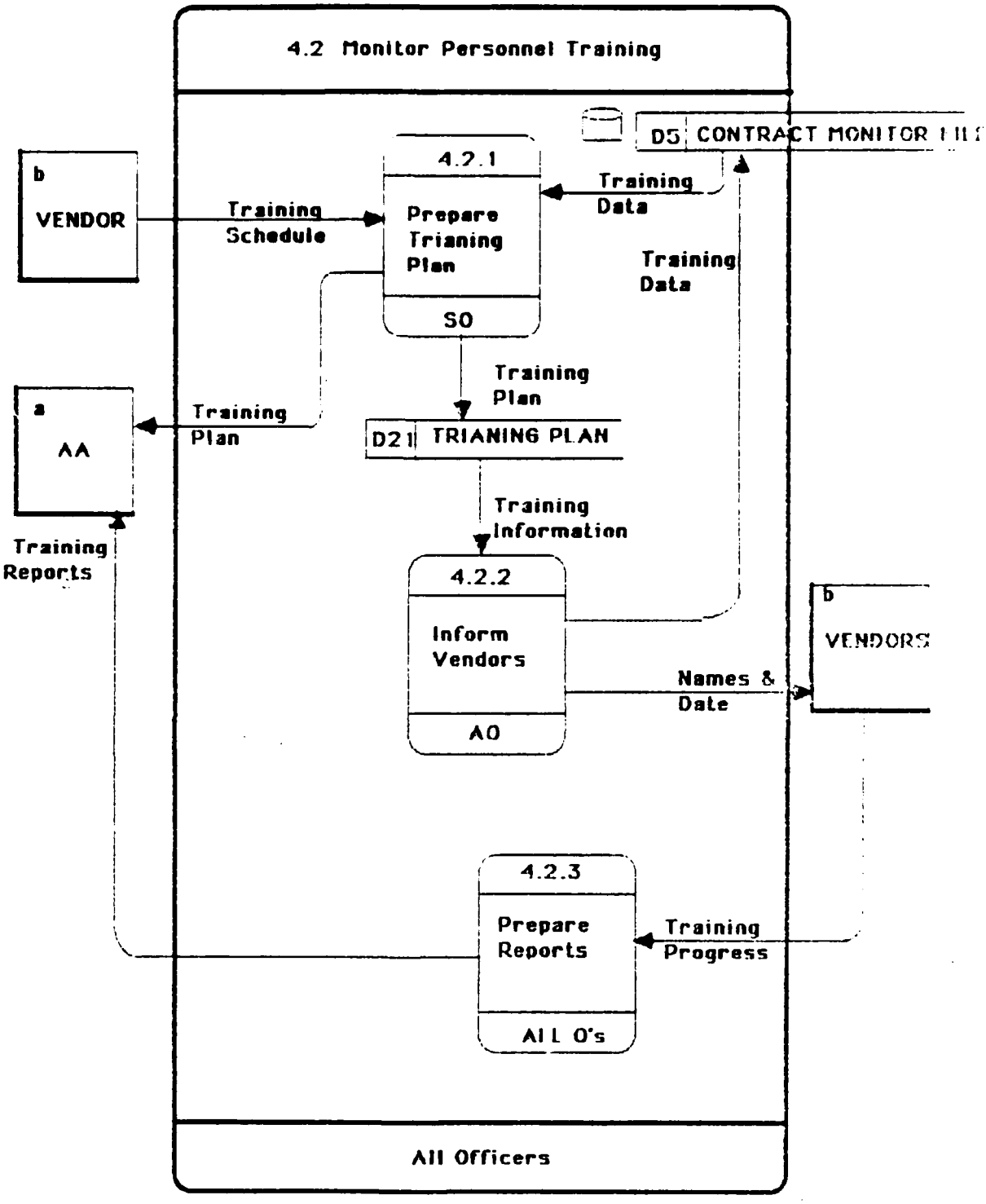


Figure 4.10 Monitor Personnel Training

is produced far enough ahead to allow enough time for requesting the renewal. The data structure for the guarantee letters is:

* Contract Number
* Guarantee Letter number (within the Contract number)
* Bank issued from
* Vendor ID
* Vendor Name
* Total Value
* The purpose of the guarantee letter
* Starting Date of Validity
* Ending Date of Validity

e. Reporting

Process 4.5 Prepare Reports. The reporting facility of the PC/FOCUS database is very powerful and can be used to generate any reports needed by POW. In chapter II we presented only the general kinds of reports that may be produced. In this Chapter, we inroduce specific reports to be generated. It is not necessary that all reports be printed; most of them may be needed only as a screen displays. PC/FOCUS has the facility to view the report on the screen first. If the user needs to print it, he can then issue two commands: OFFLINE to let PC/FOCUS forward the output to the printer and RETYPE to repeat the document.

The following are a list of the proposed reports:

(1) The status Reports:

- Vendor Status Report

  RFP/Proposals Report

- Department/RFP Report

- Department/Contract

- Vendor / Contract Report

- Department / Vendor

- Vendor / Department

(2) Progress Reports:

- Contract implementation over a period of time by the value received.

- Shipment of items over a period of time

- RFP Received and processed during a period

(3) Comparison reports:

These kind of reports are very important for decision support. Mainly it can be used during evaluation functions. The financial modeling function of PC/FOCUS can be used to produce these kind of reports. The graphic terminal system may be used for the graphic presentation of these reports.

5. Generate Effective Vendor Database

We need to build an effective vendor database for the potencial and qualified vendors who are most suitable to be supplier for the Egptian Armed Forces. This function has

a highly payoff compared with the other functions because it's relatively simple to implement on the computer and a great effort is needed in the manual system to prepare the vendor list for a particular RFP. It may take more than a week to prepare a vendor list for a particular RFP.

In the USA there are over 135,000 manufacturers. We cannot practically put all the qualified vendors in USA in our database, otherwise it becomes very big. The practical approach to building an effective vendor Ddtabase for POW is to include initially only vendors who already have contracts with POW. We can then add the RFP- driven vendors to it i.e. all vendors who offer accepted proposals. Periodically, the vendor database is reviewed and non-active vendors are dropped. Other sources of potential vendors may be used such as: USA Armed Forces and Government suppliers, and Thomas Register.

The following is the data structure for a specific vendor:

* Vendor ID (A local code is used with a cross-reference table for vendor code)
* Vendor Name
* Vendor Point of Contact
* Vendor Address
    * Street
    * City
    * state

* Zip code
* Phone Number
* Telex
* Business Asset Rate
* Business Start Date
* Business Activities (Repetitive group)
* Vendor Item Classes (Repetitive group)
* Vendor Department Area
* Vendor Supplier to USA Armed Forces
* Vendor Previous Relation with POW
* Vendor Rating Grade

C. CONCLUSION OF THE CHAPTER

This chapter was very important because all the necessary information to build the new system are now available. Each function is analyzed to determine whether or not be automated, The data elements for each function is determined also, the revisited DFD's are used to explain the system. The data dictionary section is moved to the next chapter to integrate it with the design issues for the new system. Figure 4.11 shows the logical relations between the Entities of the system, the lines with arrows represent a one to many relationship between the entities. In the designed system an entity may be divided into one or more database file.

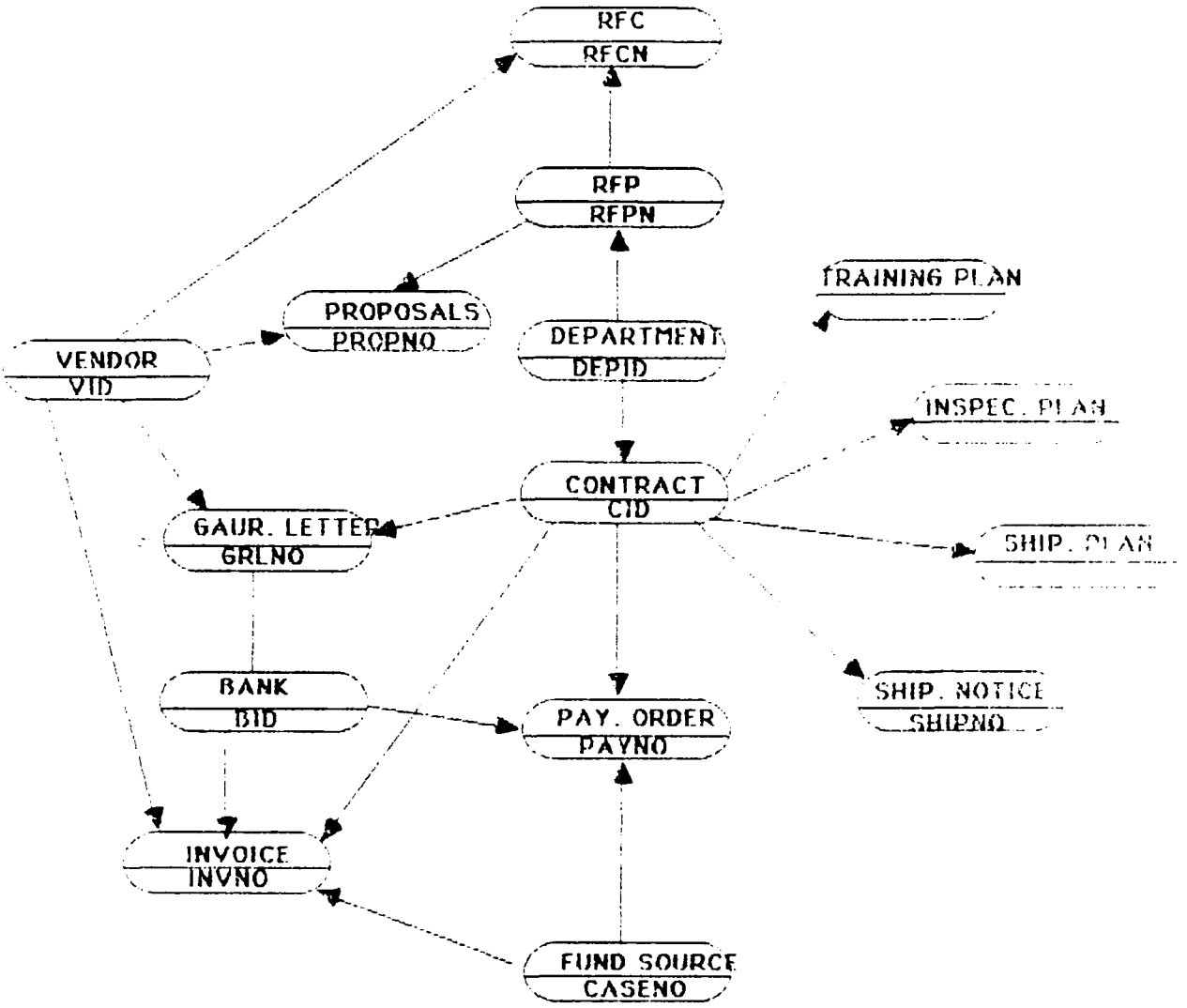


Figure 4.11 Logical Relations Between Entities

V. SOFTWARE DESIGN OF POWCP SYSTEM

A. OBJECTIVES

DSS consists of three major components, a data base, a model base, and a dialog components. The objective of the software design is to build the data base components, the most important components in DSS.

> The DBMS is one of the three major components of a DSS. (The other two components are the dialog component and the model component.) A DBMS is an important tool for building a DSS, and a poor data base management component can cause the failure of a DSS. [Ref. 1]

The software we use is the PC/FOCUS which allows easy building of the other two components as well. The POWCP system attempts to aim at:

1. Improving the performance of POW in the Commercial Procurement system by providing the right information at the right time to the right person. The result of the system must affect the RFP function by reducing the time for preparing the list of vendors who are qualified to receive a particular RFP and improving the capability of POW to administer the open contracts.

2. Introducing automated assistance to improve decision making in POW.

B. DATABASE STRUCTURE

1. Database File Relation

The following are the database file relations that show the primary key fields in each file "underlined" and the other fields which are used for linking the file in the database.

POWDEP(REQ-ID, ...)

POWRFP(RFP-NO),DEP-ID, ...)

POWRFC(RFC-NO,RFP-NO,DEPART-NO1, ...)

POWVNDR(VENDOR-ID,DEPCUSTOMER, ...)

POWCONTR(CONTR-NO,CONTRACT-DEP,CONTRACT-VID, ...)

POWBANK(BANK-NO, ...)

POWINVOI(INVOICE-NO,INV-CONT-NO,INV-VNDR-ID,INV-CHECK-NO,
...)

POWORDR(PAYORDER-NO,PAY-O-INV-NO,PAY-ORD-BANK, ...)

POWCHECK(CHECK-NO,CHECK-INV-NO,CHECK-BANK, ...)

POWICLAS(VENDOR-ID1,VNDR-ITEM-C, ...)

POWVDEP(VENDOR-ID2,VNDR-DEP-NO, ...)

POWSHIPN(SHIP-NOTICE,SHIP-CONT-NO,SHIP-INV-NO, ...)

POWCITEM(CONTR-NO1,ITEM-CODE, ...)

POWBNKAC(BANK-NO,BANK-ACCOUNT, ...)

2. Database Schema

Figure 5.1 shows the relations between the database files. Notice that the first five files represent the commercial procurement cycle until signing of the contract. The rest of the files represent the administration contract function. The connection between the two groups is done via the contract file. This structure provides the most simple way of building the database. The key fields are underlined and the other fields are used to connect the different files which can be done easily by the join facility of PC/FOCUS.

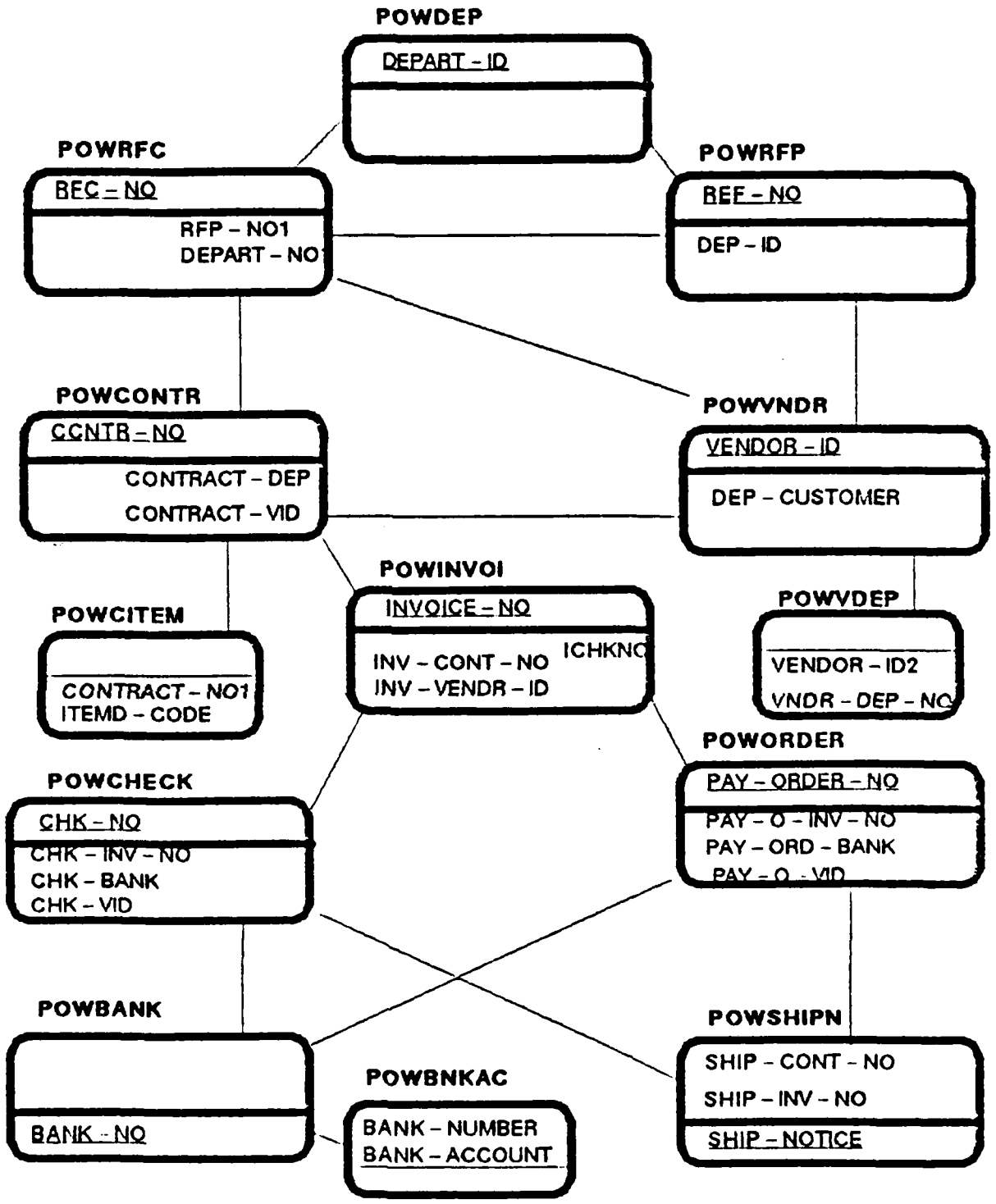


Figure 5.1 DATABASE FILE RELATIONS

From this structure we can generate many of the logical structure to produce the required reports.

C. DESIGN IMPLEMENTATION ISSUES

1. Data Dictionary

a. Normalization

Since we are going to build the DSS generator of POWCP system, the database, normalization of data is very important as a necessary logical step before undertaking the physical design of the database. One of the objectives of normalization is to get the simplest possible representation of data that we can get. In other words, remove the complex relationships between data structures by removing repeating groups (first Normal Form (1NF)), group all nonkey data elements in a structure to be fully functionally dependent on a single primary key in the same structure (Second Normal Form (2NF)), and remove all the nonkey data elements which are functionally dependent on other nonkey data element in the same structure (Third Normal Form (3NF)). The reasons to do data normalization before designing the physical database are: a. Construct the simplest possible data structure before loading the database because it is difficult to change the structure of the database after loading the actual data to the system (although PC/FOCUS allows data base rebuilding via the REBUILD COMMAND which allows reorganizing, reindexing, and rebuilding damaged

FOCUS files); b. Normalization prevents deletion anomalies which means that we may lose facts about two entities by one deletion. For example if the item class only exists in the vendor record, if only one vendor supplies this item class and this vendor does not exist in our database, the item class also will not exist. Normalization also prevents insertion anomalies which constrains inserting an entity unless another logically unrelated entity is also inserted.

> Both for the manual and for computer systems, it usually is easier and cheaper to change the logic of a process than to change the structure of a data store. Consequently, the simpler and more general the structure of a data store, the easier and cheaper it will tend to be to make changes in the data. [Ref. 3]

b. RFP Structure Normalization (An Example)

The Request For Proposals (RFP) data structure will be used as an example to apply the normalization technique. For the other data structures, we present the final result in 3NF with the proper names that will be used in the physical design of the database.

RFP Data Structure: (Not normalized)

- RFP Number
- Date Received
- Requester Code (Force or Department)
+ - Requester Name (Two character code)
- RFP Subject
* - Items Needed (Repetitive group)
* - Item Name
* - Unit of Issue
* - Quantity
* - Items Class (key words such as: Tools, Engines, Pumps, Computers, etc.)
- Estimated Dollars
- Source of Funds (Budget, Loans, Others)
* - Suggested Vendor Names (Repetitive group)

The data marked with "*" are repeating groups. The data elements marked by "+" are not functionally dependent on the RFP number. No data elements functionally dependent on other data elements appear in the RFP data structure. To do the normalization, first we separate the repeating groups as follows:

RFP Data Structure (1NF)

- RFP Number (Key data element)
- Date Received
+ - Requester Code
+ - Requester Name

- RFP Subject

RFP Number
Items Needed
Item Name
Unit of Issue
Quantity

RFP Number
Item Classes

- Estimated Dollars
- Fund Source

RFP Number
Sugg. Vendor Name

Second, we separate the data elements marked by "+" and leave the Requester Code to link the two data structures as needed. The following is the data structure in 2NF:

RFP Data Structure (2NF)

- RFP Number (Key data element)
- Date Received
- Requester Code

Requester Code

Requester Name

- RFP Subject

RFP Number

Items Needed

Item Name

Unit of Issue

Quantity

RFP Number

Item Classes

- Estimated Dollars
- Fund Source

RFP Number

Sugg. Vendor Name

The above structure is in third normal form. We notice that the original RFP data structure is divided physically into six normalized data structures. These structures can be logically grouped together to form the original data structure or any other structure as required. In the following page the new six data structure are presented.

POWRFP FILE:

*RFP_NO

RFP_DATE

+REQ_ID

RFP_SUBJECT

RFP_COMMENT

POWREQ FILE:

*REQ-CODE

REQ-NAME

RFPITEM FILE:

+RFP_NO1

+ITEM_CODE

UNIT_OF_ISSU

QUANTITY

RFPICLAS FILE:

+RFP_NO

+ITEM_CLASS

ITEMCLAS FILE:

*ITEM_CLASS

SPECFICATION

SUGVNDR FILE:

+RFP_NO

+VENDOR_ID

The new structure of the RFP data structure is divided into six files which are in the 3NF and prevent deletion or insertion anomalies as we can see from the RFPICLAS and ITEMCLAS files. We notice that the key fields are identified by "*" which means only one occurrence is allowable for each value of a key. These fields must be indexed to allow joins between other records of the same values in PC/FOCUS. The fields identified by "+" means that these fields can be used for joins between records. Combining two fields of type "+" form a key of type "*" which uniquely identifies one occurrence of a record.

c. File Structure

The following are the database record descriptions which are produced using the PC/FOCUS Filetalk utility. The Filetalk utility allows the user to interactively create Master File Descriptions (MFD). All MFD's are described as a single record (segment). Each record contains a group of relevant data. Notice that every name of a record is preceded by the procurement office initials, POW, to allow easy recognition of the files and prevent it from accidental deletion. Note that the key field of each record is marked by "*" at the beginning of the line. The other key fields which may used for joining the files are underlined.

```
FILENAME=POWDEP,SUFFIX=FOC          (Force or Department File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=DEPART_ID,     ALIAS=DEP,    FORMAT=A2,FIELDTYPE=I,$
FIELDNAME=DEPART_NAME,    ALIAS=DEPN,   FORMAT=A25,           $

FILENAME=POWRFP,SUFFIX=FOC          (Request For Proposals)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=RFP_NO,         ALIAS=RFPN,  FORMAT=I6,FIELDTYPE=I,$
FIELDNAME=RFP_DATE,       ALIAS=RFPD,   FORMAT=I6MDY,         $
FIELDNAME=DEP_ID,         ALIAS=DEPC,   FORMAT=A2,            $
FIELDNAME=RFP_SUBJECT,    ALIAS=SUBJ,   FORMAT=A50,           $
FIELDNAME=N_OF_VENDORS,   ALIAS=NOV,    FORMAT=I2,            $
FIELDNAME=NOF_PROPOSAL,   ALIAS=NOP,    FORMAT=I2,            $
FIELDNAME=RFP_COMMENTS,   ALIAS=,       FORMAT=A50,           $

FILENAME=POWRFC,SUFFIX=FOC          (Request For Contracting)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=RFC_NO,        ALIAS=RFCN,   FORMAT=I6,FIELDTYPE=I,$
FIELDNAME=RFC_DATE,       ALIAS=RFCD,   FORMAT=I6MDY,         $
FIELDNAME=RFP_NO1,        ALIAS=RFPN1,  FORMAT=I6,            $
FIELDNAME=DEPART_NO1,     ALIAS=DEPN1,  FORMAT=A2,            $
FIELDNAME=RFC_SUBJECT,    ALIAS=RFCS,   FORMAT=A50,           $
FIELDNAME=FUND_LETTER,    ALIAS=FLN,    FORMAT=A30,           $
FIELDNAME=FUND_AMMOUNT,   ALIAS=FAMOUNT,FORMAT=D12.2M,        $
FIELDNAME=RFC_COMMENT,    ALIAS=RFCCOM,FORMAT=A50,            $
```

```
FILENAME=POWVNDR,SUFFIX=FOC      (Vendor File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=VENDOR_ID,     ALIAS=VCODE, FORMAT=I4,FIELDTYPE=I,$
FIELDNAME=THOMAS_VOL_N, ALIAS=THVN,  FORMAT=I2,            $
FIELDNAME=THOMAS_PAG_N, ALIAS=THPN,  FORMAT=I3,            $
FIELDNAME=VENDOR_NAME,  ALIAS=VNAME, FORMAT=A50,           $
FIELDNAME=POF_CONTACT,  ALIAS=POFC,  FORMAT=A25,           $
FIELDNAME=VENDOR_ADRES, ALIAS=VADRS, FORMAT=A25,           $
FIELDNAME=VENDOR_CITY,  ALIAS=VCTY,  FORMAT=A15,           $
FIELDNAME=VENDOR_STATE, ALIAS=VSTA,  FORMAT=A4,            $
FIELDNAME=VENDOR_ZIPC,  ALIAS=VZIPC, FORMAT=I7,            $
FIELDNAME=VENDOR_PHONE, ALIAS=VPH,   FORMAT=A14,           $
FIELDNAME=VENDOR_TELEX, ALIAS=VTLX,  FORMAT=A12,           $
FIELDNAME=VENDOR_ASSET, ALIAS=VASS,  FORMAT=A6,            $
FIELDNAME=VENDOR_START, ALIAS=VSTD,  FORMAT=A4,            $
FIELDNAME=V_ACTIVITIES, ALIAS=VAC,   FORMAT=A50,           $
FIELDNAME=DEP_CUSTOMER, ALIAS=DEPC,  FORMAT=A2,            $

FILENAME=POWCONTR,SUFFIX=FOC      (Contract File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=CONTRACT_NO, ALIAS=CN,    FORMAT=I6,FIELDTYPE=I,$
FIELDNAME=CONTRACT_NAM, ALIAS=CNAM,  FORMAT=A50,           $
FIELDNAME=CONTRACT_DES, ALIAS=CDES,  FORMAT=A50,           $
FIELDNAME=CONTRACT_DEP, ALIAS=CDEP,  FORMAT=A2,            $
FIELDNAME=CONTRACT_VID, ALIAS=CVID,  FORMAT=I4,            $
FIELDNAME=CONTRACT_DAT, ALIAS=CDATE, FORMAT=I6MDY,         $
```

```
FIELDNAME=CONT_VALUE,    ALIAS=CVALUE,FORMAT=D14.2,          $
FIELDNAME=CONT_COMM,     ALIAS=CCOMM, FORMAT=A50,            $

FILENAME=POWBANK,SUFFIX=FOC                    (Bank File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=BANK NO,      ALIAS=BNO,   FORMAT=I2,FIELDTYPE=I,$
FIELDNAME=BANK_NAME,     ALIAS=BNAME, FORMAT=A20,            $
FIELDNAME=BANK_ADDRES,   ALIAS=BADRES,FORMAT=A25,            $
FIELDNAME=BANK_CITY,     ALIAS=BCTY,  FORMAT=A25,            $
FIELDNAME=BANK_STATE,    ALIAS=BSTATE,FORMAT=A4,             $
FIELDNAME=BANK_ZIPC,     ALIAS=BZIPC, FORMAT=I7,             $
FIELDNAME=BANK_PHONE,    ALIAS=BPHONE,FORMAT=A14,            $
FIELDNAME=BANK_TELEX,    ALIAS=BTLX,  FORMAT=A14,            $

FILENAME=POWINVOI,SUFFIX=FOC                   (Invoice File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=INVOICE NO,   ALIAS=INVN,  FORMAT=I6,FIELDTYPE=I,$
FIELDNAME=INV CONT NO,   ALIAS=INVCN, FORMAT=I6,             $
FIELDNAME=INVOICE_SUBJ,  ALIAS=INVSUBJ,FORMAT=A50,           $
FIELDNAME=INV_VENDR_ID,  ALIAS=INVVID,FORMAT=I4,             $
FIELDNAME=INVOICE_DATE,  ALIAS=INVD,  FORMAT=I6MDY,          $
FIELDNAME=INVOICE_VALU,  ALIAS=IVLU,  FORMAT=D12.2M,         $
FIELDNAME=INV_DUE_DATE,  ALIAS=IDUE,  FORMAT=I6MDY,          $
FIELDNAME=INV CHECK NO,  ALIAS=ICHKNO,FORMAT=I8,             $
FIELDNAME=INV_PAY_DATE,  ALIAS=IPD,   FORMAT=I6MDY,          $
FIELDNAME=INV_COMM,      ALIAS=,      FORMAT=A50,            $
```

```
FILENAME=POWORDER,SUFFIX=FOC            (Pay Order File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=PAY_ORDER_NO,ALIAS=PON,    FORMAT=I8,FIELDTYPE=I,$
FIELDNAME=PAY_ORDR_DAT, ALIAS=POD,    FORMAT=I6MDY,          $
FIELDNAME=PAY_O_INV_NO, ALIAS=POINVN,FORMAT=I6,              $
FIELDNAME=PAY_ORD_BANK, ALIAS=POB,    FORMAT=I2,             $
FIELDNAME=PAY_O_VALUE,  ALIAS=POV,    FORMAT=D12.2M,         $
FIELDNAME=PAY_O_VID,    ALIAS=POVID, FORMAT=I4,              $
FIELDNAME=PAY_TOWHOM,   ALIAS=POTO,  FORMAT=A25,             $

FILENAME=POWICLAS,SUFFIX=FOC            (Items Class File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=VENDOR_ID1,  ALIAS=VID1,   FORMAT=I4,             $
FIELDNAME=VNDR_ITEM_C,  ALIAS=VIC,    FORMAT=A15,            $

FILENAME=POWVDEP,SUFFIX=FOC          (Vendor Department File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=VENDOR_ID2,  ALIAS=VCODE2,FORMAT=I4,              $
FIELDNAME=VNDR_DEP_NO,  ALIAS=,       FORMAT=A2,             $

FILENAME=POWSHIPN,SUFFIX=FOC          (Snipment Notice File)
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=SHIP_NOTICE, ALIAS=SHN,    FORMAT=I6,FIELDTYPE=I,$
FIELDNAME=SHIP_CONT_NO, ALIAS=SHCN,   FORMAT=I4,             $
```

```
FIELDNAME=SHIP_SUBJECT, ALIAS=SHS,   FORMAT=A50,          $
FIELDNAME=SHIP_INV_NO,  ALIAS=SHIN,  FORMAT=I6,           $
FIELDNAME=SHIP_DATE,    ALIAS=SHD,   FORMAT=I6MDY,        $

FILENAME=POWCITEM,SUFFIX=FOC            Contract Item File
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=CONTRACT_NO1,ALIAS=CN1,  FORMAT=I6,           $
FIELDNAME=ITEMD_CODE,   ALIAS=ICOD  FORMAT=A12           $
FIELDNAME=ITEM_DESCRP   ALIAS=IDESC FORMAT=A30           $
FIELDNAME=UNIT-OF-ISSUE ALIAS-UI    FORMAT=A2            $
FIELDNAME=CONT_QTY      ALIAS=CI,   FORMAT=A30,          $
FILENAME=POWBNKAC,SUFFIX=FOC
SEGNAME=ONE,SEGTYPE=S1
*FIELDNAME=BANK_NUNBER, ALIAS=BID1, FORMAT=I2,FIELDTYPE=I,$
FIELDNAME=BANK_ACCOUNT, ALIAS=BACC, FORMAT=A10,          $
```

2. Using PC/FOCUS for the POW Softeware

The purpose of this section is to justify the use of PC/FOCUS as a DSS generator for the POW system. Some of the most important and useful features of PC/FOCUS are highlighted below.

a. Files Description

PC/FOCUS supports a hierarchical model, i.e. the file description allows a one to many relationship between segments (records) in FOCUS file or the parent to many child segments. The data description language of PC/FOCUS allows free format delimited by $ to signify the end of single

description. A checking procedure can be used to check errors in the file description. After data entry, changes in the file description are not allowed unless they are a part of reorganization of the physical database. (Rebuild facility of PC/FOCUS allows down loading an "old" physical data base to a "new" description carefully made by the designer. File relationships (cross-reference of files) in the database can be made static through FOCUS file description as a parent child relation or dynamic using PC/FOCUS JOIN command which can be invoked when needed to link two entire file structures. The condition for using the JOIN command is to allow at least one field in the desired segment of each file to be of type "indexed" in the file description. Any number of fields may be indexed on a segment. PC/FOCUS FileTalk also allows easy checking of file descriptions by producing a graphical representation of files and segment relations.

b. Data Manipulation in PC/FOCUS

A non-procedural language is used for data manipulation and producing reports from the database. Two functional types of manipulation language are available in PC/FOCUS: the transaction processor and the dialogue manager.

(1) <u>The Transaction Processor</u>. is used for report preparation by invoking the MODIFY command and typing an imperative English statement consisting of one or more

verbs followed by verb objects and optionally by various other phrases. All these statement follow the general rules of English grammar. The request statement contains all information the user has to provide in order to retrieve the desired records, perform any calculations, sort lines, accumulate totals, etc. Information which is not provided explicitly by user will be supplied by FOCUS as default options. The transaction processor has a facility to create screens for fill-in-the-blank data entry called FIXFORM. The MATCH subcommand is used to designate fields to match. Logical subcommands are used to process any demands from the database. It is possible to store FOCUS transaction processing routines in a command file for later use.

(2) The Dialogue Manager. is a stored procedure that may contain variable information for which a value is provided only at the time of execution. The variables can be used to represent numeric constants, dates, or to conduct a dialogue by prompting the user for a response. The Dialogue Manager is invoked by typing the FOCUS command "EXEC" or "EX" followed by the name of the procedure.

c. Built-in Facilities in PC/FOCUS

In addition to file description and data manipulation, there are many important facilities that make using PC/FOCUS database atractive for our system. The following are the summary of each facility as presented in [Ref. 8]

(1) Describing External Files. The report request language can be used on data files that are not maintained by FOCUS and, hence, are external. These are existing files which are maintained by, or extracted from, other systems.

(2) Maintaining FOCUS database. A simple language is used to control all the processes of adding new records to FOCUS database, deleting records,and changing values in existing records. Coupled with a transaction validation, computational, and logging facilities, the result is surprisingly brief set of ideas that must be learned in order to maintain FOCUS database.

(3) SCAN - Interactive Editing Facility. The SCAN facility is designed to take advantage of an interactive environment. It allows a user to 'browse' through a FOCUS file of any size by issuing one-line commands such as TYPE, NEXT, REPLACE, ETC. and receive an immediate response before issuing the next command. Users familiar with a text editor will find the similarities useful in learning SCAN.

(4) ANALYSIS - Formal Statistical Analysis. normal statistical techniques such as multiple regression, step-wise regression, and correlation analysis are performed on data in FOCUS (or external) files. Control over the techniques is exercised in an interactive dialogue. The displays include all of the formal statistical quantities.

(5) GRAPHS. The report request language is used to phrase and control graphical displays such as point plots, bar charts, histograms and scatter diagrams. Normal terminal output or high resolution graphics can be prepared. Default values are used for widths, grid values, etc. to simplify the process, but user can specify precise values when customized plots are needed.

(6) User Defined Language. Users can change the language and vocabulary of FOCUS to suit their own needs and preferences.

(7) Financial Modeling Language. The report request language has a series of features designed specifically for the preparation of 'row oriented' reports. These arise frequently in financial applications where reports such as Balance Sheets and Cash Flow statements are needed.

(8) FIDEL-FOCUS Interactive Data Entry Language

FIDEL enables the design and implementation of full screen interactive data entry systems as part of the data maintenance facility. It also provides easy development of 'menu' selection processes.

3. Database Creation

a. Data Entry

The Automode utility is used to enter data in the database. Test data have been generated to load the database. Real data will be loaded during the implementation phase.

b. Validation

PC/FOCUS allows validation of data during data entry. A record is rejected if any violation of field format occurs or if a record with the same key field is entered twice. In the latter case the last one entered will be rejected by PC/FOCUS. Automode does not allow range validation. There is a very powerful tool for interactive data entry, FOCUS INTERACTIVE DATA ENTRY LANGUAGE (FIDEL)) FIDEL allows the user to enter data through a visual 'fill in the form' method. After each successful transaction, the data portions of the screen are blanked out, leaving only the mask. If an error is discovered in the transaction an error message will appear on the bottom of the screen. A bell will ring (if the CRT is so equipped) and the screen will not blanked out, thus giving the operator a chance to correct the error and retransmit the screen. The FIDEL provides validation and protection mechanisms during interactive data entry. The complete language rules and facilities are presented in the PC/FOCUS user manual [Ref. 8]. In this thesis we are not going to use this tool because of the time limitation for the thesis. Automode provides adequate facility for data entry in this prototype.

c. Security

One problem with using the computer is the possibility of losing data. An important step in developing

any computer system is instituting procedures for backup of the actual data in the database and for prevention of unauthorized access to data. In our system, the security procedure is simple. FOCUS files containing data have an extension xxx.FOC to distinguish them from other files. The prefix, POW is used to precede all files generated by the system. Only an authorized person is allowed to delete these files. Every week a backup for all files in the database is done on floppy diskettes. Data entry and updating is limited to authorized persons only. PC/FOCUS has powerful tools for security which can be used for later development of the system.

d. **Database Size**

The following table shows the length of the different database files:

FILE NAME	LENGTH	ORGANIZATION	NO OF RECORDS
POWDEP	27	Indexed	20
POWVNDR	223	Indexed	500
POWICLAS	34		200
POWVDEP	6		1000
POWRFP	118	Indexed	800
POWRFC	162	Indexed	150
POWCONTR	182	Indexed	600
POWCITEM	36		3000
POWINV	154	Indexed	2000
POWORDR	63	Indexed	700
POWCHECK	63	Indexed	1300
POWBANK	111	Indexed	20
POWBNKAC	12		40
POWSHIPN	72	Indexed	2000
TOTAL	1263		12530

4. Using the Database

The database can be used for all the POWCP by using the Tabletalk utility.

a. RFP process

(1) Routine # 1. The routine is generated to match the data classes of any particular RFP with the data classes of all vendors. The result is a vendor list for all vendors that matches the data classes of the RFP.

(2) Routine # 2. This routine generates an RFP/Proposals list which summarize the RFP process and shows all proposals received from all vendors. This list is send along with the physical proposals to AA.

(3) Routine # 3. This is a general purpose routine which produces a list of the basic data in each database file. This routine can be enhanced to produce a variety of lists which suit certain logical conditions such as a list of all vendors with specific data classes. Of course we have to join the vendor data class file with the vendor file before we can generate the reports.

b. Administer Open Contacts Function

(4) Routine # 4. Produce a list of all invoices paid to a particular contract with its values and paid dates. The join between the contract file and the invoices file must be done before we use the Tabletalk. The same routine is generated by the Tabletalk. Similar routines can be generated for the pay order and the shipment notice.

(5) Routine # 5. Produce a list of all checks paid to a particular vendor. Joins with the vendor file and the checks file are necessary before producing the report.

(6) Routine # 6. Produce a Payment Plan for all invoices received and validated to be paid on a schedule according to the due dates of each invoice. This list allows the financial officer to manage the payment in the most effective way and prevent missing payment of any invoice.

(7) Routine # 7. Produce the financial status about all active contracts which shows the contracts against the amount of money paid for each one. This report is very important for the cash flow management of the fund dedicated for the contracts.

(8) Routine # 8. A validation list of all check values and dates issued to a particular bank. This list can be used to check the balance sheet of the bank. This routine can be adapted to produce reports to monitor payment from loans.

(9) Routine # 9. Produce a status list of each contract from the point of view of the shipment and compare these reports with the contract terms. The importance of this report comes from its ability to measure vendor performance and address any delay from the schedule to allow the contracting officer to take the necessary action in suitable time.

(10) Routine # 10. Produce a list of the received shipment notices to compare it with the reports received from the Freight Forwarder to check the performance of FF.

(11) Routine # 11. Produce list of officers under training for each contracts with information about the training period.

(12) Routine # 12. Produce mailing list each month to send the monthly salary. This list takes much time in the manual system.

(13) Routine # 13. Produce a list of training schedule dates to inform AA ahead of time to prepare and send training officers.

(14) Routine # 14. A list is produced of all the Guarantee letters whose validity date is close to the end of the validity period, sorted by date so the renewal can be done in a suitable amount of time. This list is produced as required to assist the Financial officer in following the guarantee letters.

5. Designed Software

The POW software is designed as a menu driven by the user. The POW main menu screen is appear when issue the name of the main module (EX POWMAINM.FEX). Selecting the options from the screen, each menu leads the user to another one. A help facility is provided to let users move from one screen to another. Three utilities we are going to use are the Filetalk which allow describing the Master Data File (MDF),

the Automode which allow loading the database, and the Tabletalk which allow producing different reports. Describing MDF is already done by the author after determining the software requirements of POWCP, a meaningful names is selected to allow easy understanding for the user. The following pages illustrate a navigation through the designed system:

Screen # 1,Main Menu

```
==========================================================
                      WELCOME TO
                POW DECISION SUPPORT SYSTEM
                      MAIN MENU
            DATA ENTRY / UPDATE / DELETE .... 1
            CREATE NEW FILE DESCRIPTION ..... 2
            GENERATE REPORTS ................ 3
            EXIT ............................ 4
            HELP ............................ 5
                   SELECT (1 2 3 4 5)
==========================================================
```

Select Option 1

```
==========================================================
            WELCOME TO THE PC/FOCUS
          AUTOMATIC DATA MANAGEMENT SYSTEM

==========================================================
          PLEASE ENTER THE NAME OF THE FILE
              YOU DESIRE TO MODIFY:
File name -->            POWDEP
==========================================================
```

Screen # 2,Main Edit

```
==========================================================
      AUTOMATIC DATA MANAGEMENT FILE  POWDEP
              PLEASE SELECT A PROCESS

            1  ADD NEW RECORDS
            2  ADD NEW RECORDS, UPDATE EXISTING RECORDS
            3  UPDATE EXISTING RECORDS ONLY
            4  DELETE RECORDS
            5  RETURN TO MAIN MENU
==========================================================
            ENTER YOUR SELECTION (1 2 3 4)
==========================================================
```

Select Option 1

```
==========================================================
            AUTOMOD OPTION #1...ADD NEW RECORDS
==========================================================
'TAB' FOR NEXT FIELD                'ENTER' TO TRANSMIT DATA
 'F7'  FOR PRIOR SCREEN              'F8'    FOR NEXT SCREEN
            'F3'  TO RETURN TO PREVIOUS MENU
==========================================================

DEPART ID  :
DEPART NAME:
==========================================================
```

```
    Enter Data
==============================================================
DEPART ID   : 02
DEPART NAME: ARMAMENT AUTHORITY

Response -->... RECORD ACCEPTED ..... ENTER NEXT RECORD ....
==============================================================

    Enter the same data to check validation facility
==============================================================
DEPART ID   : 02
DEPART NAME: ARMAMENT AUTHORITY


Response -->... RECORD ALREADY EXISTS ....... REJECTED .....
==============================================================

    Select option 2 in Edit Screen
==============================================================
                AUTOMOD OPTION #2...ADD/UPDATE RECORDS
==============================================================
 'TAB' FOR NEXT FIELD                    'ENTER' TO TRANSMIT DATA
 'F7'  FOR PRIOR SCREEN                  'F8'    FOR NEXT SCREEN
            'F3'  TO RETURN TO PREVIOUS MENU
==============================================================
DEPART ID   :
------------------------------  DEPRESS ENTER  -------------
DEPART NAME:
==============================================================
    Enter key (02)
==============================================================
DEPART ID   : 02
---------------------------  DEPRESS ENTER  ----------------
DEPART NAME: ARMAMENT AUTHORITY

FOCUS response  --> UPDATING EXISTING RECORD
==============================================================

    Enter new Department  (03)
==============================================================
DEPART ID   : 03
---------------------------  DEPRESS ENTER  ----------------
DEPART NAME: TANK

Acknowledge -->   ADDING NEW RECORD
==============================================================
```

```
    Select option 3 in Edit Screen
==============================================================
              AUTOMOD OPTION #3...UPDATE EXISTING RECORDS
==============================================================
 'TAB' FOR NEXT FIELD                    'ENTER' TO TRANSMIT DATA
 'F7'  FOR PRIOR SCREEN                  'F8'    FOR NEXT SCREEN
              'F3'  TO RETURN TO PREVIOUS MENU
==============================================================
DEPART ID  : 03
---------------------------  DEPRESS ENTER  ----------------
DEPART NAME: TANK

---------------------------  ENTER NEW VALUES --------------
==============================================================

    Enter new record
==============================================================
DEPART ID  : 04
--------------------  DEPRESS ENTER  -----------------------
DEPART NAME:

Acknowledge -->  RECORD DOES NOT EXIST....ENTER NEXT RECORD
==============================================================

    Select Option 3 in Edit Screen
==============================================================
              AUTOMOD OPTION #4...DELETE EXISTING RECORDS
==============================================================
 'TAB' FOR NEXT FIELD                    'ENTER' TO TRANSMIT DATA
 'F7'  FOR PRIOR SCREEN                  'F8'    FOR NEXT SCREEN
              'F3'  TO RETURN TO PREVIOUS MENU
==============================================================

DEPART ID  : 02
--------------------------------------------------------------

Acknowledge.: ............. . RECORD DELETED ..............
==============================================================
```

The following are the basic screen of POWCP system. Notice that we select the add/update option and dropped the help part of each screen to save space.

Screen # 3, Vendor Data

```
==============================================================
VENDOR ID   :
------------------------ DEPRESS ENTER ----------------------
THOMAS-VOL-N:                              THOMAS PAG N:
VENDOR NAME:
POF CONTACT:
VENDOR ADRES:
VENDOR CITY:                              VENDOR STATE:
VENDOR ZIPC:                              VENDOR PHONE:
VENDOR TELEX:                              VENDOR ASSET:
VENDOR START:
==============================================================
```

Screen # 4, Item class

```
==============================================================
VENDOR ID1 :
VNDR ITEM C:
------------------------------ DEPRESS ENTER -------------
==============================================================
```

Screen # 5, Vendor / Department

```
==============================================================
VENDOR ID2 :
VNDR DEP NO:
==============================================================
```

Screen # 6,RFP Data

```
==============================================================
RFP NO      :
------------------------------ DEPRESS ENTER ------------
RFP DATE    :                          DEP ID      :
RFP SUBJECT:
N OF VENDORS:                           NOF PROPOSAL:
RFP COMMENTS:
==============================================================
```

Screen # 7, RFC Data

```
==============================================================
RFC NO      :
-------------------------- DEPRESS ENTER -------------------
RFCDATE     :                          RFP NO1     :
DEPART NO1  :
RFC SUBJECT:
FUND LETTER:
FUND AMMOUNT:
RFC COMMENT:
==============================================================
```

Screen # 8,Contract Data

```
==========================================================
CONTRACT NO:
-------------------------  DEPRESS ENTER -----------------
CONTRACT NAM:
CONTRACT DES:
CONTRACT DEP:                              CONTRACT VID:
CONTRACT DAT:                              CONT VALUE :
CONT COMM   :
==========================================================
```

Screen # 9,Contract Item

```
==========================================================
CONTRACT NO1:
CONT ITEM   :
==========================================================
```

Screen # 10,Invoice

```
==========================================================
INVOICE NO :
-------------------------  DEPRESS ENTER  -----------------
INV CONT NO:
INVOICE SUBJ:
INV VENDR ID:                              INVOICE DATE:
INVOICE VALU:                              INV DUE DATE:
INV CHECK NO:                              INV PAY DATE:
INV COMM    :
==========================================================
```

Screen # 11, Pay order

```
==========================================================
  PAY ORDER NO:
---------------------  DEPRESS ENTER  --------------------
PAY ORDR DAT:                              PAY O INV NO:
PAY ORD BANK:                              PAY O VALUE:
PAY O VID   :
PAY TO WHOM :
==========================================================
```

Screen # 12, Pay Check

```
==========================================================
CHECK NO    :
----------------------  DEPRESS ENTER  -------------------
CHK PAY DATE:                               CHK INV NO :
CHK BANK    :                              CHK VALUE  :
CHK VENDR ID:
CHK TO WHOME:
==========================================================
```

Screen # 13, Bank Data

```
==========================================================
BANK NO     :
-------------------------- DEPRESS ENTER -----------------
BANK NAME   :
BANK ADDRES:
BANK CITY   :
BANK STATE  :                          BANK ZIPC  :
BANK PHONE  :                          BANK TELEX :
==========================================================
```

Screen # 14, Bank Account

```
==========================================================
BANK NO1    :
BANK ACC NO:
--------------------------- DEPRESS ENTER ----------------
==========================================================
```

Screen # 15, Shipment Notice

```
==========================================================
SHIP NOTICE:
-------------------------- DEPRESS ENTER -----------------
SHIP CONT NO:
SHIP SUBJECT:
SHIP INV NO:                           SHIP DATE  :
==========================================================
```

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS:

1. The POW system as presented in this thesis is not exactly the same as the existing POW system because of time and travel constraints, however, the main functions, problems and opportunities of POW have been addressed. Adaptation of the system to POW or any other Procurement Office will need only minor effort compared to the effort spent in developing this system. Fortunately PC/FOCUS with its Fourth Generation Language and facilities will allow easy adaptation of the system.

2. No system, no matter how efficient it is, will be effective if it is not employed by its users. There is the possibility that the proposed system will not be used any more effectively than the present manual system. However, it is felt that the probability of this happening will decrease as the users realize the benefits of the system. During the analysis phase all users of the system showed willingness to participate in using a computer system which would improve the effectiveness of the system. The manual system has no more capability to deal with the increased demand for procurement activities in the USA market. Of course, it is the responsibility of POW to support and require use of the system once it has been proven effective.

3. The approach used to design the system is the Iterative Design Approach or Staged Development Approach. The present design of POWCP system is the first iteration, the Commercial Procurement function. After receiving user feedback from the initial system, the second iteration will start. This system will be expanded into a general purpose Decision Support Systems (DSS) to be used in the procurement activities of foreign country procurement offices. Such a system with the DSS generator 'database' will provide an excellent decisionmaking tool as well as providing support for routine operation of the Management Information System, for example financial management and tracking of contracts.

4. Implementing the system required extensive efforts , especially in building the database which is the foundation for any other improvements to the system. The most difficult problem to overcome is the data entry phase for initial loading of the database. The willingness and support of the POW Director and specialized officers are essential for the success of this system.

5. The use of PC/FOCUS provides fully compatibilty with the mainframe FOCUS and its capability to handle external files (not produced by FOCUS) will give the system flexibility to interface with other systems.

6. As long as increases in microcomputer technology continue, no limits are foreseen for the system capability, including multi-user and wide area communication with Cairo.

B. RECOMMENDATIONS:

The objectives of the thesis have been successfully completed. Learning about computer systems development methodology without application is like taking swimming lessons without actually swimming. The process of developing POW was a real challenge. The following remarks about the system can be made:

1. At the beginning, the actual size of the system effort was underestimated which is a common a pitfall in system development.

2. Walking through the details of the system using the structured systems analysis technique enforced the developer to address and describe more details about the system which spent more time and efforts than required within the time limitation of doing the thesis. However this technique has been proven succeeded in designing a roubist information systems in the real world situation.

3. Combining building the DSS generator with the iterative design approach of DSS leads to a conflict in developing system requirements. The DSS generator needs a detailed and complete systems analysis to build the data dictionary down to the primitive level of detail. (Data elements that cannot be divided any more and processes that cannot be exploded any more.) On the other hand, the iterative design approach requires building DSS with short, rapid feedback from users to ensure that development is

proceeding correctly. This may be very difficult if we start from a manual system like POW. To solve this conflict in the real world probelms, developing the DSS (either the iterative or the complete DSS) should be started from a database foundation.

4. Using software development tools is very important, especially in building the DFD and the system data dictionary.

5. Importance of documentation is addressed during the systems development. Self documentation and giving data elements meaningful names are very important in designing the system.

6. Deep understanding of the system is hard to obtain unless you walk through the system. The DFD gives the developer the opportunity for self feedback and to readjust the system as necessary.

7. This thesis can be used as a requirements document for any future development of a DSS for the Egyptian Armed Forces.

Based on the learning experience dicussed above, the following recommendations can be made for the future enhancements of the POW system:

1. It is strongly recommended that efforts continue on designing a usable DSS for POW. The cost-benefits of using the system is extremely favorable.

2. Utilization of PC/FOCUS and its utilities associated with the structured system analysis technique are most suitable for the iterative design approach we used. The recommendation is to purchase the software for implementing and using the system.

3. The most suitable hardware for implementing the system are:

   a. IBM-XT or IBM-AT microcomputer (IBM-AT is preferable because its faster than IBM-XT) with 640 KB and at least one floppy diskette derive

   b. Hard Disk

   c. IBM Enhanced Graphic Adapter to allow using Arabic Language facilities in PC/FOCUS.

   d. Color Monitor

   e. Matrix Printer

   f. Power Supply and Accessories

4. Future Recommendation

It is recommended to advance the implementation of the proposed system until the third iteration, at least. The first and second iterations will emphasize building the DSS generator and giving acceptance by POW users. The third iteration will use the PC/FOCUS capability to build other two modules of the DSS: a model management subsystem which allows analytic capabilities to be added to the system like evaluation of alternatives and formulating relationships between variables in a way that permits the creation of simulation or "what if" models, and a dialog management component which can be tailored to POW functions with a complete help facility to give users of the system full capabilities without prior knowledge in computer programming. PC/FOCUS has the facilities to build both components.

APPENDIX A

DFD CONVENTIONS

Structured Systems Analysis (SSA), as presented in the reference " Structured Systems Tools and Techniques" by Gane and Sarson [Ref. 3] is a technique used to perform systems specification. Data Flow Diagrams (DFD) are used to picture the system and the Data Dictionary is used to define the data elements and the data structure. Processing logic presentations, such as decision tables and structured English are used to precisely specify processing sequences in terms that are understandable to the user and developer. For the commercial procurement subsystem, the SSA specification is refined to the detailed design level. For the other subsystem we stop at the software requirement specification.

A. DFD SYMBOL CONVENTIONS

The logical Data Flow Diagrams are very important for picturing the system to the user; they provide a blue print of the system. This way of presenting the system provides a communication tool between the systems analyst and the user on one side, and between the systems analyst and the software programmers on the other side. The DFD is designed to present the processes in a logical, top down approach, independent of physical location or physical implementation.

This technique emphasizes the data flow through the system providing a comprehensive understanding of the system and resulting in the Data Dictionary the most valuable output in systems development.

As an example, consider the following simple function in DFD:

The system will receive purchase orders from customers, check them against a file of items available, check against some file to see that the customer credit is okay, and cause the items ordered to be sent out with an invoice.

We could show this logical DFD as follows:

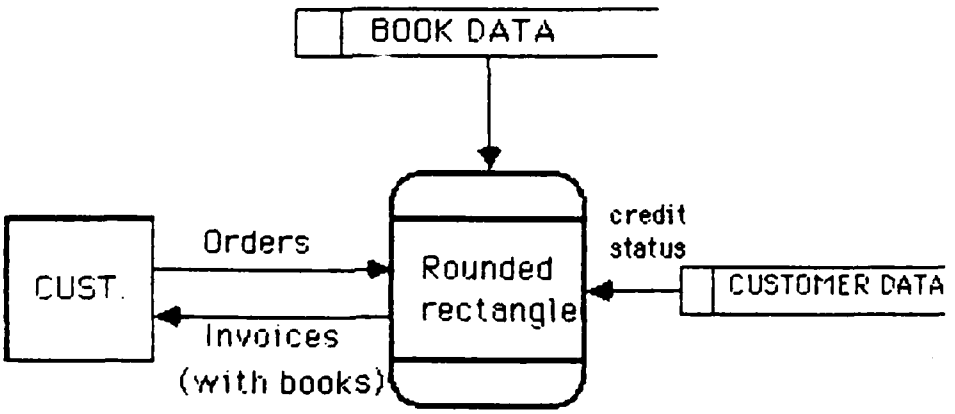


Figure 1 Logical Data Flow Diagram (DFD)

Only four symbols are used to picture this simple function. The flow of data may physically be contained in a letter or an invoice, in a telephone call, from program to

program, via satellite datalink or anyplace where data flow from one entity or process to anther. a process may physically be a room full of operators receiving mail orders, getting money from an ATM machine, or a combination of manual and automated activities. A data store can be a rotary card file, a record book, a microfiche, a filing cabinet, even a table in core, or magnetic file on tape or disk. Using the four symbols enable us to draw a picture of system without committing ourselves to how it will be implemented. We started with a very general DFD and then we could go to the details step by step. Figure 2.2 shows the expansion of the previous DFD. [Ref. 3]

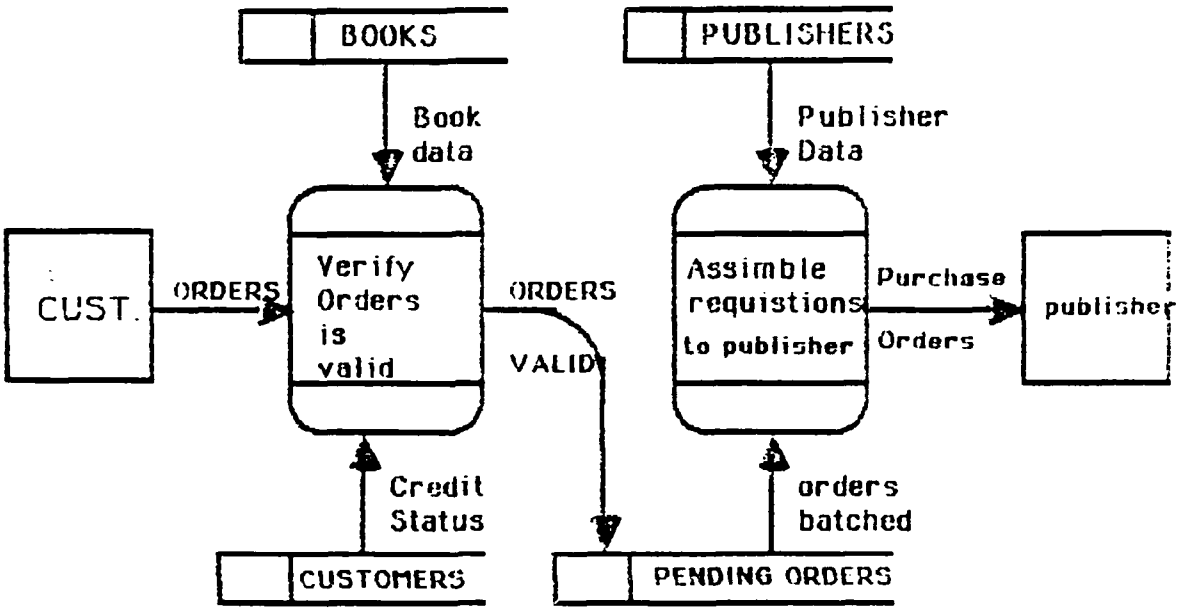


Figure 2 Expanded Logical DFD

We continue the expansion of DFD in a top down fashion until we get to the elementary process level, that can't be divided any more.

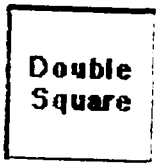
Tracing the DFD is very important to understanding the system. It is advisable for the systems analyst to present a walk through of the DFD with users at the beginning, so the user can get the concept of DFD. The preferable way to

walkthrough the DFD is to start from the external entities and describe the input data flow lines and each process in a logical sequence, and then follow the output data flow lines until exits or is stored somewhere in the DFD.

B. SYMBOLS DESCRIPTION

1. External entities

The most usually logical classes of things or people which represent a source or destination of transactions, e.g, vendors, officers, tactical units, Armament Authority, or Department. If our system accepts data from another system or provides data to it, that other system is an an external entity.



External Entity

Figure 3 External Entity

An entity is identified by lower case letters in the upper left nand corner for reference.

2. Data flow

Data flow is symbolized by an arrow, figure 2.4. Each data flow may be tnought of as a pipe down wnich parcels of data are sent. The data flow may be referenced by giving the processes, entities, or data store at its head and tail.

Figure 4 Data flow symbols

3. Process

The process can be symbolized by an upright rectangle, with the corner rounded, optionally divided into three areas, Figure 2.5.

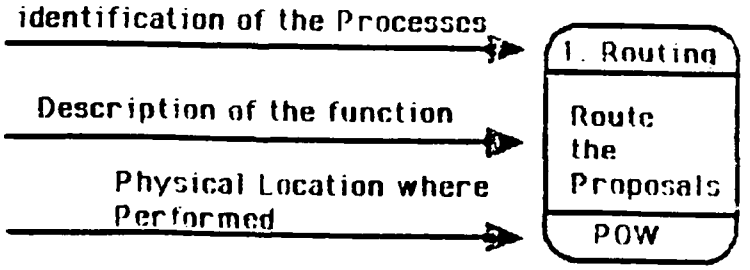


Figure 5 Process

4. Data store

Data store can be symbolized by a pair of horizontal parallel lines, closed at one end (Figure 2.6). Each store can be identified by a "D" and an arbitrary number n in a box at the left end for easy reference.

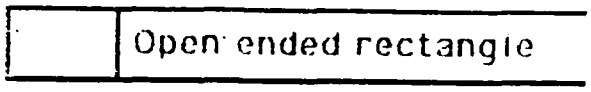


Figure 6 Data store

The external entities and the data stores may be duplicated to prevent interconnections between data flow lines (Figure 2.7). In the external entity, multiple diagonal lines are used to indicate that the external entity is pictured more than once in the same DFD.

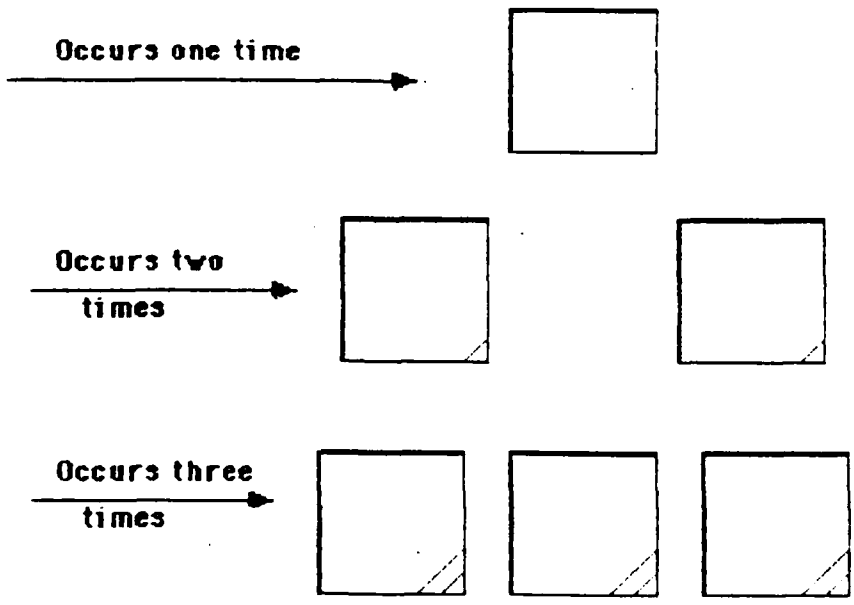


Figure 7. Duplication of the External entity

In the data store, multiple vertical lines are used to indicate that the data store is pictured more than once in the same DFD, Figure 2.8.

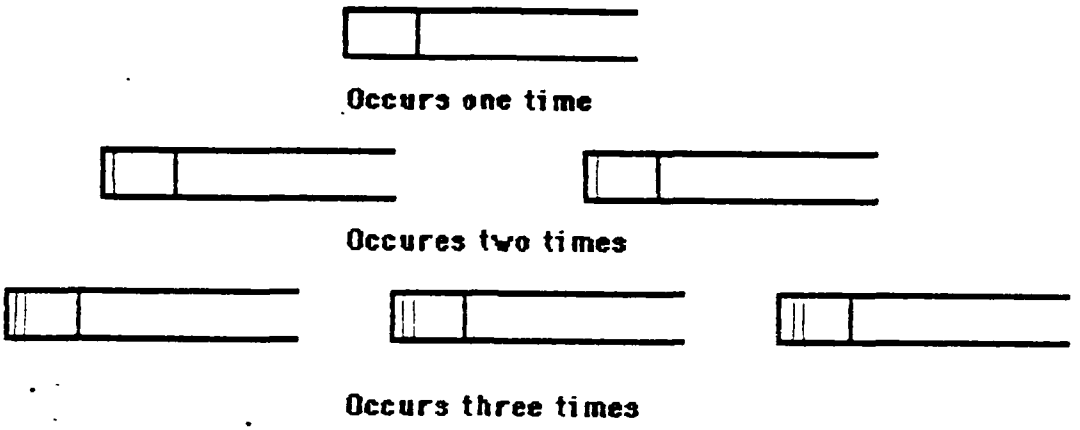


Figure 8. Duplication of Data Store

The information presented ,so far is sufficient to understand the DFD. The second step is to put detailed information about the DFD in a Data Dictionary.

C. THE DATA DICTIONARY

The data dictionary keeps all the details and contents about the data flows, data stores, and processes. The information we need to keep in the data dictionary is classified into three levels:

1. Data Elements

These are the pieces of data that it is not meaningful to decompose further for the applicated at hand; e.g, date, product number, etc.

2. Data Structures

These are made up of data elements, or of other data structure, or a mixture of both, for example:

```
VENDOR
  VENDOR-ID
  VENDOR-NAME
    FIRST-NAME
    LAST-NAME
  PHONE
    AREA-CODE
    NUMBER
    EXTENSION
BUSINESS-START-DATE
BUSINESS-ASSET-VALUE
```

3. Data Flow and Data Stores

Data flows are paths or "pipelines" along which data structures travel. Data stores are places where data structures are stored until needed. In other words, data flows are data structures in motion, data stores are data structure at rest.

The data description hierarchy can be represented as follows.

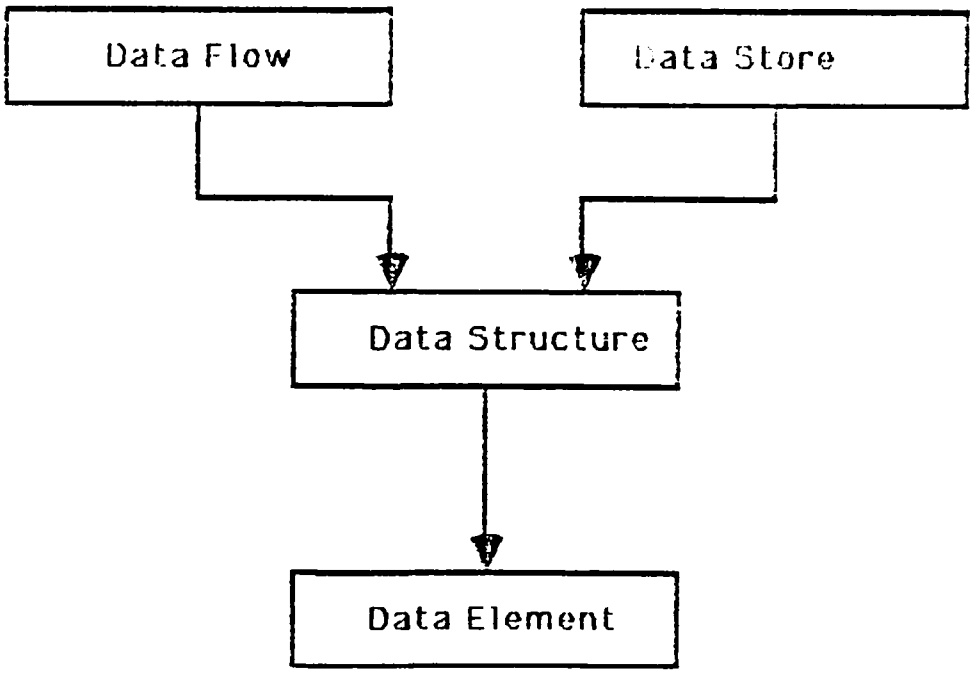


Figure 9 Data description hierarchy

APPENDIX B
MODULES LISTINGS

A. POWMAINM:

```
SET PAUSE = OFF
SET MSG=ON
-TOP
LET !1=HELP
-CRTCLEAR
-BEGIN
-SET &REPLAY=0;
-TYPE
-CRTFORM
-"                                                              "
-"                                                              "
-"                        WELCOME TO                            "
-"                                                              "
-"                POW DECISION SUPPORT SYSTEM                   "
-"                                                              "
-"                                                              "
-"                        MAIN MENU                             "
-"                                                              "
-"                                                              "
-"                                                              "
-"            DATA ENTRY / UPDATE / DELETE .... 1               "
-"            CREATE NEW FILE DESCRIPTION ..... 2               "
-"            GENERATE REPORTS ................ 3               "
-"            EXIT ............................ 4               "
-"            HELP ............................ 5               "
-"                                                              "
-"                      SELECT (1 2 3 4 5) <&REPLAY <77         "
-"                                                              "
-"                                                              "

-IF &REPLAY  EQ  1 GOTO AUTO
-    ELSE IF   &REPLAY EQ 2   GOTO FTALK
-    ELSE IF   &REPLAY EQ 3   GOTO TTALK
-    ELSE IF   &REPLAY EQ 4   GOTO EXIT
-    ELSE IF   &REPLAY EQ 5   GOTO HELP ELSE GOTO NOPE;
-AUTO
EX POWAUTO
-RUN
-CRTCLEAR
-GOTO BEGIN
-FTALK
 FILE TALK
-RUN
```

```
-CRTCLEAR
-GOTO BEGIN
-TTALK
TABLE TALK
-RUN
-CRTCLEAR
-GOTO BEGIN
-HELP
EX POWHELP
-RUN
-CRTCLEAR
-GOTO BEGIN
-NOPE
-TYPE &REPLAY IS NOT A VALID OPTION
-... PLEASE REVIEW OPTIONS AND RE-ENTER
-GOTO BEGIN
-quit
-EXIT
```

B. POWAUTO: -[Ref. 9]

```
SET PAUSE=OFF
SET MSG=OFF
-TOP
-CRTCLEAR
-IF &1.EXIST EQ 0 GOTO NONAME;
-SET &FNAME=&1;
-GOTO GOTNAME
-NONAME
-SET &FNAME='         ';
-START
-CRTFORM
-"                                                    "
-"                                                    "
-"           WELCOME TO THE PC/FOCUS                  "
-"                                                    "
-"       AUTOMATIC DATA MANAGEMENT SYSTEM             "
-"                                                    "
-"                                                    "
-"                                                    "
-"                                                    "
-"       PLEASE ENTER THE NAME OF THE FILE            "
-"                                                    "
-"            YOU DESIRE TO MODIFY:                   "
-"                                                    "
-"              <T.&FNAME <77   "
-"                                                    "
-"                                                    "
-TYPE                      PLEASE WAIT
-TYPE
-TYPE            THE MAIN MENU IS NOW LOADING
```

```
-GOTNAME
-IF &FNAME.LENGTH GT 8 GOTO BADNAME;
-SET &FF = &FNAME || '.MAS' ;
-DOS STATE &FF
-IF &RETCODE NE 0 GOTO
NONAME;
-SET &REPLY=' ';
-SECTION1
-CRTFORM
-"                                                              "
-"                                                              "
-"      AUTOMATIC DATA MANAGEMENT FILE <D.&FNAME <77            "
-"                                                              "
-"              PLEASE SELECT A PROCESS                         "
-"                                                              "
-"                                                              "
-"      1   ADD NEW RECORDS                                     "
-"      2   ADD NEW RECORDS, UPDATE EXISTING RECORDS            "
-"      3   UPDATE EXISTING RECORDS ONLY                        "
-"      4   DELETE RECORDS                                      "
-"                                                              "
-"      5   RETURN TO MAIN MENU                                 "
-"                                                              "
-"                                                              "
-"       ENTER YOUR SELECTION (1 2 3 4) <&REPLY  <77            "
-"                                                              "
-"                                                              "
-IF &REPLY EQ 1 GOTO ADD ELSE IF &REPLY EQ 2 GOTO ADDUP
-ELSE IF &REPLY
- EQ 3 GOTO UP ELSE IF &REPLY EQ 4 GOTO DEL ELSE
- IF &REPLY EQ 5 GOTO EXIT
- ELSE GOTO NOPE;
-ADD
MODIFY FILE &FNAME
CRTFORM
"                                                              "
"       AUTOMOD OPTION #1...ADD NEW RECORDS                    "
"                                                             "
"   'TAB' FOR NEXT FIELD     'ENTER' TO TRANSMIT DATA         "
"   'F7'  FOR PRIOR SCREEN   'F8'  FOR NEXT SCREEN            "
"         'F3'  TO RETURN TO PREVIOUS MENU                    "
" "
CRTFORM
*
MATCH *
KEYS
ON NOMATCH TYPE
" "
".... RECORD ACCEPTED .... ENTER NEXT RECORD ......"
ON NOMATCH INCLUDE
```

```
ON MATCH TYPE
" "
".... RECORD ALREADY EXISTS .... REJECTED ....."
LOG DUPL MSG
OFF
DATA
END
-TYPE                    PLEASE WAIT
-TYPE
-TYPE           PC/FOCUS IS LOADING YOUR FILE
-RUN
-TYPE                     PLEASE WAIT
-TYPE
-TYPE          PC/FOCUS IS UPDATING YOUR FILE
-GOTO SECTION1
-ADDUP
MODIFY FILE &FNAME
CRTFORM
"       AUTOMOD OPTION #2...ADD/UPDATE RECORDS      "
"                                                   "
"   'TAB' FOR NEXT FIELD  'ENTER' TO TRANSMIT DATA  "
"   'F7'  FOR PRIOR SCREEN   'F8'  FOR NEXT SCREEN  "
"         'F3'  TO RETURN TO PREVIOUS MENU          "
"                                                   "
" "
CRTFORM *
KEYS
"                   DEPRESS ENTER                   "
" "
MATCH *
KEYS
ON MATCH TYPE "UPDATING EXISTING RECORD "
ON NOMATCH TYPE "ADDING NEW RECORD"
ON MATCH/NOMATCH  CRTFORM T.* NONKEYS
ON MATCH UPDATE
*
ON NOMATCH
INCLUDE
LOG NOMATCH MSG OFF
DATA
END
-TYPE              PLEASE WAIT
-TYPE
-TYPE     PC/FOCUS IS LOADING YOUR FILE
-RUN
-TYPE               PLEASE WAIT
-TYPE
-TYPE     PC/FOCUS IS UPDATING YOUR FILE
-GOTO SECTION1
-UP
MODIFY FILE &FNAME
```

```
CRTFORM
"================================================="
"   AUTOMOD OPTION #3...UPDATE EXISTING RECORDS   |"
"=================================================|"
"  'TAB' FOR NEXT FIELD 'ENTER' TO TRANSMIT DATA  |"
"   'F7'  FOR PRIOR SCREEN 'F8'FOR NEXT SCREEN    |"
"         'F3'  TO RETURN TO PREVIOUS MENU        |"
"=================================================|"
" "
CRTFORM                                                          *
KEYS
 "
"                    DEPRESS ENTER                              "
MATCH *
KEYS
ON NOMATCH TYPE
"     RECORD DOES NOT EXIST....ENTER NEXT RECORD    "
ON MATCH TYPE
"                   ENTER NEW VALUES                "
" "
ON MATCH CRTFORM T.*
NONKEYS
ON MATCH UPDATE
*
LOG NOMATCH MSG
OFF

DATA
END
-TYPE                    PLEASE WAIT
-TYPE
-TYPE         PC/FOCUS IS LOADING YOUR FILE
-RUN
-TYPE                   PLEASE WAIT
-TYPE
-TYPE       PC/FOCUS IS UPDATING YOUR FILE
-GOTO SECTION1
-DEL
MODIFY FILE &FNAME
CRTFORM
"                                                               "
"      AUTOMOD OPTION #4...DELETE EXISTING RECORDS              "
"                                                              "
"   'TAB' FOR NEXT FIELD     'ENTER' TO TRANSMIT DATA         "
"   'F7'  FOR PRIOR SCREEN     'F8'   FOR NEXT SCREEN         "
"           'F3'  TO RETURN TO PREVIOUS MENU                   "
"                                                              "
" "
CRTFORM *
KEYS
"   "
MATCH *
```

```
KEYS
ON NOMATCH TYPE
" "
".. RECORD DOES NOT EXIST .... ENTER NEXT RECORD ..."
ON MATCH TYPE
" "
"............................. . RECORD DELETED ...."
ON MATCH
DELETE
LOG NOMATCH MSG
OFF
DATA
END
-TYPE                  PLEASE WAIT
-TYPE
-TYPE         PC/FOCUS IS LOADING YOUR FILE
-RUN
-TYPE                  PLEASE WAIT
-TYPE
-TYPE         PC/FOCUS IS UPDATING YOUR FILE
-GOTO
SECTION1
-BADNAME
TYPE INVALID FILE NAME (EXCEEDS 8 CHARACTERS)
-GOTO
TOP
-NOPE
-TYPE &REPLY IS NOT A VALID OPTION
-....PLEASE REVIEW OPTIONS AND RE-ENTER
-GOTO SECTION1
-NONAME
-TYPE FILE NAMED &FNAME|.XXX CANNOT BE LOCATED...
-PROMPT      &REPLY.RE-ENTER      FILE      NAME      OR      TYPE
QUIT.
-GOTO SECTION1
-EXIT
```

C. POWDIC:

```
SET PAUSE = OFF
SET MSG=OFF
-TOP
-CRTCLEAR
-IF &1.EXIST EQ 0 GOTO NONAME;
-SET &FNAME=&1;
 GOTO GOTNAME
-NONAME
-SET &FNAME='         ';
-START
-TYPE THIS IS THE AN ONLINE HELP SCREEN
-CRTFORM
```

```
-"                                                    "
-"              ONLINE HELP SCREEN                    "
-"                  =========                         "
-"                                                    "
-"      INFORMATION ON FOCUS .............<1>        "
-"      INFORMATION ON FOCEXECS ..........<2>        "
-"      DICTIONARY MAINTENANCE  ..........<3>        "
-"      QUIT .............................<4>:       "
-"                                                    "
-"                                                    "
-"                                                    "
-PROMPT &SELECT.     WHAT IS YOUR CHOIC ?  .
-END
```

D. **POWHELP:**

```
-CRTCLEAR
-BEGIN
-SET &REPLAY=0;
-TYPE
-CRTFORM
-"                                                    "
-"                                                    "
-"                     POW                            "
-"                                                          "
-"                       HELP SCREEN                        "
-"                                                          "
-"                                                          "
-"                                                          "
-"                                                          "
-"                                                          "
-"                                                          "
-"                                                          "
-"                 1. System Description                    "
-"                 2. Online Help                           "
-"                 3. Exit                                  "
-"                                                          "
-"                                                          "
-"                    SELECT (1 2 3     ) <&REPLAY <77      "
-"                                                          "
-"                                                          "

-IF &REPLAY  EQ  1 GOTO SYSDESC
-   ELSE IF   &REPLAY EQ 2   GOTO ONLINE
-   ELSE IF   &REPLAY EQ 3   GOTO EXIT
-   ELSE GOTO NOPE;
-ONLINE
EX POWDIC
-RUN
-CRTCLEAR
-GOTO BEGIN
-SYSDESC
```

```
-TYPE            *** WILL BE DEVELOPED 1ATER  ***
-GOTO BEGIN
-NOPE
-GOTO BEGIN
-quit
-EXIT
```

Form Negotiation Team	FNT	2.1.3
Negotiate Vendors	VEGV	2.2
Contract Award Process	CAWRD	2.3
Prepare Contract Draft	PCD	2.3.1
Calculate Value of Contracts	CVC	2.3.2
Check the Technical Terms	CTT	2.3.3
Collect all Documents	CAD	2.3.4
Final Review of the Contracts	FROC	2.3.5
Sign the Contract	STC	2.3.6
Sign The Contract	SC	2.4
Funding Contracts	FC	3
Identify the Source of Fund	ISOF	3.1
Process Fund From Budget	PFFB	3.2
Collect Documents of Contracts	CDOC	3.2.1
Open Credit Letter for Vendor	OCRL	3.2.2
Payment of Initial Deposit	POID	3.2.3
Process Fund From Loan	PFFL	3.3
Prepare Request for Funding From Loans	PRFL	3.3.2
Payment Initial deposit from Loan.	PIDFL	3.3.2
Administer Contract	AC	4
Payment Process	PAYP	4.1
Register and Route the Payment Documents to the Specialized Officer	RGR	4.1.1

Check Payment Documents	CPDOC	4.1.2
Check Duplication	CHKD	4.1.3
Check Invoice Amount	CHKIA	4.1.4
Monitor Training of Personnel	MTOP	4.2
Prepare Training Plan	PTP	4.2.1
Inform Vendor by Trainee Names	IVBTN	4.2.2
Prepare Status Reports	PSR	4.2.3
Monitor Shipment of Items	MSOI	4.3
Prepare Shipment Plan	PSHP	4.3.1
Compare and adjust Shipment	CADSH	4.3.2
Reporting	REP	4.4
Prepare Status Reports	PSREP	4.4.1
Prepare Progress Reports	PPREP	4.4.2
Prepare Comparison Reports	PCREP	4.4.3
Prepare Analysis Reports	PAREP	4.4.4
Generate Vendor List	GVL	5
Verify vendors	VERV	5.1
Check, if Vendor Exist	CHKVE	5.2

C. DATA STORES

DATA STORES	ABBREVIATION	IDENTIFICATION
Vendor list File	VLF	D1
RFP Monitor File	RFPMF	D2
Contracts to be Funded	CTBF	D3
Active Contracts	AC	D4

Contract Monitor File	CMF	D5
Pending Proposals File	PPF	D6
General Log Book	GLB	D7
Thomas Register	TREG	D8
Pending RFC File	PRFCF	D9
Vendor Meeting Schedule	VMS	D10
Final Reports Collection File	FRCF	D11
Fund Source File	FSF	D12
Contracting Implementation Plan	CIP	D13
Officers Work Load	OWL	D14
Rules and Regulations	RAREG	D15
Best and Final Offer	BAFO	D16
All Contract's Document File	ACDOC	D17
Budget Monitor File	BMF	D18
Loans Monitor File	LMF	D19
Previous Payment Monitor File	PPMF	D20
Training Plan File	TPF	D21
Shipment Plan	SHPF	D22
Shipment Notice Keeping File	SHNKF	D23
Shipment Monitor File	SHMF	D24
Pending Vendor Requests File	PVRF	D25

D. DATA FLOWS

DATA FLOWS	IDENTIFICATION
RFP	a-1
''	a-1.1
''	a-1.1.1
''	1.1.1-1.1.2
''	1.1.2-1.1.3
''	1.1.3-1.1.4
''	1.1.4-b
RFP Subject & date received	1.1.1-D7
''	1.2.1-D6
RFP Subject & Department	D2-1.1.3
''	1.1.2-D2
New Vendor Name	1.1.3-1.1.5
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''	1.1-b
Proposals	b-1
''	b-1.2
''	1.2-D6
''	D6-1.3
''	1.3-a
''	b-1.2.1
''	1.2.1-1.2.2
''	1.2.2-1.2.3
''	D6-1.2.3

Proposals	1.2.3-a
Number of Proposals & Vendors	1.2.3-D2
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''	D1-1.1
''	D1-1.1.3
''	D1-1.1.4
Vendor Name	D6-1.1.4
RFP Monitor Data	1-D2
''	1.1-D2
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Replay	b-1.1.5
Vendor Company Profile	D8-1.1.5
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New Vendor Data	1.1.6-D1
Supplementary Vendor List	1.1.6-1.1.4
RFC	a-2
''	a-2.1
''	2.1-D9
''	a-2.1.1
''	2.1.1-2.1.2
''	2.1.2-2.1.3
''	2.1.3-2.1.4
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Names of Negotiation Team	2.1.5-D13
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Vendor Telephone & Address	D1-2.1

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''	D2-2.٥.٥
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''	a-٥.٥.1
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Contract Draft٥	2.2.٥-2.٥.5
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''	D12-2.1.٥

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''	a-3.1
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''	e-3.2.1
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''	b-3.2.1
''	b-3.3.2
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	d-3.3.2
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''	3.2-D18
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''	4.1.3-4.1.4
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''	b-4.1
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''	b-4.2.1
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''	D5-4.2.1
''	4.2.1-D21
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''	4.2.2-D21
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