1-1-1989

Aero-industry EDP business systems environment

Gregory T. Soule

Aero-Industry EDP Business Systems Environment

by

Gregory T. Soule

An Applied Management

Decision Report

submitted in partial fulfillment

of the requirements for the degree of

Master of Business Administration

Cardinal Stritch College

December, 1989

APPROVAL PAGE

This committee has approved the Applied Management Decision Project of Gregory T. Soule

Dan Brachman 10/30/89

Dan Brachman, Case Study Advisor Date

11/1/89

Larry McCarthy, Second Reader Date

TABLE OF CONTENTS

TABLE OF CONTENTS

CASE SUMMARY

Aero-Industry is a Fortune 500 aerospace and industrial component manufacturing corporation. It is divided into Aerospace and Industrial business segments with total sales of $1.5 billion in 1988. It experienced rapid growth throughout the past fifteen years as it diversified its product lines. Executive management's overriding operational strategy promoted decentralization of business operations and EDP business systems.

The Aerospace segment consists of three divisions: Power Systems, Data Control and the Advanced Technology. These divisions have recently pleaded guilty to violations of Department of Defense (DOD) contract compliance regulations that resulted in record fines of over $130 million. The DOD specifically identified shortcomings in the inventory control and cost accounting management systems of the divisions. Most of these problems must be resolved as part of the settlement agreement. The problems will not be easy to resolve because the current systems were designed on a decentralized basis that has led to the existence of redundant data, processes and system interfaces. The lack of integration has resulted in increased staffing to use and maintain the systems. The Aerospace industry operates within a complex business environment that places many external and internal requirements on the organization and its business systems. The requirements are subject to periodic modification that creates a very complex systems environment for the divisions to maintain and operate.

The DOD settlement coincided with the resignation or retirement of several key executives. A new chief executive (CEO) and

executive team was appointed to aid the organization's recovery. The new executives have struggled with the multiple systems, operational and financial reporting formats and terminology used by the three Aerospace divisions. The CEO identified a strategic need to standardize systems and reporting and named a special committee to answer the question: How can the divisions simplify the EDP business systems environment to accommodate the changing external and internal requirements placed on business operations?

There were three alternatives identified and evaluated:

1. continue to operate with the existing systems
2. improve the integration level of the existing systems
3. replace the existing systems with a new, integrated system

Aternative 1 is not feasible because it does not resolve the strategic need identified by the CEO. Alternative 2 is feasible, but it is a short term solution and is questionable from a cost/benefit standpoint. Alternative 3 is a long term solution that resolves the systems problems and supports the strategy of system simplification. It was recommended that a vendor system package be purchased over in-house development to reduce the implementation time to two years. This will improve the strategic position of Aero-Industry to react to business changes. It was recommended that management authorize the purchase and implementation of a new, integrated system.

SECTION 1

Introduction

Aero-Industry is a Fortune 500 corporation with corporate headquarters in Milwaukee, Wisconsin. It is a major manufacturer of aircraft, aerospace and industrial component equipment. It had sales of $1.5 billion in 1988. The operations are divided into Aerospace and Industrial business segments. The Aerospace segment has been plagued by United States Department of Defense (DOD) charges of fraud and overcharges on various government contracts since 1987. The DOD conducted several audits of Aerospace segment business operations, policies, procedures and electronic data processing (EDP) business application systems.

The audits tied up critical company resources and presented a very high opportunity cost to Aero-Industry operations. The audits resulted in several confirmed instances of fraud and contract overcharges on various government contracts and the subsequent levying of charges against two of the Aerospace divisions. The company ultimately agreed to the largest defense contractor fraud settlement in history and paid over $120 million in penalties in 1989.

The DOD auditors identified key shortcomings in the Material Management and Accounting Systems (MMAS). MMAS are the EDP business systems used to control and cost inventory. The shortcomings violated government contract compliance regulations in the areas of planning, tracking, allocating and reporting of specific contract product costs.

Several key executives have resigned or retired since the start of the audits. A new chief executive officer (CEO) was brought in

from the outside, and a new management team was formed. The CEO has committed to resolve all the identified shortcomings in all EDP business systems to satisfy all contract compliance requirements as part of the settlement agreement. The CEO has decided that the business needs to be run in a more centralized manner. The CEO believes that there is too much duplication of effort and different terminology being used by the divisions. The financial data is not reported in a standardized fashion which hinders it's use for planning and control purposes. To remedy the situation, the CEO appointed a committee to analyze alternatives and present a recommendation to the executive office that includes a plan for continuing with the recommendation. The writer has chosen to perform an analysis of the issues involved and develop a recommendation independent of the special committee.

SECTION 2

Aero-Industry's Current Situation

Organization

Aero-Industry has experienced rapid growth since 1977 as a corporation due to the success of existing product lines, new product lines, and diversification into other aerospace and industrial businesses. Revenues have grown from $500 million to approximately $1.5 billion since 1977. The corporation is divided into three major segments: Corporate, Aerospace and Industrial.

The Corporate segment oversees the activities of the Aerospace and Industrial segments. The executive office that controls all corporate activities is located in Milwaukee, Wisconsin. All recent chief executive officers (CEO) have had an aerospace background. The Executive Vice-President has an industrial background.

The Aerospace segment has fueled most of the growth and is responsible for approximately sixty-five percent of revenues. Aerospace consists of three main business divisions: Data Control, Power Systems and the Advanced Technology Group. These divisions produce electrical, mechanical and hydraulic components used in both commercial and military aircraft. Products include constant speed drives, electric power regulators, actuation systems, fuel pumps, air valves and other components used in engine starting, environmental control, navigation and audio and visual systems.

The three divisions have multiple locations. Data Control has operations in Washington, California, Arizona and Massachussetts. The Power Systems division has operations located in California and

Arizona. The Advanced Technology Group has operations in Illinois, California, Arizona, Nebraska, Colorado and Singapore.

The Industrial segment accounts for thirty-five percent of revenues. This segment produces gear drives and flexible couplings for basic industries; pumps, compressors and blowers for processing industries; heat transfer components for heating and air conditioning; and rotary screw air and gas compressors for construction and general industry. The Industrial segment has divisions located in Indiana, Colorado, Michigan, Missouri, Texas, Alabama and Wisconsin.

Aero-Industry began as a manufacturer of mechanical products and gradually moved into the Aerospace business as a result of the market monopoly position of the constant speed drive (CSD) product. The company's CSD was used on virtually all modern aircraft until the advancement of electrical technology. CSD sales and related research and development led to the development of other aerospace and high-technology products that caused the company to focus on the Aerospace business.

The Aerospace business includes both commercial and military applications. It is cyclical in nature. Military business grew rapidly during the Reagan presidency, but is expected to remain flat into the next decade. Currently forty percent of Aerospace sales are military. Commercial business was flat during the Reagan presidency as a result of deregulation and the subsequent cutthroat competition among the airlines for market share. The competition lead to fare wars and declining revenues that caused most airlines to delay the replacement of older aircraft. Now that the weak competitors have consolidated with stronger airlines, old fleets are being replaced and

commercial business is strong and should continue to be strong into into the next decade. Commercial sales represent about sixty percent of Aerospace sales.

Aero-Industry has developed a reputation as a high-quality, high-cost manufacturer in the Aerospace industry. It has traditionally invested huge sums of capital into research and development activities to develop and maintain a technological edge over the competition. It also uses an excellent employee compensation and benefit program to attract and retain an excellent workforce.

The Industrial segment has gradually become the minor player in the corporation. Revenues had been depressed over the last decade until making a comeback beginning in 1987. Business is expected to remain strong into the next decade, but will continue to be placed behind the Aerospace segment in the attention it receives.

Automated Business Systems

Aero-Industry's growth and expansion led to enormous pressure to automate existing business systems into EDP business systems. Automation was required due to competition, increased business transaction volume and the need to control increasing staff levels. There was no central policy guiding EDP business systems development at the time. Each division developed unique systems over time to support the business functions related to their unique operations. These systems were developed in a modular fashion with little thought given to integration of the systems and data. If one system needed data from another system an interface was developed. This process was replicated over time until it was standard practice, and as a result, each Aerospace

and Industrial division developed or purchased their own EDP systems, computer software, computer hardware and Systems Development staff.

The decentralized approach to EDP systems development was not unique to Aero-Industry and was prevalent throughout industry over the last twenty years. Formal EDP business systems were developed to support the automation of customer order management, master production scheduling, purchasing, inventory control, shop floor control, cost accounting management systems, billing and pricing systems. The DOD refers to these systems as material management and accounting systems (MMAS) and they are used to control procurement for, manufacturing of and costing of products used to fill customer orders. As each system was developed as a separate module, required interfaces were also developed for communication among systems. For example, the order management system passed product demand data to the inventory control system to facilitate production and generation of the necessary product inventory. Typically, the functional department designed each system to meet it's current operational and informational needs only.

The EDP business systems designed and used by the Industrial divisions are relatively simple compared to the Aerospace systems. This is due to the tremendous external requirements placed on the Aerospace divisions to comply with product and contract requirements. Some of these external requirements are documented in Appendix A. The commercial sector requires various safety and quality certifications as well as compliance to Air Transport Association (ATA) requirements. The military sector places even more requirements on contractors' systems. The DOD has identified ten key elements that must be accommodated by a contractor's EDP systems to be in compli-

ance. These are listed in Appendix B. A schenmatic diagram depicting the Material Management and Accounting Systems (MMAS) for the Advanced Technology Group is depicted in Appendix C.

Typical aerospace MMAS include order management, master production scheduling (MPS), inventory control, shop floor control, cost accounting systems (CAMS) and billing systems. Order management supports the functions involved with processing customer orders from the time the order is received from the customer until it is shipped to the customer. If the requested product is available, it is pulled from inventory and shipped. If it is not available, it is backordered until the product is generated. Product demand information is passed to the MPS and inventory control systems.

MPS reviews the quantities and dates of each product that is required and combines production quantities for efficiency. MPS makes use of a detailed bill of material, associated manufacturing process information and leadtimes required to generate inventory.

Once the MPS process is complete, the data is passed to the inventory control system which processes all the information required to breakdown all ordered products into the step-by-step processes and components necessary to mnufacture the products. Included in this process is a determination as to which components to purchase from vendors and which components to manufacture as well as the creation of workorders and production schedules. Purchase order requirements are passed to a purchasing module to enable buyers to initiate requests for price quotes or release purchase orders to vendors to supply components. The system then tracks the order as shipments are received from the vendor and transferred to inventory.

Once the inventory control system has processed all the data and produced a production schedule, the data is passed to a shop floor control (SFC) system that is used to manage the flow of workorders through all factory manufacturing processes. The SFC system uses bill of material and factory operation information to track and collect process information for each workorder.

Costs associated with the components, processes and labor involved with processing the workorder are recorded and passed to the Cost Accounting Management Systems (CAMS). CAMS accumulates order costs and stores the costs for use in product costing and inventory valuation. Other costs are assigned to products based on overhead rates. Once a product is shipped to satisfy a customer order, the CAMS transfers the costs from finished inventory to a cost of sales account. Similarly, sales data is passed from the customer order management system to the CAMS. Periodically all CAMS data is passed to divisional and corporate general ledger accounting systems.

The general ledger systems categorize the data and provide summary financial reporting to financial and executive management. In addition, the customer order management and CAMS systems interface with a billing system to generate customer invoices and process invoice payments as well as pay vendors for purchase order receipts.

Systems Development Process

The process that results in the development of a new EDP business system usually begins with identification of a need in a functional department. The department prepares, collects and develops a cost justification statement that documents the need and benefits related

to the system and presents the justification statement to management for authorization. The requesting department becomes the system sponsor. The divisional EDP Systems Development department becomes involved once the management authorization is received. Systems Development assists in defining the requirements for and developing the EDP system to meet the user department needs. Several functions have been automated over the last fifteen years at all divisions. Typically each system has been viewed as a separate entity with little or no attention given to other systems and data needs. This was the typical development mode that most manufacturing companies followed as the computerization age matured and most businesses were looking to automate day-to-day operations. The main problem with this approach is that it resulted in the same data and processes being contained in multiple systems. The Advanced Technology Group has product item inventory data stored in the order management, inventory control, and CAMS systems to satisfy the user needs for inventory balance information. Transactions that updated inventory balances in one system had to be sent to the other two systems to keep the balances reconciled in all three systems. The existing redundant environment results in much confusion for both the system users and the Systems Development staff.

The life cycle of each system begins when it is implemented. External and internal business requirements change over time and require that periodic maintenance be made to the system to ensure continued useability. Maintenance support, for existing systems, is a costly process that usually results in adding a certain level of complexity to the system programs and makes future maintenance even more

difficult for the Systems Development staff. A continual pattern of maintenance can leave an EDP system in disarray over the years.

This pattern occurred with most of the key EDP business systems over the years at all Aerospace divisions due to the pressures to to respond to changing internal and external business requirements. Each Systems Development staff was increased gradually over the years to accommodate the increased need to enhance and maintain existing systems, because the environment continually limited the staff's ability to develop new systems. Data Control and Power Systems currently have staffs of ten developers each to accommodate the needs of divisions generating $150 million and $100 million in sales. The Advanced Technology Group has a staff of sixty developers to accommodate divisional sales of $660 million. All three staffs operate on a direct chargeback basis and services are billed as an expense item back to the sponsoring department's budget. The current staffs have been reduced by thirty to forty percent over a two year period. An average rate of $47 per hour is currently charged for developer services. Senior management has cut-back on the use of Systems Development services since the direct chargeback process was implemented in 1987.

D.O.D. Audits

The DOD began audits into Aero-Industry aerospace operations in early 1987. Congress responded to public pressure resulting from media stories reporting deliberate overcharging by defense contractors on various contract programs. Congressional pressure led the DOD to audit defense contractor policies and EDP business systems in

relation to the contract compliance regulations set forth by the DOD. The huge increases in the DOD budget combined with stories of $100 hammers and $200 coffee pots created a very emotional environment.

The DOD requirements applied to all government contracts and the elements require EDP business systems to be designed to identify, track, and report contract cost data. Key requirements include cost accounting standards, inventory control, and cost/schedule control criterion. The DOD sent an auditing team in to review all aspects of Aerospace operations.

The Data Control division was audited first. The DOD auditors identified costs that were applied to military contracts that should have been applied to commercial contracts. These findings resulted in Data Control agreeing to pay $15 million in penalties.

The Data Control division audit was followed by an audit of the Advanced Technology Group division. The auditors found several shortcomings in cost allocation, accounting and billing practices. Improper labor and overhead charges were applied to several military contracts and shortcomings in the policies and EDP systems for accummulating these charges were identified. Elaborate perks for some executives were also identified as being improperly charged to military contracts. These findings led Aero-Industry to agree to the largest defense-fraud settlement ever and pay over $120 million in penalties. The company was placed on the suspended contractor list and could not bid on any new military contracts. Any further problems could have resulted in the company being suspended from doing business on existing contracts. The audits and investigations also tied up key personnel and resources for more than a two-year period which

presented a high opportunity cost to Aerospace operations by diverting attention away from strategic activities. The associated negative publicity resulted in a loss of prestige for the company and the employees.

Several key executives, including the Chief Executive Officer (CEO), retired or resigned during or shortly after the audits and investigations. A new CEO was named that had previous aerospace experience and a good reputation within the industry. He quickly placed new individuals in key management positions with the intention of resolving negative feelings with the DOD. The CEO embarked on a public relations campaign aimed at soothing relations with the DOD and the general public. The corporation adopted a formal code of business conduct and ethics that included formal education and training of all employees on proper business conduct and ethics.

The investigations and negative publicity also had a very negative effect on employee morale. The negative financial effect that the settlement had on the Aerospace segment resulted in an increased emphasis on cost reduction within all functional departments. There were substantial personnel and capital budget cutbacks in an eighteen month period that has had severe negative impact on employee productivity and morale.

Management has emabarked on a campaign to review all policies, procedures and EDP business systems to ensure that proper guidelines exist to direct the day-to-day operations and decision-making involved in running the Aerospace business. The CEO has committed to DOD officials that all EDP systems will be brought into compliance with contract regulations.

The DOD has pressured the Aerospace divisions to get the MMAS environment into compliance with the ten key elements referenced in Appendix B. All system-related proecedures and training manuals are being reviewed and revised as needed. Various enhancements are being made to the systems to bring them into compliance. The DOD has scheduled additional audits of the procedures, policies and systems in late 1989. Two MMAS change review committees have been named to control the changes being made to the systems. The Technical Committee includes members from Systems Development management and management from the key functional departments. The Executive Committee includes the vice-presidents from the key business functions that are responsible for the MMAS systems. These committees must review and approve all system changes before they can be made. This process has worked to slow the rate of change being applied to the systems and also continued to tie up key management personnel and and reduced the time these individuals spend on strategic issues.

The DOD has forced this requirement on the divisions because of the previous lack of management involvement in and control of system enhancements. The changes that have been made to several of the MMAS have made the systems difficult to understand and maintain. Several systems are old or have been modified enough over time that the systems need to be replaced of re-written.

New Management Direction

The new CEO and executive management team has been struggling to understand the divergent operations and activities of the Aerospace and Industrial business segments during a transition period. They

are receiving a first-hand look at the multiple financial and operating data, reporting and terminology used by all divisions. The CEO does not favor the decentralization philosophy of the previous executive team. He is pushing for more consistency in management reporting and business terminology. Consistency should aid in increasing his ability to compare the plans and performances of the divisions as well as monitorring and recognizing variances to the plans. Consistency should lead to reduced information processing costs as well as increased economies of scale. It follows that if all divisions use the same terminology and reporting processes, the transfer of personnel between divisions and future reorganizations or acquisitions will be much simpler to accomplish.

The CEO appointed a special committee, with representatives from each division, to review alternatives to bring the EDP systems of all Aerospace divisions into compliance with government contract regulations and standardize financial and operational reporting for all Aerospace and Industrial divisions.

SECTION 3

Identification of the Problem

Aero-Industry is faced with continual pressure by the DOD to ensure that the MMAS of all aerospace divisions meet all government compliance regulations. Each division has had to increase the level of divisional management involvement in the review and control of system changes. Failure to get the systems into compliance could result in the DOD suspending the company from doing business with the government. However, the DOD is not the only factor that requires business systems to be changed. Internal factors such as organization changes, management style and operational improvements result in the need to make changes. There are also other external requirements placed on the business from the commercial sector such as various quality requirements and compliance with the Air Transport Association requirements for processing orders electronically.

The new CEO wants to standardize the financial and operational reporting received from each division. The existing reporting is too diverse to allow comparisons between divisions due to the use of different terminology and formats.

The current systems at the aerospace divisions were designed in a modular mode that has led to the development of several complex and redundant interfaces between the systems that have added a great degree of complexity to the tasks of maintaining and retaining system integrity. Most of the existing business systems were developed over the last twenty years. The volume of system changes that have been required over the years have led to the need to re-write some of the

systems. The costs associated with the Systems Development staffs and and other costs associated with these systems is a long term management concern that the organization must address.

The lack of systems integration is the key problem that Aero-Industry must address in resolving the above operational issues. The external and internal environment will continue to force the aerospace divisons to modify and enhance the business systems. The organization must come to grips with the current environment and improve it's ability to change the systems as required by internal and external factors in order to control the organization's exposure to risk. The divisions must develop a greater degree of integration between the business systems in order to respond more effectively and efficiently to the environmental business requirements placed on the organization.

SECTION 4

Analysis of the Problem

The lack of system integration is the key problem facing the Aerospace divisions of Aero-Industry. It seriously hinders the organization's ability to respond to the external and internal factors that continually pressure the organization to modify procedures, policies and EDP business systems. The competitive aerospace industry operating environment generates requirements that the company must comply with, such as the DOD requirements. Executive management acted responsibly in agreeing to resolve the identified EDP business system shortcomings as part of the settlement agreement. Further denial of compliance problems would have resulted in additional audits and the continued need to divert management attention from strategic issues. The organization could have been suspended from any further government contract business, further tarnishing its image and profitability.

The government contract compliance regulations are subject to continual revision by the DOD. The regulations are complex and require specialized personnel to interpret and guide the organization in formalizing policies, procedures and EDP systems. There is no one compliance expert within Aero-Industry. The DOD officials are not always authorities on the regulations either. The organization needs to stay abreast of the compliance requirements and ensure that the policies, procedures and systems that are used to guide the day-to-day business operations fulfill the requirements. The EDP business systems must be designed to be flexible enough to accommodate periodic changes in compliance requirements.

Current MMAS System

The integration problem centers on the fact that the Aerospace divisions designed systems in modular fashion over the last twenty years. Most of the key MMAS were developed individually to meet the needs of a functional department. Each system was designed to accomodate the functional department's information needs based on its input and direction. This mode of system development resulted in a reduced ability to produce timely information for the whole organization. It also made it difficult to effectively and efficiently provide information to other systems as needed on a timely basis.

The decentralized approach to systems development, in each Aerospace division, has resulted in a redundant and complex EDP business system environment. An examination of the Advanced Technology Groups's MMAS systems illustrates the complexity of the current system environment. The key MMAS systems are order management, MPS, inventory control, shop floor control, CAMS and billing.

The order management system was implemented in 1982. It is an interactive system that includes the order entry, order administration, shipping, invoicing and accounts receivable functions. It has no major identified weaknesses. It retains product item and inventory data that is redundant with MPS, inventory control and CAMS. Once a customer order is entered, end product demand is passed to MPS via a daily batch interface and spare part demand is passed to inventory control via a weekly interface.

The MPS system is used to group and schedule customer demand for end products to make the most efficient use of inventory, labor and

equipment. The system was purchased and implemented in 1983. It is used by production schedulers to manipulate product demand quantities and schedules passed by order management. MPS stores redundant product item and inventory data. A weekly batch interface passes the demand data to the inventory control system.

The inventory control system is composed of several modules: item data control, material requirements planning, purchasing, order tracking and inventory tracking. The five modules were implemented from 1974 through 1977. Item data control functions to maintain the item, bill of material, stockroom and manaufacturing process information for all items used in all products. The information is updated using manually-written transmittals that are keyed to tape and entered to a batch system update process. This module also had redundant item and inventory data.

The material requirements planning module uses the item data, end product demand data from MPS and other product data from order management to determine the flow of work and product manufacturing schedules through the factories. It is a weekly regenerative process that produces new manufacturing schedules and reporting used by manufacturing support personnel.

The purchasing module receives suggested order information for component items used in the manufacturing processes of products. Purchasing support personnel review and use the information to request quotes for items from vendors and to place firm purchase orders with vendors. The system makes use of manually-written transmittals that are keyed to tape and entered into a batch update process. Purchase order documents and data error listings are produced. The order in-

formation is used by material requirements planning in generating manufacturing schedules. The order tracking module stores information about each manufacturing order. The inventory tracking module stores item inventory and stockroom location information. The order and inventory tracking modules are updated via a batch update interface with the SFC system.

The SFC system is used to open, record activity and track all manufacturing orders open to generate products to meet customer demand. SFC was implemented in phases from 1983 through 1985. SFC receives reorder and manufacturing process information from inventory control via weekly and daily batch interfaces. It is an interactive system. SFC also stores redundant item, inventory, order, bill of material and manufacturing process information in conjunction with inventory control. It has daily batch interfaces with the inventory control modules. When a product order is completed, SFC provides the capability to allocate the product to a customer order and relieve the demand. Another batch interface is used to pass this data to the MPS and order management systems. SFC also passes recorded manufacturing process and cost information for each order to the CAMS for storage via a daily batch interface.

The CAMS system collects, processes and stores all costs and transactions associated with inventory and manufacturing orders and processes. It receives information from the order management, inventory control, SFC and billing systems via batch interfaces. The system information is updated three times per week which presents a greater chance that it is not synchronized with the other systems at any one point in time.

The billing systems include accounts payable and progress payments. The accounts payable system is over twenty years old and requires the manual processing and entry of vendor invoices. It needs to be re-written. The progress payment system is used to calculate accumulated costs associated with certain government contract orders for billing purposes. The government allows progress billing invoices to be issued on certain long-running contracts to relieve the contractor's burden in carrying the accumulated inventory and overhead costs. The old semi-manual system had its calculation processes declared non-compliant in 1988 and a new system was implemented in 1989. The system consists of several complex processes due to the need to pull data from all MMAS systems for use in the allocation of inventory and cost accumulation processes.

Current MMAS System Problems

The MMAS environment contains product item data bases in five of the systems. Manufacturing order data is stored in four of the systems. Inventory information is stored in five of the systems. The transactions used to update these data bases result in a complex set of redundant transaction interface processes, audit trails and reconciliation reporting and exercises.

The complex environment requires large systems development, manufacturing support and cost accounting staffs to support the systems. Appendix D includes information on the resources utilized by these groups at the Aerospace divisions.

Since 1987, the systems development staff has been required to spend over eighty percent of work capacity on MMAS and other system

enhancements required due to changes in both internal and external requirements within the industry. The staff has spent minimal time developing new or strategic business information systems. A simple change such as adding a new manufacturing plantsite or identifying an order as being a DOD priority-rated order requires changes to multiple systems due to the high level of redundant data and the lack of integration between the systems. These changes are time-consuming and costly and continually frustrate management.

The Problem

Each division is addressing the compliance issues and implementing solutions to their respective MMAS systems. The compliance issues are being addressed and will be satisfied in the near future. A more strategic issue needs to addressed by the organization: How can the Aerospace divisions simplify the EDP business systems environment to improve their ability to accommodate the changing internal and external requirements placed on business operations?

The need to reduce redundancy and integrate the data and the processes included in the current systems environment is key to the strategic needs of the organization in the dynamic, complex aerospace industry. Executive management's desire to simplify and streamline the financial and operational reporting it receives, requires standardization of and increased timeliness and accuracy of the information. Too much time has been spent on treating the symptoms related to the requirements placed on the organization. The organization must address the issue of systems integration or the divisions will continue to consume tremendous resources operating and maintaining the

existing systems and scrambling to react to new business requirements.

Section 5

Description of Potential Solutions

Aero-Industry is faced with the MMAS business systems integration problem at all three Aerospace divisions. There are three alternatives for the organization to evaluate:

1. continue to operate with the existing business systems
2. improve the integration level of the existing business systems
3. replace the existing systems with a new, integrated business system

Alternative 1 - Continued Use of Existing Systems

This alternative has a few advantages. It will not interrupt the current operations. It will allow the divisions to retain the unique functionality that is designed into the systems. This alternative will not require any additional EDP development costs.

However, it has several disadvantages. It does not decrease the level of data and processing redundancy that is common with the existing systems. As a result, the manufacturing and accounting staffs cannot be decreased. In addition, large EDP system development staffs will need to be retained to support on-going system maintenance. This alternative does not support executive management's direction toward common reporting and terminology and does not improve the timeliness of or accuracy of data. It also does not accommodate the transfer of personnel, products and facilities between the divisions because it does not reduce the need for retraining or conversion. The biggest

disadvantage is the opportunity cost it presents the organization. An estimated $2.5 million in staff resources is tied up annually dealing with system inefficiencies.

Alternative 1 is impractical. Continued reliance on these systems threatens Aero-Industry's competitive position in the industry. One of the most pressing problems with the existing MMAS systems is the reliance on batch data entry, processing and interfaces. The inventory control purchasing module is a prime example of this inefficiency. A buyer analyzes production's need for a component item and decides a new purchase order to a supplier is needed. The buyer must write his purchase order data on several transimittal documents that are sent to a data entry clerk who keys the data from the transmittal onto a data tape with other purchase order requests. The tape is input into a batch process that edits the entered data for errors. If any errors occur, an exception record is created and printed on an exception report that the buyer will receive sometime the next workday. He must correct the data and resubmit a new transmittal and go through the same batch process. If it passes all edits, a purchase order document is printed and the buyer will receive it, review it and mail it to the vendor. The whole process should be done on an interactive basis. The buyer should enter the data on a terminal, have the system edit it, make any necessary corrections, submit it and generate a purchase order document instantaneously. This type of labor-intensive process exists throughout the three divisions. The need to remain competitive, contain costs and adapt to changing business requirements preclude the selection of this alternative.

Alternative 2 - Improve System Integration Level

The second alternative would involve rewriting or replacing some MMAS systems to improve the integration level. The order management system is the only MMAS system that should remain intact. The MPS and inventory control systems would be modified to receive and transfer data between the order management, SFC and CAMS systems on an interactive basis. Most of the batch, time-delayed data entry and batch processing would be overhauled. These changes would provide more timely data as well as reduce the professional and clerical staffs by ten percent or twenty-seven people. It is estimated that changes could reduce the time the manufacturing and cost accounting staffs spend submitting, correcting and reconciling data by about twenty percent. It would also allow the divisions to retain the unique functionality that is built into the systems. The increase in integration reduces the need for EDP systems development personnel by approximately seven, as data and processing redundancy is reduced.

The main shortcoming with alternative 2 is that it only improves the integration problem. It does not solve it. Multiple data bases will still store redundant data and redundant interface processes will be required to retain data integrity. The fact that all three divisions will still be operating in this environment with three different MMAS systems and three sets of unique terminology does not provide any strategic advantage to Aero-Industry. Executive management would still have to contend with terminology and reporting differences. It is a short term solution that has a questionable payback and a high opportunity cost. It is estimated that the total effort would take

approximately two years and twenty-five thousand manhours ($560K) to complete for the ATG division. These resources could be better spent addressing a long term solution.

Alternative 3 - Install a New, Integrated System

Alternative three proposes that a new, integrated MMAS business system be implemented at all three divisions. The divisions are all focused on approximately the same markets for commercial and military products and must comply with the external requirements of the DOD and the aerospace industry. It is more economical to resolve the integration problem on a centralized basis to minimize development and maintenance costs and EDP staff requirements for the three divisions versus having each division develop their own system. A common MMAS system would also accommodate executive management's strategy for common business terminology and reporting by the divisions. It would also enhance the organization's ability to transfer products, facilities and personnel among the divisions. All three divisions would be able to reduce staff levels by an estimated twenty percent or approxi- fifty-four people, as the need for redundant data handling and reconciliation would be reduced. System interfaces would be minimized with the use of an integrated system. This will result in a reduction of fifteen EDP personnel included in the fifty-four mentioned above.

There are some disadvantages. The divisions may lose some of the existing functionality. Training requirements and the need to revise policies and procedures would divert attention from current operations and consume about $1 million in personnel to implement. It is the most costly alternative. Its biggest drawback is the estimated four

year timeframe needed to develop and implement it at all divisions. Political maneuvers by the divisions to ensure that their own unique requirements are met could extend that timetable.

One way to counter these drawbacks would be to purchase an integrated system package from a software vendor. A project team consisting of functional business and EDP representatives from all three divisions, should be assigned the responsibility to document the requirements that the system must meet and use this to select a vendor system. The requirements should comply with the DOD compliance requirements (ten key elements), accommodate management's strategy for common reporting and terminology, minimize data and processing redundancy and emphasize interactive processing. A purchased system will cost more than an internally developed system initially. However, a purchased system could be installed in about two years. The shorter installation period would result in an earlier payback in staff and processing savings of over $5.7 million versus an additional $900K cost associated with the purchase of a vendor system. The intangible, strategic benefits of having an integrated system installed two years earlier, further add to the attractiveness of this alternative. It is obvious that this is the most logical long term solution.

Refer to Appendix E for comparative estimates of the savings and costs associated with the three alternatives.

SECTION 6

The Resolution

Standard System Justification

The implementation of a new, integrated EDP business system is the best long term solution to the system integration problem. It is not feasible to continue to operate with the existing MMAS systems due to the extra resources and staff required to operate them. It is feasible to rewrite or replace some of the existing MMAS systems to improve the integration level, but it would be costly and would only benefit the organization in the short term. Aero-Industry has the opportunity to implement a system that will improve current business operations and provide a strategic tool to assist the Aerospace divisions operate well into the next decade. The system must resolve the integration problem, meet DOD compliance requirements and satisfy executive management strategy for system and reporting standardization.

All three Aerospace divisions target closely-related markets. All three must comply with the same industry requirements. Even though the divisions operate on a decentralized basis, it makes sense to use a standard system for the common MMAS system functions. Each division loses some of the unique functionality that has been designed into the existing systems, but standardization provides benefits that more than offset this loss. Information processing continues to grow as the need for more timely information to run the business grows. Processing costs continue to grow and represent a larger portion of

total operational costs. In addition, the need to share information among systems and divisions is becoming more critical to the business.

A standard system with integrated data bases would work to reduce data processing costs and would save an estimated $350K annually. Integrated data bases minimize data and processing redundancy. There is no need for item product information to be stored on multiple data bases and for multiple interface processes to keep the data synchronized. The task of generating accurate, timely reporting is simplified. The system design is simpler which translates into reduced training needs and lower staffing in the manufacturing, accounting and EDP functions that use and maintain the system. Initial personnel training costs for the new system are estimated at $1 million. It facilitates electronic data transfer between divisions and locations which would reduce the need for and distribution of paper documents and reports for an annual savings of $100K. A standard system will also facilitate the transfer of personnel, products and facilities between divisions and improve resource utilization since retraining would be minimal and common terminology is used. A standardized, integrated system would also reduce the pressure placed on the EDP systems development organization to accommodate changes due to reduced data and processing redundancy.

The Aerospace Group at Boeing Aircraft and 3M Corporation have implemented standardized, integrated systems with success. Boeing has saved $617 million on an investment of $285 million and the CEO wants to use standard systems company-wide. Both Boeing and 3M developed the system internally. Aero-Industry estimated that it would take a minimum of four years to develop its own system. Aero-Industry cannot

wait that long. It needs to move quickly to resolve the integration problem. The purchase of a vendor software system is a more favorable alternative. The company will more than offset the additional cost of purchasing the vendor software system package with two additional years of personnel savings as shown in Appendix E. The organization should be able to select a system and implement it in all divisions within two years. This approach will minimize the delays and resistance that an internal development project would experience. The vendor system software will not provide all the unique functionality the divisions have grown accustomed to, but it will provide the functions needed to run the business. The organization needs to move quickly to solve its problem and a vendor system would provide this solution two years sooner with much less disruption to current operations.

Implementation Plan

The first task that must be completed is to select a special project team to staff the project on a full-time basis. The team would include representatives from the three Aerospace divisions. The project team would report directly to a project manager who has overrall responsibility for the project and reports to the CEO. This will minimize conflicts and improve divisional participation. Once this is complete, the rest of the project plan can be developed. A high-level project plan is documented in Appendix F.

The first task is to define and document the system requirements. The project team must involve other divisional personnel to ensure proper business requirements are defined. These requirements will be

used to evaluate different vendor systems and make a final selection. This is an important task and it must be properly managed in order to complete it on a timely basis.

The documented requirements should be submitted to selected vendors in the integrated systems market. The vendors should review the requirements and prepare a response documenting the requirements their systems meet and do not meet. A review session should be scheduled with each vendor that responds and is judged to have a system that fits Aero-Industry's needs. The review should include a demonstration of each system and appropriate system and technical information should also be provided to the project team.

No more than three vendors should be selected for further review after the initial review is completed. Each vendor should be analyzed a second time and technical issues such as programming languages, data base systems and technical support should also be included in the second review. A vendor should be selected and the system and associated costs reviewed, approved and funded by executive management.

Once vendor selection is complete, detail implementation plans can be defined. Involvement of technical EDP personnel is critical to ensure a successful implementation in Aero-Industry's computing environment. Each division should be implemented separately to minimize risk to on-going operations. Data Control and Power Systems are much smaller than ATG and it makes sense to implement at these divisions first. It will also allow any system problems to be worked out without impacting the major division. Organization structure, procedures and policies, system training and converting existing data to the new system are key tasks in the implementation phase. Many

detail tasks will be identified and must be assigned to divisional personnel as each division's implementation plan is developed. Aero-Industry should target to have the system implemented at all divisions within two years.

Impact on the Organization

Implementation of a new, integrated business system will have a tremendous positive impact on the organization. It will provide Aero-Industry with a competitive boost by strategically upgrading its system environment leading into the next decade. The system will be simpler to use and facilitate more timely generation of information needed to run the business. It will also cause a minor revolution within the business functions of each division as each struggles to convert from a decentralized to a centralized system environment. A certain faction will undoubtedly resist the change, but top management support will alleviate most of the resistance.

The ability of each division to react to changing internal and external requirements will be greatly enhanced. Any required changes will be accommodated on a more timely basis. The DOD compliance requirements and the ten key elements will be satisfied. Executive management will be able to develop and transfer management personnel between locations and divisions much more easily due to standard reporting and terminology. The organization should have a system that fits the flow of the business and the flow of the business needed to remain successful well into the next decade. It will affect the job functions of the existing system users and will allow the business functions to reduce staffs and simplify jobs. It will probably affect

organization structures by reducing the need for management personnel to gather, summarize and interpret data for the next level of management. This will result in a flatter organization structure. The number of personnel involved with redundant data processing and reconciliation will also be reduced.

Finally, the need for large EDP staffs will be reduced. The redundant data bases and interface processing will be reduced allowing for staff reductions or involvement in other information systems or projects. The simplified system environment will contribute to the bottom line at all three divisions by reducing information processing and staffing costs as well as contributing to the execution of activities in support of the organization's strategies.

APPENDIX A

EXTERNAL BUSINESS REQUIREMENTS

1. GAAP - Generally Accepted Accounting Principles
2. IRS - Foreign Sales Corporation, Inventory Valuation, Others
3. ATA - Air Transport Association

FEDERAL GOVERNMENT REGULATIONS:

4. Cost Accounting Standards
5. Cost Type Contract Requirements (FAR)
6. Quality Assurance Considerations
7. Progress Billing Regulations (FAR)
8. MRP (MMAS) Guidelines
9. Cost/Schedule Control Systems Criterion (C/S CSC)
10. Priority Flowdown Requirements
11. U.S. Customs Requirements
12. Small And Disadvantaged Business Program
13. Work Measurement, MIL-STD 1567A

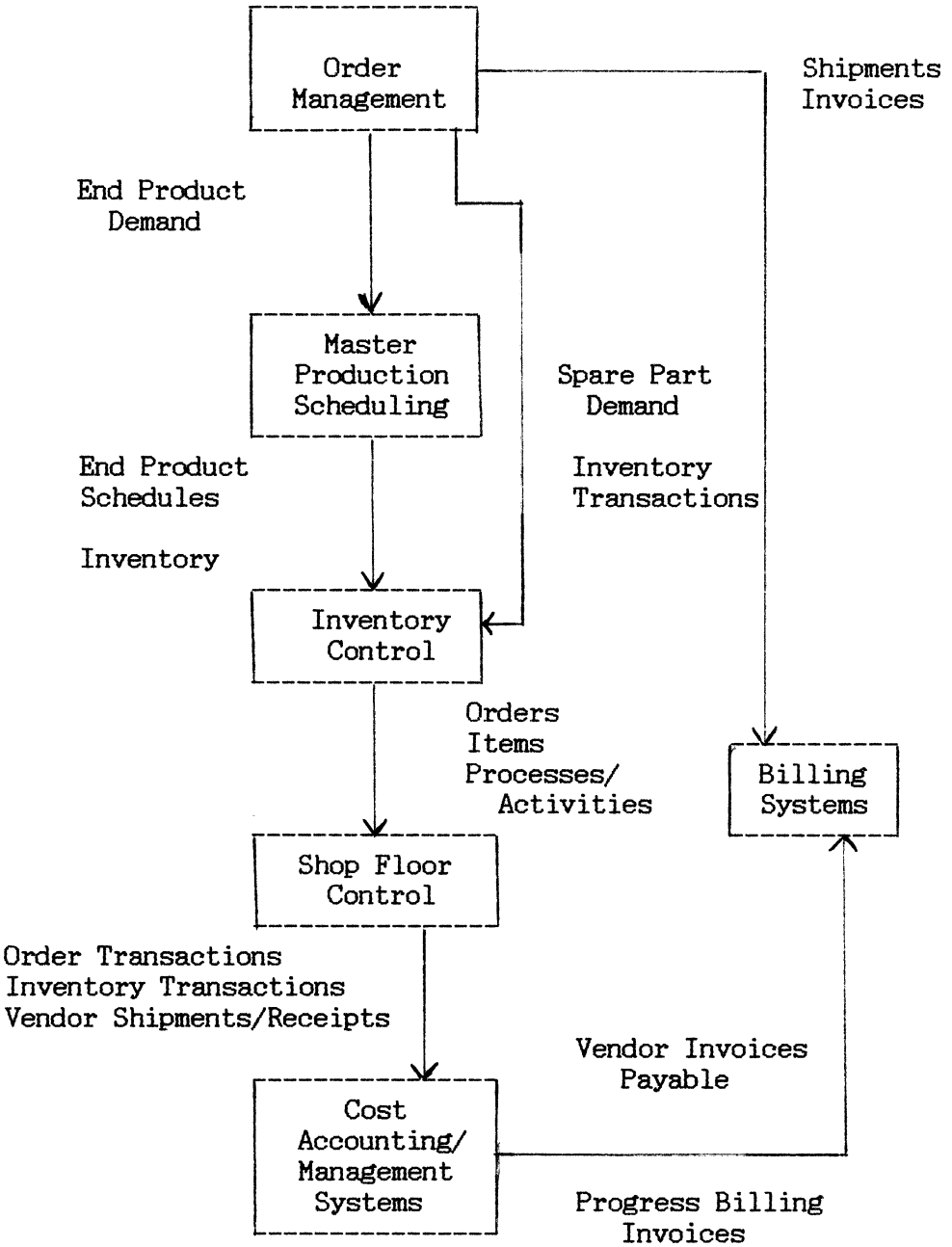
APPENDIX B

DOD 10 KEY EDP SYSTEM COMPLIANCE CRITERION

1. Applicable Policy / Procedure / User Guide
2. Accuracy Levels of Bill-of-Material and Master Production Schedule
3. Identify System Control Weakness & Manual Override
4. Records Retention & Evaluate System Logic
5. 95% Inventory Accuracy Level
6. Transfer of Parts
7. Cost of Material Transaction
8. Common Inventory Allocation Controls
9. Commingled Inventories
10. Internal MRP Audit Plan

APPENDIX C

MMAS SYSTEM INTERFACE BLOCK DIAGRAM



APPENDIX D

RESOURCES UTILIZED
MANUFACTURING AND COST SYSTEMS

	ATG	Power Systems	Data Control
1989 Sales	$661M	$98M	$150M
Plant Sites	10	1	3
Product Numbers	60K	4.5K	25K
Monthly EDP Costs:			
CAMS	$100K	N/A	$1K
CAMS & MRP	$394K	$40K	$40K
EDP Staff	56	10	10
CAMS Staff	25	3	3
MRP Staff	107	22	38
Manufacturing Orders	24K	1K	5K

APPENDIX E

COMPARISON OF SAVINGS AND COSTS FOR THE THREE ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3
Staff Base / Estimated Reduction	274	-10%	-20%
EDP	76	69	61
CAMS	31	28	25
MRP	167	150	134
TOTAL	274	247	220
Annual Personnel Savings *	0	$1235K	$2471K
Annual Processing Savings	0	$75K	$350K
TOTAL ANNUAL SAVINGS	0	$1310K	$2821K
Additional Training Costs *	0	$750K	$1000K
Internal Development Costs * Optional Vendor Purchase	0	$560K	$1540K / $2400K
TOTAL SYSTEM COSTS	0	$1310K	$2540K / $3400K
PAYBACK PERIOD	N/A	1 YEAR	.9 YEAR / 1.2 YEARS

* = $22/hour average personnel costs

Alternative 1 - Continued Use of Existing System

Alternative 2 - Improve System Integration Level

Alternative 3 - Install a New, Integrated System

APPENDIX F

INTEGRATED SYSTEM IMPLEMENTATION PLAN

Task	Time
1. Organize Project Team	
2. Define and Document System Requirements	2 months
3. Submit Requirements to Vendors	1 month
4. Vendor System Reviews & Demonstrations	2 months
5. Preliminary Selection of 3 Vendors	
6. Select Vendor System & Obtain CEO Approval	1 month
7. Divisional Implementation Plans	
- Data Control	6 months
- Power Systems	6 months
- Advance Technology Group	6 months

This is a high level plan that will have detail tasks added as the project develops.