GUIDE FOR

MODULAR CONTRACTING

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FOREWORD

The General Services Administration (GSA) is issuing this *Guide for Modular Contracting* to assist federal agencies in employing modular contracting techniques for their major information technology development efforts. It provides useful information on the application of modular contracting techniques, and it should be used in conjunction with Federal and agency regulations and directives.

This guide is one in a series to be issued by GSA that will focus on key issues and important topics in the acquisition and management of information technology (IT) resources. We welcome your comments regarding this guide and the acquisition guide series. Comments and/or suggestions for improving future versions of the guides should be sent to:

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We also welcome suggestions for topics to be covered in future guides. Please contact the Emerging IT Policies Division at (202) 501-1551.

Acquisition guides and white papers published to date, as well as additional information about federal IT acquisition, are available on the IT Policy OnRamp: http://www.itpolicy.gsa.gov.

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GSA also gratefully acknowledges the following individuals who assisted in the review of this guide: Ms. Diana Maykowskyj, Defense Logistics Agency; Mr. Stan March, United States Social Security Administration; Mr. Walter Cate, United States Department of State; and Mr. Carl Peckinpaugh, Winston and Strawn law firm. GSA also thanks the Federal Systems Integration and Management Center (FEDSIM), who provided program management and contracting assistance in developing the series. It also acknowledges the Modular Acquisition Work Group of the Government Information Technology Services Board, whose *Modular Acquisition in Support of "Access America": A Best Practices Guide* was used in the development of this guide. Finally, GSA would like to thank the Robbins-Gioia Inc., of Alexandria, Virginia for granting permission to include its program management plan outline as an attachment to this guide.

GSA's Office of Emerging IT Policies (MKE) identifies, addresses, and develops emerging business, management, legal, and technology issues. MKE disseminates timely and useful IT policies, guidance (such as this Modular Contracting Guide), and best practices to federal agencies. For more information about the Emerging IT Policies Division, please contact Mr. Richard Kellett at (202) 501-1650, or by e-mail at richard.kellett@gsa.gov, or contact Mr. David Middledorf at (202) 501-1551, or by e-mail at dave.middledorf@gsa.gov.

Federal Systems Integration and Management Center (FEDSIM) is a part of GSA's Federal Technology Service and provides information technology client services on a fee-for-service basis. For more information on FEDSIM's capabilities, please contact Ms. Martha Banks, Program Manager, at (703) 756-4234, or by email at Martha.Banks@gsa.gov.

SIGNAL Corporation is a leading high-technology services company, providing Information Technology, Engineering and Management, and Multimedia Services in industry and government. For more information on SIGNAL's capabilities, please contact Mr. Wayne Self, Vice President, at (703) 205-2461, or by email at wayne_self@signalcorp.com, or view SIGNAL's web site at www.signalcorp.com.

Acquisition Solutions, Inc (ASI) is a small business dedicated to helping government agencies understand and implement acquisition reform and best practices. For information on this guide, or on ASI corporate capabilities, contact Mr. Chip Mather, Senior Vice President, at (703) 378-3226, or by email atchip.mather@acqsolinc.com .

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EXECUTIVE SUMMARY

Modular contracting is an acquisition strategy that breaks a large "grand design" program into discrete components that are easier to manage. To increase the application of modular contracting techniques in the acquisition of major information technology (IT) systems, Congress passed, and the President signed, the Information Technology Management Reform Act (ITMRA, P.L. 104-106, also known as the Clinger-Cohen Act). Section 5202 of this law directs federal agencies to use modular contracting "to the maximum extent practical" in the acquisition of major IT systems. Following Clinger-Cohen, the President issued Executive Order No. 13011, which instructs agencies to apply modular contracting "where appropriate" and "to the maximum extent practicable."

As defined in the Clinger-Cohen legislation and Executive Order, modular contracting provides for the delivery, implementation, and testing of a workable system or solution in discrete increments or modules. In its simplest terms, modular contracting is the acquisition of a major IT system in successive increments of interoperable modules that:

- Are easier to manage individually than they would be in one comprehensive acquisition.
- Address complex IT objectives incrementally to enhance the likelihood of achieving workable solutions to attain those objectives.
- Provide for delivery, implementation, and testing of workable systems or solutions in discrete increments, each of which comprises a system or solution that is not dependent on any subsequent increment in order to perform its principal functions.
- Provide an opportunity for subsequent increments of the acquisition to take full advantage of any evolution in technology or needs that occur during implementation of the earlier increments.

Analysis of relevant laws, regulations and studies, etc., indicates that modular contracting can provide a significant opportunity to address and overcome problems endemic to major systems development efforts. Through the appropriate application of an incremental strategy, agencies can decrease overall program risk, obtain quicker results, realize a more rapid return on investment, and incorporate rapidly evolving technologies into subsequent modules and increments. Practical application of modular contracting techniques has the potential to greatly improve the chances of success in large federal information technology development programs.

The Guide for Modular Contracting provides government program, technical, and contracting officials with an introduction to modular contracting. It provides valuable background and "how to" information on the application and use of modular contracting techniques. This guide is intended to greatly assist an agency in successfully planning and conducting a modular development effort. However, despite the comprehensive scope of this guide, the application of modular contracting techniques to major systems development efforts requires significant judgment and experience.

While reducing some risk associated with system development, application of modular strategies introduces a number of additional management and cultural changes. Modular contracting tech-

niques require increased attention to areas such as agency IT architecture, interoperability standards, systems integration, program management, and configuration control.

Modular contracting is one strategy that can be used by federal agencies to acquire major IT systems. However, no matter what the acquisition strategy, people continue to be the deciding factor for success. The knowledge, skills, talent, and experience of both the project team and contractor personnel remain the key determinant of a successful development program. Agencies are encouraged to ensure that a highly skilled and knowledgeable team of acquisition professionals is available to be dedicated to a program before pursuing any major development effort.

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LIST OF ACRONYMS

AFCEA	Armed Forces Communications and Electronics Association
CCB	Configuration Control Board
CIO	Chief InformationOfficer
CLIN	Contract Line Item Number
CM	Configuration Management
CMM	Capability Maturity Model
COTS	Commercial Off-the-Shelf
CPFF	Cost Plus Fixed Fee
EO	Executive Order
FAR	Federal Acquisition Regulation
FASA	Federal Acquisition Streamlining Act (P.L. 103-355)
FFP	Firm Fixed Price
FSS	Federal Supply Schedule
FY	Fiscal Year
GPRA	Government Performance and Results Act (P.L. 103-62)
GSA	General Services Administration
GWAC	Governmentwide Acquisition Contract
ICD	Interface Control Document
ICWG	Interface Control Working Group
ID/IQ	Indefinite Delivery/Indefinite Quantity
IPT	Integrated Product Team
IT	Information Technology
ITMRA	Information Technology Management Reform Act (P.L. 104-106); also known as the Clinger-Cohen Act
ITOIWG	Information Technology Oversight Improvement Working Group
OBS	Organization Breakdown Structure
OMB	Office of Management and Budget
PL	Public Law
PM	Program Manager
PMP	Program Management Plan
RFP	Request for Proposal
ROI	Return on Investment
WBS	Work Breakdown Structure

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND

The current statutory preference for modular contracting is the result of a considerable history of high-profile, multi-billion dollar failures of "grand design" information technology (IT) development efforts. The "grand design" approach to IT development often resulted in systems that were extremely expensive, fielded years behind schedule (if at all), provided less than the desired capabilities, and were most often technologically outdated by the time they were implemented.

While the failure of megasystem grand design development efforts was well known, former Senator Cohen captured the scope of the problem in his seminal October 1994 report Computer Chaos, Billions Wasted Buying Federal Computer Systems[1]. One of the major findings of the report was that "the Government should address automation in manageable segments that are compatible with other systems and easily canceled if they run into any cost and schedule difficulties."

Partially as a result of the findings in the Computer Chaos report, in May of 1995, the Information Technology Oversight Improvement Working Group (ITOIG) prepared a white paper addressing areas for improvement in information technology[2]. One of the white paper's conclusions was that the government needed "to expand agency efforts to use incremental and evolutionary approaches to major systems development and acquisition." The ITOIG recommended that the government adopt "an acquisition process that models industry best practices," which would require agencies to "structure IT acquisitions into relatively short-term modules that can be easily evaluated and will allow projects to change direction." The ITOIG recognized that, while much could be done to improve existing practices within the current procurement statutes, statutory changes were required to promote modular acquisition.

In addition to Congressional and industry recognition of the failure of a grand design approach to major system development, the current focus on modular-type approaches was also encouraged by the efforts of the Canadian "Common Purpose Procurement Framework." The Canadian approach encouraged an innovative teaming relationship between the government and the contractor(s). It further embraced risk management and modular, phased delivery as principal features of its approach to major system design and development.

On June 20, 1995, Senator Cohen introduced the Information Technology Management Reform Act (ITMRA) of 1995. Section 203 of that act (Incremental Acquisition of Information Technology) required that "to the maximum extent practicable, an executive agency's needs for information technology should be satisfied in successive, incremental acquisitions of interoperable systems," [3] otherwise known as modular contracting.

As a result of both statutory direction and the experiences of the Canadian and industry ap-

[1] "Computer Chaos: Billions Wasted Buying Federal Computer Systems," an investigative report by Senator William S. Cohen, Subcommittee On Oversight of Government Management, Senate Governmental Affairs Committee, October 1994.

[2] "Report of Information Technology Working Group, Roger Johnson, Administrator of GSA and John A. Koskien, Deputy Director for Management of OMB, May 7, 1995.

[3] Congressional Record, June 20, 1995, pg. S8686.

proaches to systems development, modular contracting is now the preferred method for acquiring major developmental IT systems. It is most effectively applied when a requirement can be satisfied in successive acquisitions of interoperable increments. In its simplest terms, modular contracting is the acquisition of a major IT system through smaller, successive increments of interoperable modules.

While a statutory preference for modular contracting exists, even with its potential benefits, it represents a significant challenge and a major change from the traditional IT acquisition strategies. Although it presents a beneficial alternative to the traditional development models, modular contracting cannot be viewed as a "silver bullet" solution. As discussed later in this guide, the careful application of modular contracting techniques has considerable potential to solve some very troubling acquisition issues while at the same time raising others. These new challenges, however, do not negate the significant benefits associated with a modular contracting approach.

The planning and management of any major IT development effort is a complex and demanding task. Acquisition strategies must be carefully crafted, balancing the risks presented by the facts and circumstances of the particular requirement and environment. The knowledge, skills, talent, and experience of the project team remain the key determinant of a successful IT development program. Given the statutory preference, and the opportunities and advantages offered by modular contracting, agencies should seek ways to understand and incorporate this acquisition innovation to the maximum extent practicable.

1.2 AUDIENCE

This guide was developed for government program, technical, and contracting officials involved in major IT development programs.

1.3 OBJECTIVE

The General Services Administration (GSA) published this guide to help agencies understand and successfully plan and conduct modular IT development efforts. Modular contracting represents a new approach to acquiring major IT systems. As with any new process, it is important to understand the underlying principles and concepts in order to apply them successfully to each agency's unique requirements. Therefore, this guide addresses the laws, regulations, directives, and policies issued to implement modular contracting. It also provides guidance on modular contracting and program management approaches and techniques.

CHAPTER 2. LEGISLATIVE AND POLICY GUIDANCE

2.1 FEDERAL LEGISLATIVE POLICY AND GUIDANCE

During the past several years, Congress has passed numerous initiatives intended to re-invent the way the federal government conducts its business. These initiatives have streamlined the federal acquisition processes and procedures, specifically bringing the acquisition of IT more in line with the realities of the forces of the commercial market place and the risks involved in acquiring information technology. As an evolving public policy objective, guidance to date on modular contracting has been limited. The government guidance that has been issued falls into four general categories: legislative, policy, regulatory, and budgetary.

2.1.1 Legislative

The principal statutory direction making modular contracting the preferred acquisition approach for agencies to use in acquiring major IT developmental systems is found in Section 5202 of the Clinger-Cohen Act of 1996, originally referred to as ITMRA[4]. The statute requires that the head of the agency should "to the maximum extent practicable, use modular contracting for an acquisition of a major system of information technology." The act describes modular contracting as follows:

> Under modular contracting, an executive agency's need for a system is satisfied in successive acquisition of interoperable increments. Each increment complies with common or commercially accepted standards applicable to information technology so that the increments are compatible with other increments of information technology comprising the system.

Further, the statute directed that the Federal Acquisition Regulation (FAR) require that, under the modular contracting process, an acquisition of a major IT system may be divided into several smaller acquisition increments that:

- Are easier to manage individually than would be one extensive acquisition.
- Address complex information technology problems incrementally in order to enhance the likelihood of achieving workable solutions to these problems.
- Provide for delivery, implementation and testing of workable systems or solutions in discrete increments, each of which comprises a system or solution that is not dependent on any other increment in order to be workable for the purposes for which acquired.
- Provide an opportunity for later increments of the acquisition to take advantage of any evolution in technology or needs that occurs during conduct of the earlier increments.[6]

In addition, Section 5202 of Clinger-Cohen required that "an increment of an information technology acquisition should to the maximum extent practicable, be awarded within 180 days after the date on which the solicitation is issued". If the contract for that increment can-

[4] The ITMRA of 1996 was passed by Congress and signed into law as Division E of the National Defense Authorization Act of 1996 (P.L. 104-106).[4] It was later re-titled as the Clinger-Cohen Act.

[6] Congressional Record, June 20, 1995, pg S8686.

not be awarded within that time, the increment should be considered for cancellation. Additionally, the delivery of the information technology should occur within 18 months after the date the solicitation was issued.

In February 1998, the requirements of the Act were incorporated into the FAR. See Section 2.1.3.

2.1.2 Policy

The principal policy direction for implementing modular contracting is found in the July 16, 1996 Executive Order 13011, Federal Information Technology (Appendix 2). Under the order, agencies are tasked to significantly improve the management of their information systems, including the acquisition of information technology. The order also promotes the strategy of structuring information systems investments "into manageable projects as narrow in scope and brief in duration as practicable" (modular contracting).

2.1.3 Regulatory

On February 23, 1998, Federal Acquisition Circular 97-04 added guidance and direction on modular contracting requirements to FAR Part 39, *Acquisition of Information Technology*. This change implemented the statutory requirements of Clinger-Cohen Section 5202.

In drafting the FAR language, the FAR IT committee discussed the need to include discretionary material and guidance on modular contracting. The committee recognized that modular contracting is a complex subject, and there has been little or no guidance on how to implement this new approach to acquiring major IT systems. The committee concluded that it would be more appropriate to issue such guidance as a separate document. While FAR guidance does not contain detail on how to implement modular contracting, it does provide some guidance beyond that contained in the Clinger-Cohen statute. (See Appendix 3 for the full text of the FAR language.)

FAR part 39.002 includes a definition for modular contracting: "'Modular contracting,' as used in this part, means use of one or more contracts to acquire information technology systems in successive, interoperable increments."

FAR part 39.103 implemented Section 5202, Incremental Acquisition of Information Technology, Clinger-Cohen Act of 1996 (P.L. 104-106). It states in part that:

> Modular contracting is intended to reduce program risk and to incentivize contractor performance while meeting the government's need for timely access to rapidly changing technology. Consistent with the agency's information technology architecture, agencies should, to the maximum extent practicable, use modular contracting to acquire major systems.

FAR part 39.103 (b) also specifies that, when using modular contracting, the IT system may be divided into several smaller acquisitions that:

- Are easier to manage individually than would be possible in one comprehensive acquisition.
- Address complex information technology objectives incrementally in order to enhance the likelihood of achieving workable systems or solutions for attainment of those objectives.
- Provide for delivery, implementation, and testing of workable systems or solutions in discrete increments, each of which comprises a system or solution that is not dependent on any subsequent increment in order to perform its principle functions.
- Provide an opportunity for subsequent increments to take advantage of any evolu-

tion in technology or needs that occur during implementation and use of the earlier increments.

- Reduce risk of potential adverse consequences on the overall project by isolating and avoiding custom-designed components of the system.

FAR part 39.103 (c) adds guidance on factors to be considered in designating increments (modules). It suggests agencies should address the following issues:

- To promote compatibility, IT modules for each increment should comply with common or commercially acceptable IT standards and the agency's master information technology architecture.
- The performance requirements of each increment should be consistent with the performance requirements of the completed overall system…and should address the interface requirements with succeeding increments.

The FAR guidance continues with FAR 39.103 (d) stating that contracting officers shall choose the appropriate contracting technique for the particular circumstances (e.g., indefinite delivery, indefinite quantity (ID/IQ), single-award contracts with options, successive contracts, multiple award task order contracts, etc.). Additionally, the contracting technique should facilitate the acquisition of subsequent increments. Whatever the contractual approach, the FAR requires that contract(s) be structured to ensure that the government is not required to procure additional increments.

Finally, FAR part 39.103(d) includes the statutory requirement that, to the maximum extent practicable, a modular contract for IT should be awarded within 180 days after the date the solicitation was issued. It also requires that, to the maximum extent practicable, deliveries under the contract should occur within 18 months after issuance of the solicitation.

2.1.4 Budgetary

Budgetary guidance and direction is one area where modular contracting requirements have been incorporated and compliance is expected. The Office of Management and Budget (OMB) has made it clear that funding for IT systems will be dependent to a large extent on following a modular approach.

Former OMB Director Franklin Raines made OMB's position on grand design programs very clear. At the Armed Forces Communications and Electronics Association's (AFCEA's) 1998 Virtual Government conference, he stated "We aren't smart enough to manage a multi-billion dollar project, turn it on the last day, and see if it works." Instead, Raines suggested agencies plan and budget their IT initiatives in phases, with regular milestones to measure performance. He suggested that "the time period from a project's conception to getting some use out the program should be 6 to 9 months. Otherwise, return on investment will probably shrink, and the technology may become outdated." This principle is the essence of modular contracting.

OMB has promulgated its modular contracting guidance in multiple documents, including OMB Policy Memorandum M-97-02 and OMB Circular A-11. OMB Memorandum M-97-02 contained what is now referred to as "Raines' rules."[7] Raines' rules are eight rules that were originally issued on October 25, 1996 Rules 6 and 7 incorporate modular contracting direction for budget submission. OMB will apply the following criteria in recommending new or continued funding for IT investments.

[7] Named for past OMB Director Franklin D. Raines.

Investments in major information systems proposed for funding the President's budget should:

6. reduce risk by: avoiding or isolating custom-designed components to minimize the potential adverse consequences on the overall project; using fully tested pilots, simulations, or prototype implementations when necessary before going to production; establishing clear measures and accountability for project progress; and, securing substantial involvement and buy-in throughout the project from the program officials who will use the system.
7. be implemented in phased, successive segments as narrow in scope and brief in duration as practicable, each of which solves a specific part of an overall mission problem and delivers a measurable net benefit independent of future segments, unless it can be demonstrated that there are significant economies of scale at acceptable risk from funding more than one segment or there are multiple units that need to be acquired at the same time.

Raines' rules were subsequently incorporated in OMB Circular A-11 (Preparation and Submission of Budget Estimates), (1997 and 1998 versions), Appendix 300A, Principles of Budgeting for Capital Asset Acquisitions. In addition, A-11's Exhibit 300B, Capital Asset Plan and Justification, requires the agencies to describe the use of modular contracting techniques as part of the asset's acquisition strategy.

CHAPTER 3. MODULAR CONTRACTING CONCEPTS AND ACQUISITION STRATEGIES

3.1 TRADITIONAL SYSTEMS DEVELOPMENT APPROACH

To appreciate the advantages offered by modular contracting, it is important to compare this approach to the traditional process. Traditional system development procurement models follow the same conceptual approach as those used in non-IT supply and service procurements. While the standard procurement model is suitable for numerous types of federal acquisitions, it adds a significant degree of difficulty to large-scale IT systems development and modernization acquisitions. This difficulty arises from limitations in the standard model, which does not allow for the higher magnitude complexities, risks, uncertainties, and rate of technological change inherent in large-scale IT development efforts.

Difficulties associated with the traditional procurement process can be attributed to the fact the model requires that agencies "solve" the entire operational problem during the pre-award source selection. For example, offerors are asked to propose and price the design, development, test, and implementation of a software system that, in many cases, has not been fully defined or understood. The problem with this approach is that the actual tasks will take place several years in the future. The government also often requires proposals to include the design and sizing of the computer hardware and system software, which also will not exist for several years. Once the contract is awarded, these estimates and assumptions became the baseline requirements by which the success or failure of the program is measured.

For some IT acquisitions, the traditional procurement model can provide satisfactory results and meet all desired program objectives. However, in many cases, applying the traditional approach to a major system development imposes significant obstacles and unnecessary demands and risks. The traditional "procurement model" demands specificity in planning, funding, and acquisition, and a predictive precision that is extremely difficult to achieve in large-scale IT systems. This fact is particularly true in today's rapidly changing environments. The traditional approach considers any deviation from the early planning estimates as a failure or mistake, warranting some form of penalty and additional oversight. Forcing this rigidity into the systems development acquisition process — intending to minimize risks and mistakes — can actually exacerbate it.

By developing systems in much smaller increments (modules), the "event horizons" are much closer, have much less complexity, and are easier to estimate, plan, and manage. Modular contracting provides an opportunity to adapt the current procurement model to the realities of the IT environment.

3.2 MODULAR CONTRACTING APPROACH

Modular contracting offers an alternative acquisition process that allows agencies to incrementally acquire a system. This alternative provides for the delivery, implementation, and testing of a workable system or solution in discrete increments, or modules. The modules can be acquired via a single procurement or multiple procurements, but the intent is to ensure that the government is not obligated to purchase more than one module at a time.

Under the modular contracting approach, the agency incrementally contracts and manages the program. In contrast to the traditional acquisition methods, where the entire effort is priced and baselined in the initial program source selection, the modular approach allows agencies to make decisions based on smaller, more manageable increments. Acquisition strategies can allow for the competition and pricing of the future modules to take place "just in time" for module development. Hardware and system software can be acquired when sizing information is available. In this way, future efforts can take advantage of any lessons learned or advancements in technology.

3.2.1 Characteristics of Modular Contracting

As stated in the Clinger-Cohen Act, agencies must, to the maximum extent practicable, use modular contracting to acquire major IT systems. The structure and content of a module may vary significantly, depending on the type of IT being acquired and the nature of the program being developed. The characteristics that define modular contracting are specified in legislation, regulation, and OMB guidance, which stipulate that a module must:

- Be an economically and programmatically separable segment of the system that is, or should be, fully funded.
- Have substantial programmatic use, even if no additional segments are acquired; that is, each module should provide for delivery, testing, and implementation of a functional system or solution that is not dependent on any subsequent module in order to perform its significant functions.
- Provide an opportunity for later increments of the acquisition to take advantage of any evolution in technology or needs that are identified during the acquisition or implementation of the earlier increments.
- Reduce the risk of potential adverse consequences on the overall project by isolating and avoiding custom-designed components of the system.
- Reduce integration risk; each module should comply with common or commercially acceptable IT standards when available and appropriate. Additionally, each module must be developed within the agency's standard IT architecture.

3.3 MODULAR CONTRACTING PREFERENCE AND APPLICATION

While Clinger-Cohen imposed a statutory "preference" for the use of modular contracting (maximum extent practicable), the legislation did not *mandate* that agencies use modular contracting. There are times when application of modular contracting technique is inappropriate for the system being developed. For example, a system or business process that is seamless and monolithic, with no logical breakout, is not a candidate for modular acquisition. Conversely, an enterprise-type system comprised of multiple business component programs is an ideal candidate for the modular approach.

To determine if modular contracting is practicable, agencies must decide if the system to be acquired can be separated into logical segments. Major IT systems are comprised of a mix of hardware, software development, commercial off-the-shelf (COTS) software, integration, support services, transition, conversion, training, and related services. While most major IT systems have logical modular break points, it is difficult to envision a system in which each module completely meets the requirements noted in Section 3.2.1. In reality, the majority of systems require at least some degree of modular interoperability. Modules in

these systems cannot operate at full capability without both preceding and subsequent modules. This situation becomes an issue when subsequent modules are required to enable the system to meet operational and programmatic goals and objectives.

However, the advantages offered by a modular approach should not be rejected because a segment does not meet the strict definition of a module, or it cannot be contracted for within 180 days or delivered within 18 months. Agencies who fail to adopt a modular contracting approach because they strictly apply the definitions and time constraints will lose the benefits of this valuable acquisition technique. The extent to which these principles can be applied is dependent upon the nature of the system being acquired. Even traditional program development efforts can benefit from modular contracting techniques and philosophies.

> **The key to implementing modular contracting is to phase the system's development to minimize the integration risk and define each module so that *"to the maximum extent practicable"* it meets the objectives noted in law and regulation.**

3.4 CONTRACTING STRATEGIES AND TECHNIQUES FOR MODULAR CONTRACTING

Selecting the appropriate contracting strategy and technique is a key factor for success of any development effort. This fact is especially true for modular contracting. Determining the number and type of contracts and the number of contractors is critical to program control and success. After completing the requirement analysis, conducting market research, and understanding the program constraints, contingencies, and system design, the program manager, contracting officer, and other members of the program office working together can craft the appropriate contracting approach. The key to success is to craft a contract strategy that can accommodate rapid changes in technology, increased interoperability and integration risk, and potentially, multiple contractors.

3.5 SYSTEM DESIGN AND MODULAR IDENTIFICATION

To determine if modular contracting is practicable, agencies must first decide if the requirement can be separated into logical segments. One of the first steps in making this determination is for the program office to prepare a high-level logical system design. It is extremely unlikely that logical breakout modules can be identified without first having a system design. This effort will be the key factor in determining the acquisition and development methodology.

The challenge raised by the modular approach is to structure the program so that modular components can be integrated into a single system. This capability requires that modules are designed and controlled so that increments:

- Remain backward-compatible with previously developed modules.
- Are compatible with future modules.
- Are compatible with agency IT architecture standards and will, as required, be compatible with other agency systems.
- Maintain compatibility across the program to ensure users have continuous availability of the system during implementation of subsequent modules.

Addressing these challenges requires a management discipline that includes system engineering and very strong program and configuration management. In many cases, the program office may wish to acquire the serv-

ices of a systems integrator to assist in program management and the development of the system design.

If the system is a candidate for modular contracting, the design will include an agency-developed optimum module breakout structure and phasing schedule. This approach includes implementing modules that have the biggest "payback" (Return on Investment, or ROI) early in the program. The more realistic the system design is, the more informed the risk decisions, strategies, and contracting actions will be.

Exhibit 3-1 depicts the integration and interrelationships between the agency's IT architecture, standards and business processes, other agency systems, identification of modules that will comprise system "B," and integration testing and control.

3.6 CONTRACT STRATEGY

In crafting a modular contracting strategy, the program team must consider several factors. In addition to designing the program to meet the definition and objectives of a module, the contract(s) should:

- Ensure that the acquisitions of the modules are independent of each other and the agency is not obligated to purchase more than one module at a time.
- To the maximum extent practicable, be awarded within 180 days after the date on which the solicitation is issued.
- To the extent practicable, schedule deliveries under the contract to occur within 18 months after issuance of the solicitation.

Prior to acquisition reform and streamlining initiatives, it would have been difficult to meet these requirements. In today's environment of streamlined source selection and the availability of governmentwide agency contracts (GWACs) (multiagency and agency task order contracts focused on IT system development), program teams have a number of options.

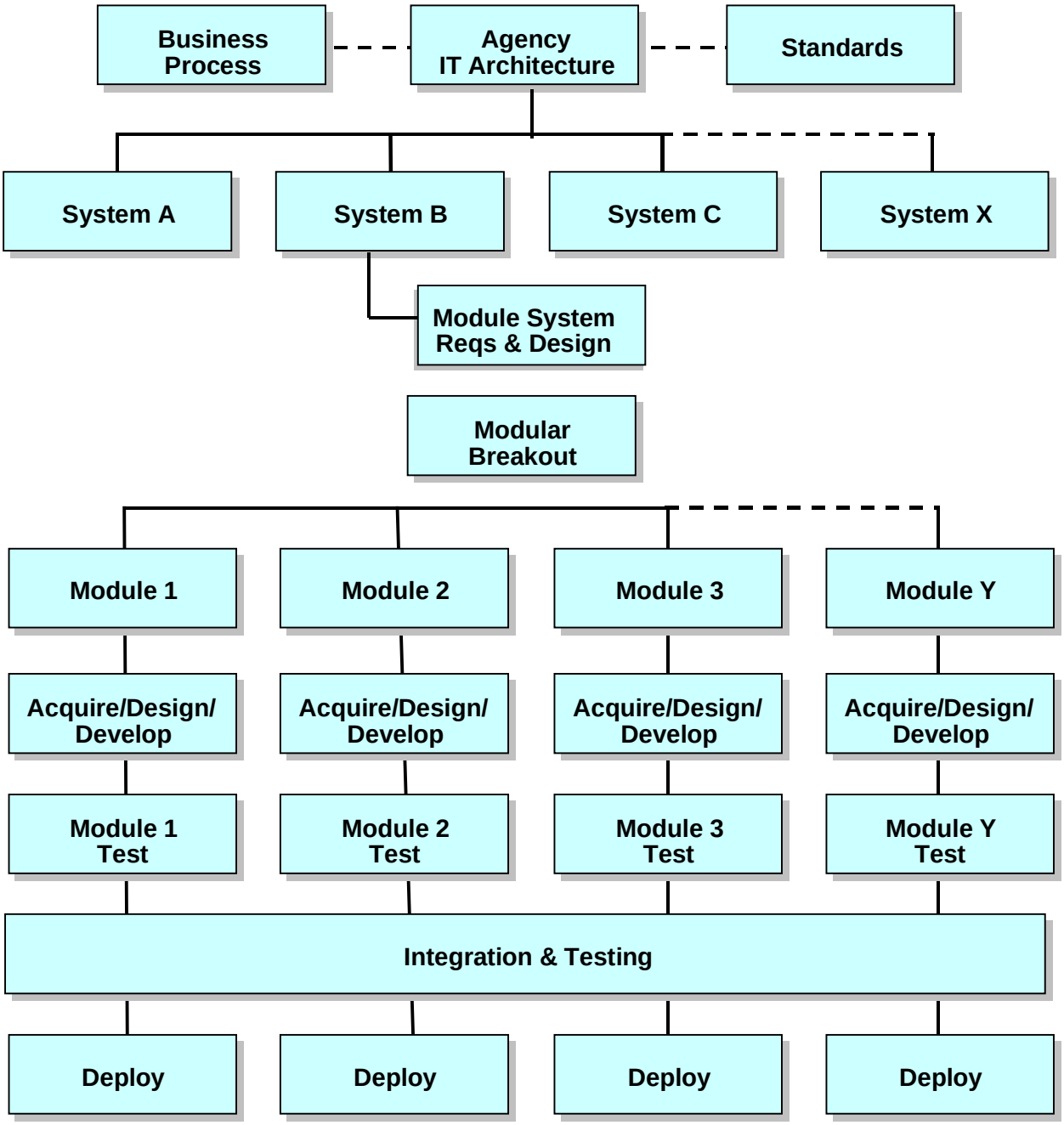
Crafting a contract strategy is not an exact science. What would be a best practice for one acquisition could be a disaster for another. Each acquisition option and technique has associated advantages, disadvantages, overhead requirements, and risks.

Additionally, program teams are not limited to a single approach. They can simultaneously use a variety of contract vehicles and techniques to satisfy their requirements. The "best" acquisition approach for a particular project or program can only be determined after examining each requirement's many different objectives, risks, and environments.

3.6.1 Serial Versus Parallel Development

Under one model, modular contracting can be viewed as a serial process in which one module is completed and implemented before subsequent development efforts are initiated. This approach can reduce program risk by ensuring the module is complete and any deficiencies are corrected before implementation. Modular contracting can also follow a parallel development strategy, in which multiple modules are being developed simultaneously or in a slightly staggered fashion.

A parallel development strategy can significantly reduce development time and allow a faster implementation and ROI for the program. However, this strategy increases interface and interoperability risks and places greater oversight demands on the program's systems integrator. Furthermore, if parallel development is chosen, the agency will be expending resources before preceding modules are implemented. If these preceding modules are canceled or fail to meet objectives, parallel development could be adversely affected. For these reasons, parallel development should



SYSTEM DESIGN RELATIONSHIPS

Exhibit 3-1

only be applied if the risk of developing subsequent modules is considered acceptable and if adequate resources are available to manage the increased oversight workload.

3.6.2 Contract Type

One important aspect of any contract strategy is the proper allocation of risk. The selection of contract type is one means of determining the extent to which the government and contractor share risk. A major factor in determin-

ing the amount of risk present in a requirement is the amount of "unknowns" it contains. For example, system design and requirements definition efforts have more unknowns and are usually higher-risk tasks than coding and testing or acquiring COTS computer hardware and software. A cost reimbursement-type contract line item or task order would be appropriate for the design and requirements definition modules. A fixed-price relationship is appropriate for the lower-risk tasks.

3.6.3 Single Versus Multiple Contracts

Even though modular contracting has the potential to mitigate many of the risks inherent in major IT system development efforts, it raises some new challenges. Perhaps the most significant of these new challenges is integration risk. When the government takes a large requirement and breaks it down into successive acquisitions of interoperable increments, it must address the responsibility for and the process of integration. Although the government can assume overall systems integration responsibilities, it is generally recommended that these duties be assigned to a contractor with specialized systems integration expertise.

In developing a modular contract strategy, the potential impact of having multiple contractors perform the effort must be assessed. Having one contractor perform both module development and system integration tasks mitigates integration risk and may be an appropriate strategy. At the same time however, the single contractor approach eliminates the significant advantages associated with maintaining competition throughout the program's development. It would be very beneficial to have a single contractor responsible for integration while maintaining the program flexibility to compete the development of each module.

One strategy that may come close to achieving this balance is for the program office to begin the development of the modular program by acquiring the services of a systems integrator. The system integrator ensures that adequate interface and interoperability standards are specified. The system integrator further assists the program office in ensuring that contractor(s) developing the modules comply with interface and interoperability direction. Finally, the systems integrator assists the program office in maintaining interface control and configuration management. Under this strategy, modules are competed and the agency benefits from the competitive pricing. The program office can also take advantage of the contractor's past development performance for future module competitions.

3.6.3.1 Single Contracts

One of the major advantages of modular contracting is the ability to contract for each module's development at the most appropriate time. This advantage is constrained if a single contract strategy is proposed. A single contract may be most appropriate when the scope of subsequent modules can be clearly defined at contract inception.

The initial effort is acquired with contract award and future modules structured as options. Structuring the contract so that future modules are orderable as options ensures that the government is not obligated to purchase more that one module at a time. However, options must be priced in the initial competition. This condition constrains the introduction of lessons learned and incorporation of new technology into future modules, as these changes must be made by contract modification. For this reason, the single contract strategy is generally not recommended for modular contracts.

Advantages

- Single source selection reduces overhead in awarding and managing the contract.
- Single contractor reduces integration risk.

Disadvantages

- Requires the entire program to be priced and technical solution to be proposed at time of contract award.
- Lessons learned and technology changes must be incorporated by modification.
- Competitive environment is not maintained.

3.6.3.2 Successive Competitions

A more appropriate strategy for modular contracting may be conducting successive competitive contracts. Successive competitive contracts allow the government to conduct a separate competition for each module. Using streamlined source selection techniques, the government can award a series of contracts for module development. While the method allows for introduction of lessons learned and incorporation of new technology, it requires significant time and resources to conduct each source selection. Additionally, this strategy will most likely result in multiple contractors, increasing integration risk.

Advantages

- Optimal pricing and technical solution for each module is obtained "just in time," allowing incorporation of lessons learned and new technology.
- Competitive environment is maintained throughout the program development.

Disadvantages

- Significant probability of multiple contractors increases integration risk.
- Large overhead requirement to conduct multiple source selections, with increased risk of protest and program delays.

3.6.3.3 Task Order Contracts

Task order-type, ID/IQ contracts represent perhaps the best option for modular contracting. Ranging from GWACs to GSA Federal Supply Schedules (FSS), nearly every IT product and service needed for modular development is readily available under an existing contract. In most cases, program managers can have a major systems integrator or developer under task order within a maximum of 60 days from initiating the request. Additionally, there are several multiple-award GWAC and multiagency ID/IQ contract programs whose primary focus is software development and integration. These contracts are important because they have been awarded to contractors that specialize in developmental efforts. In addition, the contracts contain special provisions and contract types appropriate for development and integration efforts.

These contracts are particularly useful for modular contracting because of the ease of task order award and the vast array of products and development contractors. Through the task order "fair opportunity" competitive process, agencies can compete each module's development and maintain a competitive environment. Conversely, the task order's competitive process recognizes that directed awards for a follow-on effort may also be appropriate. The directed award option may be a significant advantage when the program office wants to reduce integration risk by allowing the incumbent contractor to continue the development effort. Finally, the issues that contractors can protest in a fair opportunity competition are limited.

Advantages

- Wide selection of products and services available from top-ranked integrators and developers.
- Fair opportunity competitive procedures are very streamlined (<60 days) and require

significantly less overhead than full and open competitions.

- Fair opportunity competitive procedures authorize directed follow-on orders.
- Numerous contracts are available offering a range of contract types [e.g., cost plus contract line item numbers (CLINs)] and contract provisions.
- Competitive environment can be maintained throughout program development.

Disadvantages

Some potential loss of direct administrative control if using another agency's contract.

3.7 RIGHTS IN TECHNICAL DATA AND COMPUTER SOFTWARE

In using a modular contracting approach, it is essential that the agency has a well-defined IT architecture and interface requirements. The contract must also contain the appropriate provisions that require the developmental contractor(s) to fully document the module design and interfaces. Documentation of the module design and interfaces is an integral part of the system and must be completed before module acceptance. If the government does not obtain adequate rights and software documentation, it may prove impossible to develop and integrate individual modules, especially if the acquisition approach plans on using multiple contractors.

The cost structure, license agreements, and methods of distribution for COTS software can also be problematic. Issues dealing with data rights, license fees, and impact of upgrades and updates can result in delays and significant increased program costs. The assistance of a dedicated systems integrator can prove invaluable in anticipating and resolving issues dealing with software license, data rights, and upgrade/update integration issues.

3.8 SOURCE SELECTION CONSIDERATIONS

As with any source selection, a competition for a modular contracting development effort should focus on selecting the contractor(s) that provides the government the highest degree of confidence that it can meet or exceed cost, schedule, and performance requirements. To achieve this goal, the agency must select evaluation criteria that identify the contractor(s) that can successfully manage and develop a complex software development effort that contains higher levels of integration risk. The objective should be to select the contractor(s) that has successfully developed comparable software systems and demonstrates a mature software development capability and process. In light of this objective, two evaluation criteria that are particularly applicable to modular efforts include past performance and the software capability maturity model (CMM).

3.8.1 Past Performance Evaluation Criteria

Recent changes to the FAR have made an offeror's past performance a mandatory source selection evaluation factor. The complexities involved in any major IT development effort make it essential for the government to select only the highest qualified and experienced contractor(s). While not infallible, past performance information is arguably the single best predictor of quality and potential customer satisfaction. Past performance information provides the source selection official with valuable data to estimate the future performance of a contractor by answering: In contracts of similar size, scope, and complexity, how well did the contractor:

- Conform to the contract requirements and standards of high-quality workmanship?
- Adhere to contract schedules?

- Forecast and control costs?
- Provide reasonable and cooperative behavior and commitment to customer satisfaction?

3.8.2 Software Capability Maturity Model (CMM)

The Software Engineering Institute (a Federally Funded Research and Development Contractor) developed the software development capability maturity model (CMM). The CMM provides organizations with a framework for improving their software engineering and management processes. It provides both government and contractor organizations with guidance on how to gain control of processes for developing and maintaining software.

In simplest terms, the offeror with the more mature software development process is more likely to develop software within the contract's cost, schedule, and performance requirements. Thus, the CMM provides an excellent tool to assist the government in identifying and selecting the offeror that provides the greatest probability of completing the development effort successfully.

The CMM is organized into five (5) levels as shown in Exhibit 3-2. It has been reported that over 80 percent of commercial firms engaged in software development are at Level 1.

While it is obvious that a CMM evaluation can be a powerful discriminator in any software development source selection, like most tools, it requires a complete understanding of its proper usage. CMM evaluation is a complex action that can be costly for both the offerors and the government. It is strongly recommended that agencies ensure they have either in-house or contract support personnel who are knowledgeable in the CMM and software capability assessments before applying CMM as a source selection evaluation criterion.

Level 1	Initial	The software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort.
Level 2	Repeatable	Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.
Level 3	Defined	The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.
Level 4	Managed	Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
Level 5	Optimizing	Continuous process improvement is enabled by quantitative feedback for the process and from piloting innovative ideas and technologies.

FIVE LEVELS OF THE SOFTWARE CAPABILITY MATURITY MODEL

Exhibit 3-2

CHAPTER 4. MANAGING THE PROGRAM

4.1 PROGRAM MANAGEMENT OVERVIEW

A meaningful and disciplined program management process is essential to effectively manage the risks of any software development program. This need is even more critical in conducting a modular contracting development effort. The inherent integration risks and the increased opportunity for multi-functional disciplines (e.g., engineering, customers, procurement, finance, other agencies, oversight, etc.) to participate in system development make strong and effective program management critical for success.

4.2 SYSTEMS ACQUISITION PROCESS

A major IT development program requires a systematic acquisition process that takes into consideration the efforts, complexities, and uncertainties. OMB Circular A-109, Major Systems Acquisition, provides some guidance in this area. Of particular note is the recognition of a "systems acquisition process" — one that differs from the norm — that must be managed more deliberately, fully and carefully. That process is defined in paragraph 5.i of the Circular to cover:

> the sequence of acquisition activities starting from the agency's reconciliation of its mission needs with its capabilities, priorities, and resources, and extending through the introduction of a system into operational use or the otherwise successful achievement of program objectives.

In this context, A-109 principles call for an integrated, systematic approach for establishing mission needs, budgeting, contracting, managing the program, improving opportunities for innovative private sector contributions, and avoiding premature commitment to unwise courses of action (an advantage of modular contracting). The A-109 management concepts are designed to achieve program objectives within resource constraints. A-109 requires an analysis of the acquisition and risk management strategy to best match mission needs with business and technical approaches. A well-defined and integrated program management plan becomes the framework for managing research development, testing, production, fielding, support, and other essential program activities.

4.3 PROGRAM MANAGEMENT

Large-scale systems development, "grand design" class, and modular-oriented programs are critically dependent on effective, acquisition-oriented program management. The planning and management of any major IT development effort is a complex and demanding task. Acquisition strategies must be carefully crafted, balancing the risks presented by the facts and circumstances of the particular requirement and environment.

For major IT development efforts, program management cannot be viewed as a part-time effort or additional duty. It requires a dedicated Program Manager (PM) leading a team of highly trained and experienced personnel. The team should also be familiar with and apply sophisticated management techniques such as "earned value reporting," strong configuration management, and other performance measuring tools. The knowledge, skills, talent, and experience of the program team remains a key determinant of a successful IT development program.

Effective program management:

- Vests authority, responsibility, and accountability for success in one individual.
- Establishes a single point of contact for the customer(s).
- Facilitates rapid responses to problems and conflict resolution.
- Keeps a central focus on program success, with the ability to make appropriate tradeoffs among cost, schedule, and performance.

Program managers and program management planning should focus on:

- Non-technical program management activities, such as:
  - — Developing a program management plan as the conceptual basis for program execution.
  - — Planning and controlling the framework, milestone schedules, reporting, risk management, etc.
  - — Systematically scheduling all steps and products required for appropriate visibility, assignment, identification, and tracking.
  - — Gathering information to support decision making.
  - — Reviewing input from team members and contractors on all activities
- Technical program management activities, such as:
  - — Controlling the system design so that all elements are integrated into the optimum system.
  - — Using configuration management to identify functional/physical characteristics (baselining), control changes, record/ report changes.
  - — Measuring and reviewing technical performance.

4.3.1 Program Management Office

The majority of developmental program disappointments can be attributed to failure to identify and manage cost, schedule, and/or performance risks. The primary method for mitigating such risks is to establish a program control office responsible for tracking and evaluating the program's achievement of cost, schedule, and performance objectives.

A more informed and effective modular contract strategy is possible when the program office identifies and plans for the systems acquisition's risks. One method to ensure a well-planned strategy is to develop a baselined program management plan (PMP). (See Appendix 5 for a program management plan template.) The PMP describes how the overall system will be modularized, managed, integrated, and deployed; it includes such items as:

- Module definition and go/no-go criteria.
- Determination as to whether the agency will assume the high-risk integration role/responsibility, or contract it out, etc.
- Resource requirements, make or buy.
- Sequencing, phasing, scheduling module development, testing.
- Information needs from agency and contractor, performance measure development and utilization.
- Requirements and change control, configuration management.
- Decision-making processes.
- System testing, deployment, operational support.

- Security/privacy standards.

4.3.2 Integrated Product Team

Successful modular contracting demands communication between the various internal government activities as well as with, and among, the various contractors. Integrated Product Teams (IPTs) have proven to be an important organizational tool that has shown considerable potential to help achieve this increased communication and improve program office decision making. Program offices that have structured their organization based on IPT principles have seen significant improvements in both the quality and timeliness of decision making.

IPTs are composed of representatives from all appropriate functional disciplines (e.g., program management, engineering, manufacturing, test, logistics, financial management, procurement, contract administration, etc.). They are brought together early in to the program to work together to identify and resolve issues and problems. The goal of the IPT is to build successful and balanced programs, identify and resolve issues, and make sound and timely decisions. Thus, the IPT seeks to use teamwork to significantly reduce turnaround time for decisions and to ensure delivery of a system that best meets the total life-cycle requirements of the end-user.

4.3.3 Interface Control Working Group

Another program management organization that can be particularly useful in managing a modular effort is the Interface Control Working Group (ICWG). The ICWG is established when interface requirements exist between two or more organizations. This scenario can occur often in modular contracting, as modules may satisfy different organizational requirements. The ICWG is tasked to maintain the interface baseline and ensure that modules will integrate. This responsibility is carried out through the management of an interface control document.

An interface control document (ICD) explicitly defines the standards and agreed-upon methods of communication within the program. No changes may be made to the ICD without the consent of the member organizations. In this manner, any changes can be assessed for their impact on both previously implemented modules and future increments.

4.4 RISK MANAGEMENT AND CONTROL

Program risk is generally identified as falling into four categories: technical risks, program stability risks, programmatic risks, and cost and schedule risks. In addition to defining the overall program goals, deliverables, milestones, etc., an important aspect of the program management plan is to systematically identify, analyze, and plan for monitoring relevant risk areas. A systems development and/or modernization program management strategy must identify and select the available program management tools and tracking options to reduce or control selected areas of risk. This goal can be accomplished through combinations of risk avoidance, control, assumption, and transfer.

4.4.1 Configuration Management

Configuration management (CM) defines both the functional and physical characteristics of a system throughout its life cycle. It is a critical component of any modular development effort, because a change to one module may affect the ongoing procurement, development, or operation of any other modules in the system. CM applies to hardware, software, documentation, testing, and virtually any element that requires detailed tracking. CM promotes the integrity and continuity of the design and engineering and enables the evaluation of trade-offs that are made as

products evolve. It shows how the project got from one point to another.

A simple example, which many users of word processing software have experienced, shows the importance of maintaining strong configuration management. Word processing software users who upgrade their systems often find that the systems are no longer compatible with previous versions. Users of the previous versions cannot read documents produced in updated format. In a modular contracting environment, the program office must decide whether to upgrade the entire system, including any previously implemented modules, in order to maintain interoperability. The challenge is in recognizing the need to integrate newer components of segments into a system of older components. Strong CM practices will assist in identifying and documenting these requirements.

4.4.2 Change Management

Change management provides a disciplined process to prevent arbitrary changes to the system(s). Change management applies administrative discipline and supplies management direction throughout the design, production, implementation, operation, and maintenance phases of a project's lifecycle. Each element is identified and described, forming the baseline from which all changes are controlled. Changes require complete justification. The justification process should require analyses of the impact on the cost, schedule, and technical elements of the project before the change is implemented.

Change management consists of four processes, each of which works in conjunction with an established baseline:

- ***Configuration Identification***—The process of establishing and maintaining a basis for control and status accounting for an item throughout its life cycle.
- ***Change Control***—The process of regulating justification, evaluation, and coordination of all proposed changes.
- ***Audit and Verification***—The process of verifying the item is in compliance with its corresponding configuration information.
- ***Configuration Status Accounting***—The process of ensuring accurate identification of each configuration item so that logistics support is available.

The concept of baselines is fundamental to change management. A baseline is an agreed-upon set of characteristics of any configuration item. The baseline is defined in a manner that prevents unauthorized alteration. Baselines cannot be changed without the approval of the PM and configuration control board (CCB).

All change management procedures should be identified and documented in a PM-approved Configuration Management Plan. The availability of a change management plan and procedures, and the PM's enforcement of the discipline, is critical to the success of any system implementation, but it is especially critical to a system implemented through modular contracting.

4.4.3 Integration Risk

A high-risk area raised by the modular acquisition methodology is integration risk. Integration risk means that the independently developed modules may be fully operational themselves, but when they are integrated into the overall system, the individual modules reveal flaws or gaps that degrade system or module performance. Failure to manage the integration effort significantly raises the risk of system failure.

When the government takes a large requirement and breaks it down into successive acquisitions of interoperable increments, it must

address the responsibility for and process of integration. In traditional system or solution buys, the problem of integration is contracted out as part of the overall acquisition. In modular buys, however, agencies must address integration in terms of government or contractor responsibility, standards, and deliverables. In reality, rarely does the government have the necessary in-house expertise to manage the integration effort and, in most cases, it should consider obtaining contractor support for this critical effort.

The definition of the system's modules and their integration and interoperability requirements is important for the success of any modular effort. Modular contracting by its very nature contains a higher degree of risk that developed modules will not integrate or operate together. The single greatest way to mitigate and control this risk is the formulation and enforcement of an agency-wide IT architecture based on common and commercial standards. As the overall system is based on agency standards, each module should, in turn, be consistent with the approved standards. While modular contracting success is possible without an agency-wide architecture, it is highly improbable.

4.4.3.1 Integration Testing

Integration testing is also a critical component of the modular contracting methodology. Testing is one of the most challenging and costly process activities, and yet it is generally one of the least understood and most underfunded processes in system implementation.

As described by the Illinois Institute of Technology's Burnstein and Carlson[8], most organizations believe that testing consists of an ad hoc "debugging" process in which the only objective is to show that the software works. Some organizations have progressed to the level where they understand that testing is required. However, these organizations believe the goal of testing is merely to show that the software meets its specifications[9], so testing is limited to a phase that follows coding.

Because of the intricacies of integrating separate modules into an overall system, it is incumbent upon the PM to establish a testing process that considers the system during all stages of its life cycle. Testing must thus consist of quantified and documented test and quality assurance objectives measured and administered by a professional test cadre.

4.5 COST AND SCHEDULE PERFORMANCE TRACKING

There are three key elements that are normally associated with any project: performance, cost, and schedule. An effective program management control system should provide data that indicates conclusive work progress and relevant cost, schedule, and technical performance characteristics. To enable the government to monitor performance in terms of cost and schedule, the contractor should be required to submit periodic reports that inform the program office of the actual progress of the project. These reports constitute a series of data points that account for :

- The variances in cost between the planned budget and the actual cost, and,
- The variances between the completed tasks versus the planned ones, expressed in dollars.

[8] Burnstein, I., T. Suwannasart, and C. R. Carlson, "Developing a Testing Maturity Model: Part I," Crosstalk, STSC, Hill Air Force Base, Utah, August 1996.

[9] Gelperin, D. and B. Hetzel, "The Growth of Software Testing," CACM, Vol. 31, No. 6, 1988, pp. 687-695 as set forth by Burnstein, I., T. Suwannasart, and C. R. Carlson, "Developing a Testing Maturity Model: Part II," Crosstalk, STSC, Hill Air Force Base, Utah, 1996.

Based on the variance indicators, the government can determine the contractor's performance status in managing both cost and schedule. To optimize the utility of this information, the cost and schedule data must be provided in a timely, accurate, and valid fashion. A PM can successfully control the program by using this information to predict shortcomings and reduce program risks.

Programs and projects can be considered budgeted efforts that consist of numerous tasks that are spread out over a period of time. The PM must make sure the contractor accomplishes each project by finishing all the tasks that were planned, on time and within budget. At completion, the program should have been finished on schedule and within cost while meeting performance requirements. The degree to which performance varies from the original plan, in terms of cost and schedule as a function of time, forms the basis of earned value.

4.5.1 Earned Value Measurement

Earned value is a sophisticated management technique for measuring cost and schedule performance. The earned value concept provides a practical approach to the planning of work, the monitoring of progress against the plan (or the *earned value*), and the accumulation of costs incurred to accomplish the completed work that is in progress. The monitoring of progress against the earned value plan enables an organization to assess the cost, schedule, and technical value of the accomplished work and identify variant conditions that require management attention to mitigate cost growth or schedule slippage.

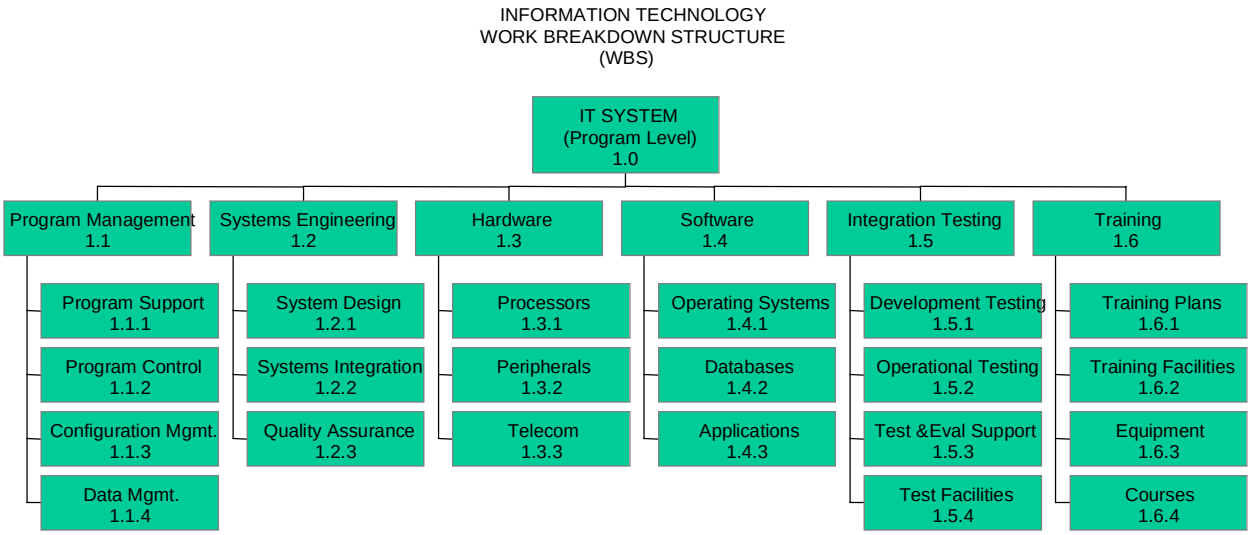
From an overall management standpoint, earned value is a set of control principles and disciplined practices used in the execution of acquisition projects to monitor cost, performance, and schedule progress. The concept of earned value goes beyond the two-dimensional approach of comparing budgeted costs to actual costs. It attempts to compare the value of the actual work accomplished during a given period with the work planned for that period. Earned value is an "early warning" management tool that enables managers to identify and control problems before they become insurmountable. Earned value information provides management with greater insight into potential risk areas. It also provides estimates that are more accurate for projected completion costs. With this information, managers can develop risk mitigation plans based upon the actual cost, schedule, and technical progress of the work[10].

4.5.2 Work Breakdown Structure

The work breakdown structure (WBS) is one of the most important and useful tools available to the PM. The WBS provides essential definition for baseline identification, change control, cost estimating, contractual actions, and execution of work. The WBS clearly and explicitly identifies all the deliverables of each project on which to base project estimates for schedule, cost, and performance.

An essential element of any earned value reporting system, the WBS uses a "family tree" arrangement to display the products, services, and data items to be developed or produced for the project (see Exhibit 4-1). The tree relates the WBS elements to each other and to the end product. The WBS breaks the program down into lower-level logical categories that facilitate the comprehensive identification of all constituent program elements. At the same time, the logical structure of the WBS helps ensure that each project element is identified in a mutually exclusive way, preventing items from being accidentally double-counted or billed.

[10] General Accounting Office, "Major Acquisitions-Significant Changes Underway in DOD's Earned Value Management Process", May 1997.



WORK BREAKDOWN STRUCTURE

Exhibit 4-1

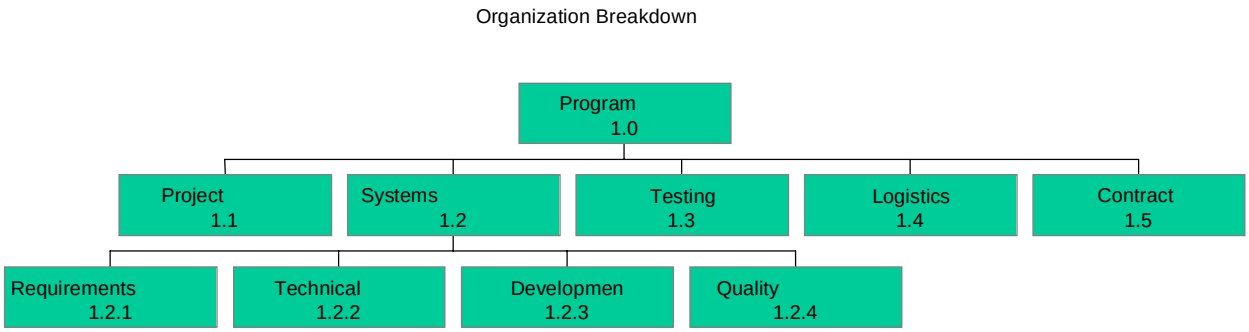
In a modular acquisition, the WBS will have two levels: one for the program or system, and one for each module. A program summary WBS is developed early in the program and used throughout the program life cycle as a framework for both technical and management activities. As the name implies, the program summary WBS consolidates the technical and management activities of multiple modular development efforts into a single, program-level tracking and reporting tool. The program summary WBS is used to guide and organize the development of user requirements, system specifications, budgets, and statements of work and to establish standards for progress, performance, and cost reporting.

The module-level WBS identifies all efforts required to complete the development, testing, and integration of the module. This WBS allows tracking of module progress and performance, as well as cost reporting. To enable consistent tracking and reporting, each module WBS follows the framework and conventions established by the program-level WBS.

4.5.3 Organization Breakdown Structure (OBS)

The organization breakdown structure (OBS) is an organization-oriented family tree identical to an organization chart. Its purpose is to define the top-down hierarchical structure of the organization or work group responsible for implementing the products or services defined in the WBS. The OBS mirrors the hierarchical structure used to assign responsibility for any work within an organization (see Exhibit 4-2). In most cases, the existing corporate organization chart can be used.

The OBS identifies the person or element within the organization responsible for ensuring that the work to deliver a product or service is performed. This entity usually corresponds to the lowest element of budgetary responsibility, although it may be even lower on some occasions. However, the level selected should be the lowest responsible manager. Once the lowest-level responsible manager is identified, cost, plans, and efforts can be tracked for the entire program. The OBS shows exactly who in the organization has the responsibility for getting the work done.



ORGANIZATION BREAKDOWN STRUCTURE

Exhibit 4-2

The OBS may be developed for any organization providing products or services to a program or project. There could be an OBS for the primary organization responsible for delivering the products and services as well as a separate OBS for each project.

4.5.4 Cost Accounts

A cost account is the core of earned value performance measurement. A cost account is the point at which the WBS and OBS intersect and functional responsibility is assigned. Each cost account must contain a specific scope of work, time frame, and budget. These accounts are the focal point for the integration of cost, schedule, and performance. Each cost account must have the capability of distinguishing the planned value with its earned value and the earned value against the actual costs[11]. The sum of the individual cost accounts forms the performance measurement baseline.

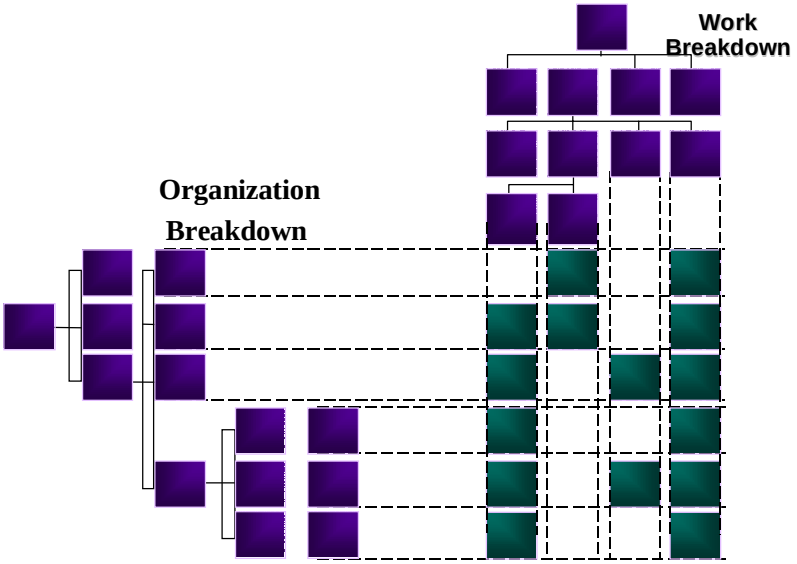
The cost account is derived by determining what product, as defined by the WBS, is being provided by a particular person or group, as defined by the OBS. In some instances, this process is described as a responsibility matrix. (See Exhibit 4-3.)

This product is usually a budgeted item that a particular manager will be responsible for delivering. The manager's goal is to deliver that product or service within the budget and time constraints agreed on by the manager and the project leaders.

4.5.5 Precedence (Critical Path) Schedule

Once the WBS is developed and tasks are identified, the next step is to relate them sequentially in a precedence-type network. A precedence network, in its final form, identifies the interrelationship between activities and their associated time duration. Such information in graphic form enables the PM to determine project duration and tasks that are critical. The expected project duration is based on the estimated time required to accomplish each activity. The critical path represents the longest time path within the network diagram. (See Exhibit 4-4.)

[11] Fleming, Quentin W. and Joel M. Koppelman, "Earned Value Project Management", Project Management Institute, 1996 as cited by Rita Le, "Earned Value," July 98.



COST ACCOUNT DERIVATION—RESPONSIBILITY MATRIX

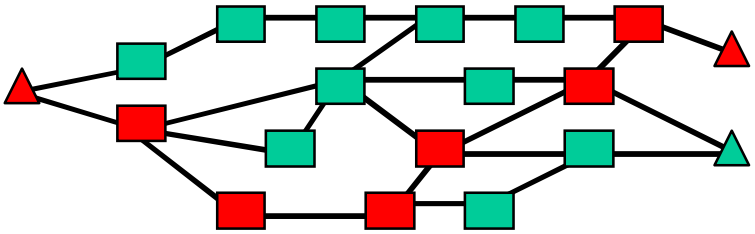
Exhibit 4-3

By identifying the critical path within the network, the PM and development contractor(s) can focus on those issues most in need of management attention and can analyze the effects of shifting resources from one activity to another. The resources for the tasks, both personnel and physical, can be identified and profiled in accordance with the schedule, thereby providing the means to calculate the personnel resources and associated budget requirements. By integrating the WBS to the precedence network, the PM can determine the following task relationships:

1. What must be done before starting a particular activity?
2. What can be done concurrently?
3. What follows this activity?

4.5.6 Software Measures and Metrics

As noted in Section 3.8.2, software developers are increasingly seeking to improve the management of the development process. A goal for many of the top software developers is to reach CMM Level 4—Managed. Achieving this level indicates the developer collects detailed measures of the software process and product quality. Software development contractors who reach CMM Level 4 ranking are quantitatively measuring their software processes and product quality on factors such as those shown in Exhibit 4-5.



PRECEDENCE (CRITICAL PATH) SCHEDULE

Exhibit 4-4

It is, however, well beyond the scope of this guide to address the relative merits of quality measurements for software development. Two excellent sources of information are *Practical Software Management, A Guide to Objective Program Insight*, sponsored by the Joint Logistics Commanders, Joint Group on Systems Engineering (JLC-JGSE), available on the Internet at http:www.cards.com/psm, and the Software Engineering Institute's *Software Measurement for DOD Systems: Recommendations for Initial Core Measures* (Technical Report CMU/SEI-92-TR-19), also available on the Internet at http:www.sei.cmu.edu.

4.6 AGENCY INFORMATION TECHNOLOGY ARCHITECTURE

The Clinger-Cohen Act of 1996 (Public Law 104-106) made the Chief Information Officer (CIO) within each agency responsible for developing, maintaining, and facilitating the implementation of an agency's information technology architecture. This responsibility includes ensuring that:

- The requirements for agency-sponsored information systems are aligned with the processes that support the agency's missions and goals.
- Information systems have adequate

DEVELOPMENT AND INTEGRATION TASKS		
Issue	**Measurement Category**	**Question Addressed**
Schedule and Progress	Milestone Performance	Is the program meeting scheduled milestones?
	Work Unit Progress	How are specific activities and products progressing?
	Schedule Performance	Is program spending meeting schedule goals?
	Incremental Capability	Is capability being delivered as scheduled?
Resources and Cost	Effort Profile	Is effort being expended according to plan?
	Staff Profile	Are qualified staff assigned according to plan?
	Cost Performance	Is program spending meeting budget objectives?
	Environment Availability	Are necessary facilities and equipment available as planned?
Growth and Stability	Product Size and Stability	Are the product size and content changing?
	Functional Size and Stability	Are the functionality and requirements changing?
	Target Computer Resource Utilization	Is the target computer system adequate?
Product Quality	Defect Profile	Is the software good enough for delivery to the user?
	Complexity	Is the software testable and maintainable?
Development Performance	Process Maturity	Will the developer be able to meet budgets and schedules?
	Productivity	Is the developer efficient enough to meet current commitments?
	Rework	How much breakage due to changes and errors has to be handled?
Technical Adequacy	Technology Impacts	Is the planned impact of the leveraged technology being realized?

Adapted from: *Practical Software Measurement: A Guide to Objective Program Insight*

SOFTWARE PROCESS AND PRODUCT QUALITY FACTORS

Exhibit 4-5

interoperability, redundancy, and security.

- The agency applies and maintains a collection of standards by which it evaluates and acquires new systems.

Agencies have considerable latitude to tailor their respective concepts of the IT architecture. However, to be considered compliant, the IT architecture will contain two elements: the Enterprise Architecture and a Technical Reference Model and Standards Profiles.[12]

An enterprise architecture is a strategic information asset base that defines the business, the information necessary to operate the business, the technologies necessary to support the business operations, and the transitional processes necessary for implementing new technologies in response to the changing needs of business.[13] The enterprise architecture should take into account the agency's overall goals and direction. Then it should consider how issues such as interoperability, open systems, public access, end-user satisfaction, and security promote the ability to achieve the overall goals. In determining the enterprise architecture, agencies should consider the following elements:

- Business Processes
- Information Flows and Relationships
- Applications
- Data Descriptions
- Technology Infrastructure

4.6.1 Standards-Based Environment

A critical component of reducing the risks associated with modular contracting is the existence of a standard, agency-wide IT architecture based on common and commercial standards. Whereas the agency architecture framework describes the fundamental relationship between business, IT program, and technical policy, the technical element of an actual IT architecture requires much greater specificity and an approved set of technology standards. By identifying agency development and interface standards, the agency can reduce program risk by selecting and reusing proven solutions and sharing common functionality.

The technical element of an IT architecture will help the agency eliminate:

- Duplication of development (in areas such as mapping, track management, and communications interfaces), and
- Design incompatibility among agency systems.

A well-defined technical architecture standard enables the agency to increase interoperability, reusability, portability, and operational capability, while at the same time curtailing program risk by reducing development time, technical obsolescence, training requirements, and life-cycle costs. It may be possible to conduct a module development effort without a technical architecture. However, its absence will significantly increase program risk. Agencies are strongly encouraged to put a comprehensive architecture framework in place before attempting a modular development effort.

[12] OMB Memorandum, "Information Technology Architectures," June 18, 1997.
[13] The Federal Conceptual Model Subgroup for the CIO Council, "The Federal Enterprise Architecture Conceptual Framework - Draft", August 1998.

CHAPTER 5. CONCLUSION

As stated in the Executive Summary, the purpose of this guide is to provide government program, technical, and contracting officials with an introduction to the techniques, advantages, and considerations associated with modular contracting. The guide is structured to provide both valuable background and "how-to" information on the application and use of modular contracting techniques. It is intended to help an agency successfully plan and conduct a modular development effort.

In its simplest terms, modular contracting is acquisition of a major system of IT in successive purchases of interoperable modules. Its application allows the government to quickly access the latest technology and make informed decisions at a time when pertinent facts are available. The flexibility inherent in modular contracting allows the agency to control costs by stopping or altering the acquisition of future modules while retaining the maximum value from modules acquired to date. Additionally, because follow-on efforts are not guaranteed, modular contracting provides a powerful incentive for the selected contractors to produce high-quality products within projected cost estimates. Thus, if properly planned and managed, modular contracting has the potential to offer significant advantages over traditional system development approaches.

Although it presents a beneficial alternative to the traditional procurement model, modular contracting should not be viewed as a "silver bullet" solution. Its application does solve some very troubling issues, but it raises others. For example, modular contracting requires agencies to have agency-wide architecture and interoperability standards in place to ensure that the modules will integrate. This requirement is critical if modular contacting is to be successful.

Successful application of modular techniques also requires strong program management and careful attention to configuration management and system integration issues. A meaningful and disciplined program management process is essential to effectively manage the risks of any software development program. Moreover, given the increased integration issues, this need is especially critical in conducting a modular contracting development effort. These new challenges, however, do not negate the numerous benefits associated with modular contracting.

The single greatest determinant of success of any development effort is its people. Modular development demands a dedicated team of highly skilled, trained, and experienced personnel using sophisticated program management and system development techniques. If this experience is not available within the government, contract support should be obtained to fill the need. To be successful, modular contracting demands one additional attribute: it requires a strong partnering approach between the government and the contractor(s). In reality, both the government and contractor have the same objective—a successful program that meets or exceeds cost, schedule, and performance criteria!

The question as to whether to apply modular contracting techniques to a development effort should not be a matter of debate. Given Clinger-Cohen's statutory direction, Presidential Executive Order 13011, OMB guidance, and the opportunities and advantages offered by modular contracting, the question is not *whether* to apply modular techniques, but rather how to maximize the degree to which they can be applied.

APPENDIX

1. ITMRA Sections 5201 & 5202 (Division E of Clinger-Cohen Act)
2. Executive Order 13011 “Federal Information Technology” July 1996
3. FAR 39.002, 39.103
4. Glossary of Terms
5. Program Management Plan
6. Contacts for More Information

APPENDIX 1. ITMRA SECTIONS 5201 & 5202 (DIVISION E OF THE CLINGER-COHEN ACT)

TITLE LII—PROCESS FOR ACQUISITIONS OF INFORMATION TECHNOLOGY

SEC. 5201. PROCUREMENT PROCEDURES.

The Federal Acquisition Regulatory Council shall ensure that, to the maximum extent practicable, the process for acquisition of information technology is a simplified, clear, and understandable process that specifically addresses the management of risk, incremental acquisitions, and the need to incorporate commercial information technology in a timely manner.

SEC. 5202. INCREMENTAL ACQUISITION OF INFORMATION TECHNOLOGY.

(a) POLICY- The Office of Federal Procurement Policy Act (41 U.S.C. 401 et seq.) is amended by adding at the end the following new section:

SEC. 35. MODULAR CONTRACTING FOR INFORMATION TECHNOLOGY.

(a) IN GENERAL- The head of an executive agency should, to the maximum extent practicable, use modular contracting for an acquisition of a major system of information technology.

(b) MODULAR CONTRACTING DESCRIBED- Under modular contracting, an executive agency‘s need for a system is satisfied in successive acquisitions of interoperable increments. Each increment complies with common or commercially accepted standards applicable to information technology so that the increments are compatible with other increments of information technology comprising the system.

(c) IMPLEMENTATION- The Federal Acquisition Regulation shall provide that--

(1) under the modular contracting process, an acquisition of a major system of information technology may be divided into several smaller acquisition increments that--

(A) are easier to manage individually than would be one comprehensive acquisition;

(B) address complex information technology objectives incrementally in order to enhance the likelihood of achieving workable solutions for attainment of those objectives;

(C) provide for delivery, implementation, and testing of workable systems or solutions in discrete increments each of which comprises a system or solution that is not dependent on any subsequent increment in order to perform its principal functions; and

(D) provide an opportunity for subsequent increments of the acquisition to take advantage of any evolution in technology or needs that occur during conduct of the earlier increments;

(2) a contract for an increment of an information technology acquisition should, to the maximum extent practicable, be awarded within 180 days after the date on which the solicita-

tion is issued and, if the contract for that increment cannot be awarded within such period, the increment should be considered for cancellation; and

(3) the information technology provided for in a contract for acquisition of information technology should be delivered within 18 months after the date on which the solicitation resulting in award of the contract was issued.

(b) CLERICAL AMENDMENT- The table of contents in section 1(b) of such Act is amended by inserting after the item relating to Section 34 the following new item: Sec. 35. Modular contracting for information technology.

APPENDIX 2. EXECUTIVE ORDER 13011

EXECUTIVE ORDER 13011 OF JULY 16, 1996
FEDERAL INFORMATION TECHNOLOGY

A government that works better and costs less requires efficient and effective information systems. The Paperwork Reduction Act of 1995 and the Information Technology Management Reform Act of 1996 provide the opportunity to improve significantly the way the federal government acquires and manages information technology. Agencies now have the clear authority and responsibility to make measurable improvements in mission performance and service delivery to the public through the strategic application of information technology. A coordinated approach that builds on existing structures and successful practices is needed to provide maximum benefit across the federal government from this technology.

Accordingly, by the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Policy. It shall be the policy of the United States Government that executive agencies shall:

(a) significantly improve the management of their information systems, including the acquisition of information technology, by implementing the relevant provisions of the Paperwork Reduction Act of 1995 (Public Law 104-13), the Information Technology Management Reform Act of 1996 (Division E of Public Law 104-106) ("Information Technology Act"), and the Government Performance and Results Act of 1993 (Public Law 103-62);

(b) refocus information technology management to support directly their strategic missions, implement an investment review process that drives budget formulation and execution for information systems, and rethink and restructure the way they perform their functions before investing in information technology to support that work;

(c) establish clear accountability for information resources management activities by creating agency Chief Information Officers (CIOs) with the visibility and management responsibilities necessary to advise the agency head on the design, development, and implementation of those information systems. These responsibilities include: (1) participating in the investment review process for information systems, (2) monitoring and evaluating the performance of those information systems on the basis of applicable performance measures, and, (3) as necessary advising the agency head to modify or terminate those systems;

(d) cooperate in the use of information technology to improve the productivity of federal programs and to promote a coordinated, interoperable, secure, and shared government-wide infrastructure that is provided and supported by a diversity of private-sector supplies and a well-trained corps of information technology professionals; and

(e) establish an interagency support structure that builds on existing successful interagency efforts and shall provide expertise and advice to agencies; expand the skill and career development

opportunities of information technology professionals; improve the management and use of information technology within and among agencies by developing information technology procedures and standards and by identifying and sharing experiences, ideas, and promising practices; and provided innovative, multi-disciplinary, project-specific support to agencies to enhance interoperability, minimize unnecessary duplication of effort, and capitalize on agency successes.

Section 2. Responsibilities of Agency Heads. The head of each executive agency shall:

(a) effectively use information technology to improve mission performance and service to the public;

(b) strengthen the quality of decision about the employment of information resources to meet mission needs through integrated analysis, planning, budgeting, and evaluation processes, including:

(1) determining, before making investments in new information systems, whether the government should be performing the function, if the private sector or another agency should support the function, and if the function needs to be or has been appropriately redesigned to improve its efficiency;

(2) establishing mission-based performance measures for information systems investments, aligned with agency performance plans prepared pursuant to the Government Performance and Results Act of 1993 (Public Law 103-62);

(3) establishing agency-wide and project-level management structures and processes responsible and accountable for managing, selecting, controlling, and evaluating investments in information systems, with authority for terminating information systems when appropriate;

(4) supporting appropriate training of personnel; and

(5) seeking the advice of, participating in, and supporting the interagency support structure set forth in this order;

(c) select CIOs with the experience and skills necessary to accomplish the duties set out in law and policy, including this order and involve the CIO at the highest level of the agency in the processes and decisions set out in this section;

(d) ensure that the information security policies, procedures, and practices of the executive agency are adequate;

(d) where appropriate, and in accordance with the Federal Acquisition Regulation and guidance to be issued by the Office of Management and Budget (OMB), structure major information systems investments into manageable projects as narrow in scope and brief in duration as practicable, consistent with the Information Technology Act, to reduce risk, promote flexibility and interoperability, increase accountability, and better correlate mission need with current technology and market conditions; and

(e) to the extent permitted by law, enter into a contract that provides for multiagency acquisitions of information technology as an executive agent for the government , if and in the manner that the Director of OMB considers it advantageous to do so.

Section 3. Chief Information Officers Council.

(a) Purpose and Functions. A Chief Information Officers Council ("CIO Council") is established as the principal interagency forum to improve agency practices on such matters as the design, modernization, use, sharing, and performance of agency information resources. The Council shall:

(1) Develop recommendations for overall federal information technology management policy, procedures, and standards;

(2) share experiences, ideas, and promising practices, including work process redesign and the development of performance measures, to improve the management of information resources;

(3) identify opportunities, make recommendations for, and sponsor cooperation in using information resources;

(4) assess and address the hiring, training, classification, and professional development needs of the federal government with respect to information resources management;

(5) make recommendations and provided advice to appropriate executive agencies and organizations, including advice to OMB on the government-wide strategic plan required by the Paperwork Reduction Act of 1995; and

(6) Seek the views of the Chief Financial Officers Council, Government Information Technology Services Board, Information Technology Resources Board, Federal Procurement Council, industry, academia, and State and local governments on matters of concern to the Council as appropriate.

(b) Membership. The CIO Council shall be composed of the CIOs and Deputy CIOs of the following executive agencies plus two representatives from other agencies:

1. Department of State;
2. Department of the Treasury;
3. Department of Defense;
4. Department of Justice;
5. Department of the Interior;
6. Department of Agriculture;
7. Department of Commerce;
8. Department of Labor;
9. Department of Health and Human Services;
10. Department of Housing and Urban Development;
11. Department of Transportation;
12. Department of Energy;
13. Department of Education;
14. Department of Veterans Affairs;
15. Environmental Protection Agency;
16. Federal Emergency Management Agency;
17. Central Intelligence Agency;

18. Small Business Administration;
19. Social Security Administration;
20. Department of the Army;
21. Department of the Navy;
22. Department of the Air Force;
23. National Aeronautics and Space Administration;
24. Agency for International Development;
25. General Services Administration;
26. National Science Foundation;
27. Nuclear Regulatory Commission; and
28. Office of Personnel Management.

The Administrator of the Office of Information and Regulatory Affairs of OMB, the Controller of the Office of Federal Financial Management of OMB, the Administrator of the Office of Federal Procurement Policy of OMB, a Senior Representative of the Office of Science and Technology Policy, the Chair of the Government Information Technology Services Board, and the Chair of the Information Technology Resources Board shall also be members. The CIO Council shall be chaired by the Deputy Director for Management of OMB. The Vice Chair, elected by the CIO Council on a rotating basis, shall be an agency CIO.

Section 4. Government Information Technology Services Board.

(a) Purpose and Functions. A Government Information Technology Services Board ("Services Board") is established to ensure continued implementation of the information technology recommendations of the National Performance Review and to identify and promote the development of innovative technologies, standards, and practices among agencies and state and local governments and the private sector. It shall seek the views of experts from industry, academia, and state and local governments on matters of concern to the Services Board as appropriate. The Services Board shall also make recommendations to the agencies, the CIO Council, OMB, and others as appropriate, and assist in the following:

(1) creating opportunities for cross-agency cooperation and intergovernmental approaches in using information resources to support common operational areas and to develop and provide shared government-wide infrastructure services;

(2) developing shared government-wide information infrastructure services to be used for innovative, multiagency information technology projects;

(3) creating and utilizing affinity groups for particular business or technology areas; and

(4) developing with the National Institute of Standards and Technology and with established standards bodies, standards and guidelines pertaining to federal information systems, consistent with the limitations contained in the Computer Security Act of 1987 (40 U.S.C. 759 note), as amended by the Information Technology Act.

(b) Membership. The Services Board shall be composed of individuals form agencies based on their proven expertise or accomplishments in fields necessary to achieve its goals. Major government mission areas such as electronic benefits, electronic commerce, law enforcement, en-

vironmental protection, national defense, and health care may be represented on the Services Board to provide a program operations perspective. Initial selection of members will be made OMB in consultation with other agencies as appropriate. The CIO Council may nominate two members. The Services Board shall recommend new members to OMB for consideration. The Chair will be elected by the Services Board.

Section 5. Information Technology Resources Board.

(a) Purpose and Functions. An Information Technology Resources Board ("Resource Board") is established to provide independent assessments to assist in the development, acquisition, and management of selected major information systems and to provide recommendations to agency heads and OMB as appropriated. The Resources Board shall:

(1) review, at the quest of an agency and OMB, specific information systems proposed or under development and make recommendations to the agency and OMB regarding the status of systems or next steps;

(2) publicize lessons learned and promising practices based on information systems reviewed by the Board; and

(3) seek the views of experts from industry, academia, and state and local governments on matters of concern to the Resources Board, as appropriate.

(b) Membership. The Resources Board shall be composed of individuals from executive branch agencies based on their knowledge of information technology, program, or acquisition management within federal agencies. Selection of members shall be made by OMB in consultation with other agencies as appropriate. The Chair will be elected by the Resources Board. The Resources Board may call upon the department or agency whose project is being reviewed, or any other department or agency to provide knowledgeable representation(s) to the Board whose guidance and expertise will assist in focusing on the primary issue(s) presented by a specific system.

Section 6. Office of Management and Budget. The Director of OMB shall:

(a) evaluate agency information resources management practice and, as part of the budget process, analyze, track and evaluate the risks and results of all major capital investments for information systems;

(b) notify an agency if it believes that a major information system requires outside assistance;

(c) provide guidance on the implementation of this order and on the management of information resources to the executive agencies and to the Boards established by this order; and

(d) evaluate the effectiveness of the management structure set out in this order after 3 years and make recommendations for any appropriate changes.

Section 7. General Services Administration. Under the direction of OMB, the Administrator of General Services shall:

(a) continue to manage the FTS2000 program and coordinate the follow-on to that program, on behalf of and with the advice of customer agencies;

(b) develop, maintain, and disseminate for the use of the federal community, as requested by OMB or the agencies, recommended methods and strategies for the development and acquisition of information technology;

(c) conduct and manage outreach programs in cooperation with agency managers;

(d) be a focal point for liaison on information resources management, including federal information technology, with state and local governments, and with non-governmental international organizations subject to prior consultation with the Secretary of State to ensure such liaison would be consistent with and support overall United States foreign policy objectives;

(e) support the activities of the Secretary of State for liaison, consultation, and negotiation with intergovernmental organizations in information resources management matters;

(f) assist OMB, as requested, in evaluating agencies. performance-based management tracking systems and agencies. achievement of cost, schedule, and performance goals; and

(g) provide support and assistance to the interagency groups established in this order.

Section 8. Department of Commerce. The Secretary of Commerce shall carry out the standards responsibilities under the Computer Security Act of 1987, as amended by the Information Technology Act, taking into consideration the recommendations of the agencies, the CIO Council, and the Services Board.

Section 9. Department of State.

(a) The Secretary of State shall be responsible for liaison, consultation, and negotiation with foreign governments and intergovernmental organizations on all matters related to information resources management, including federal information technology. The Secretary shall further ensure, in consultation with the Secretary of Commerce, that the United States is represented in the development of international standards and recommendations affecting information technology. In the exercise of these responsibilities, the Secretary shall consult, as appropriate, with affected domestic agencies, organizations, and other members of the public.

(b) The Secretary of State shall advise the Director on the development of United States positions and policies on international information policy and technology issues affecting federal government activities and the development or international information technology standards.

Section 10. Definitions.

(a) “Executive agency” has the meaning given to that term in section 4(1) of the Office of Federal Procurement Policy Act (41 U.S.C. 403 (1)).

(b) “Information Technology” has the meaning given that term in section 5002 of the Information Technology Act.

(c) “Information resources” has the meaning given that term in section 3502(6) of title 44, United States Code.

(d) Information resources management” has the meaning given that term in section 3502(7) of title 44, Untied States Code.

(e) "Information system" has the meaning given that term in section 3502(8) of title 44, United States Code.

(f) "Affinity group" means any interagency group focused on a business or technology area with common information technology or customer requirements. The functions of an affinity group can include identifying common program goals and requirements; identifying opportunities for sharing information to improve quality and effectiveness; reducing costs and burden on the public; and recommending protocols and other standards, including security standards, to the National Institute of Standards and Technology for government-wide applicability, for action in accordance with the Computer Security Act of 1987, as amended by the Information Technology Act..

(g) "National security system" means any telecommunications or information system operated by the United States Government, the function, operation, or use of which (1) involves intelligence activities; (2) involves cryptologic activities related to national security; (3) involves command and control of military forces; (4) involves equipment that is an integral part of a weapon or weapons system; or (5) is critical to the direct fulfillment of military or intelligence missions, but excluding any system that is to be used for routine administrative and business applications (including payroll, finance, logistics, and personnel management applications).

Section 11. Applicability to National Security Systems. The heads of executive agencies shall apply the policies and procedures established in this order to national security systems in a manner consistent with the applicability and related limitations regarding such systems set out in the Information Technology Act.

Section 12. Judicial Review. Nothing in this Executive order shall affect any otherwise available judicial review of agency action. This Executive order is intended only to improve the internal management of the executive branch and does not create any right or benefit, substantive or procedure, enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

William J. Clinton

THE WHITE HOUSE
July 16, 1996

APPENDIX 3. FAR 39.002, 39.103 MODULAR CONTRACTING

39.002 Definitions.

"Modular contracting," as used in this part, means use of one or more contracts to acquire information technology systems in successive, interoperable increments."

39.103 Modular Contracting.

(a) This section implements Section 5202, Incremental Acquisition of Information Technology, of the Clinger-Cohen Act of 1996 (Public Law 104-106). Modular contracting is intended to reduce program risk and to incentivize contractor performance while meeting the government's need for timely access to rapidly changing technology. Consistent with the agency's information technology architecture, agencies should, to the maximum extent practicable, use modular contracting to acquire major systems (see 2.101) of information technology. Agencies may also use modular contracting to acquire non-major systems of information technology.

(b) When using modular contracting, an acquisition of a system of information technology may be divided into several smaller acquisition increments that--

(1) Are easier to manage individually than would be possible in one comprehensive acquisition;

(2) Address complex information technology objectives incrementally in order to enhance the likelihood of achieving workable systems or solutions for attainment of those objectives;

(3) Provide for delivery, implementation, and testing of workable systems or solutions in discrete increments, each of which comprises a system or solution that is not dependent on any subsequent increment in order to perform its principal functions;

(4) Provide an opportunity for subsequent increments to take advantage of any evolution in technology or needs that occur during implementation and use of the earlier increments; and

(5) Reduce risk of potential adverse consequences on the overall project by isolating and avoiding custom-designed components of the system.

(c) The characteristics of an increment may vary depending upon the type of information technology being acquired and the nature of the system being developed. The following factors may be considered:

(1) To promote compatibility, the information technology acquired through modular contracting for each increment should comply with common or commercially acceptable information technology standards when available and appropriate, and shall conform to the agency's master information technology architecture.

(2) The performance requirements of each increment should be consistent with the performance requirements of the completed, overall system within which the information technology will function and should address interface requirements with succeeding increments.

(d) For each increment, contracting officers shall choose an appropriate contracting technique that facilitates the acquisition of subsequent increments. Pursuant to Parts 16 and 17 of the Federal Acquisition Regulation, contracting officers shall select the contract type and method appropriate to the circumstances (e.g., indefinite delivery, indefinite quantity contracts, single contract with options, successive contracts, multiple awards, task order contracts). Contract(s) shall be structured to ensure that the government is not required to procure additional increments.

(e) To avoid obsolescence, a modular contract for information technology should, to the maximum extent practicable, be awarded within 180 days after the date on which the solicitation is issued. If award cannot be made within 180 days, agencies should consider cancellation of the solicitation in accordance with 14.209 or 15.206(e). To the maximum extent practicable, deliveries under the contract should be scheduled to occur within 18 months after issuance of the solicitation.

APPENDIX 4. GLOSSARY

Acquisition means the acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the federal government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract.

Contracting means purchasing, renting, leasing, or otherwise obtaining supplies or services from non-federal sources. Contracting includes description (but not determination) of supplies and services required, selection and solicitation of sources, preparation and award of contracts, and all phases of contract administration. It does not include making grants or cooperative agreements.

Delivery Order Contract means a contract for supplies that does not procure or specify a firm quantity of supplies (other than a minimum or maximum quantity) and that provides for the issuance of orders for the delivery of supplies during the period of the contract.

Earned Value is a management technique that relates resource planning to schedules and to technical performance requirements. Earned value management (EVM) uses earned value as the tool for integrating cost, schedule, and technical performance and risk management.

Government-wide Acquisition Contracts (GWACs) are contracts that enable agencies (requesting agencies) that need information technology products and services to obtain them from another federal agency (servicing agency) that has entered into a contract:

(a) Before August 7, 1996, under a delegation of procurement authority issued by the General Services Administration (GSA) under authority granted to it by the Brooks Act, 40 U.S.C. 759, or

(b) After being designated as an executive agent for such by the Office of Management and Budget (or otherwise covered by such designation) pursuant to section 5112(e) of the Clinger-Cohen Act, 40 U.S.C. 1412(e). GWACs are subject to applicable Executive branch policies and procedures. However, they are not subject to the requirements and limitations of the Economy Act.

Information Technology means any equipment, or interconnected system(s) or subsystem(s) of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the agency.

(a) For purposes of this definition, equipment is used by an agency if the equipment is used by the agency directly or is used by a contractor under a contract with the agency which:

(1) Requires the use of such equipment, or

(2) Requires the use, to a significant extent, of such equipment in the performance of a service or the furnishing of a product.

(b) The term "information technology" includes computers, ancillary equipment, software, firmware, and similar procedures, services (including support services), and related resources.

(c) The term "information technology" does not include:

(1) Any equipment that is acquired by a contractor incidental to a contract, or

(2) Any equipment that contains embedded information technology that is used as an integral part of the product, but the principal function of which is not the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. For example, HVAC (heating, ventilation, and air conditioning) equipment, such as thermostats or temperature control devices, and medical equipment for which information technology is integral to its operation, are not information technology.

Major Systems, as defined by the Federal Acquisition Regulation (FAR) 2.101 include:

- Civilian Agency systems with total expenditures of more than $750,000 (based on Fiscal Year (FY) 1980 constant dollars),
- Department of Defense systems with total expenditures for research, development, test, and evaluation estimated to be more than $115,000,000 (based on FY 1990 constant dollars) or an "eventual total expenditure for the acquisition" in excess of $540,000,000 (FY 1990 constant dollars), or
- Any system designated a "major system" by the head of the Agency responsible for the system.

Module: A module is an economically and programmatically separable segment that has a substantial programmatic use, even if no additional segments are acquired.

Modular Contracting: Modular contracting is accomplished when an "agency's need for a system is satisfied in successive acquisitions of interoperable increments. Each increment complies with common or commercially accepted standards applicable to IT so that the increments are compatible with other increments of IT comprising the system."

Multiagency Contracts are ID/IQ contracts that enable agencies (requesting agencies) that need products and services, including but not limited to information technology services, to obtain them from another federal agency (servicing agency) that also has a need for such services and has awarded, or will be awarding, a contract for such services. Multiagency contracts are subject to the requirements and limitations of the Economy Act (except where more specific statutory authority exists) and applicable Executive branch policies and procedures, including, for information technology services, OMB Memorandum M-97-07 dated February 26, 1997.

Task Order Contract means a contract for services that does not procure or specify a firm quantity of services (other than a minimum or maximum quantity) and that provides for the issuance of orders for the performance of tasks during the period of the contract.

APPENDIX 5. THE PROJECT MANAGEMENT PLAN©

I. OUTLINE

A project management plan (PMP) could include all or most of the sections that follow. Tailoring is essential, and additional sections should be added as appropriate.

Section	Title
1.	Project Summary and Authorization
2.	Project Management
3.	System Engineering and Configuration Management
4.	Test and Evaluation
5.	Telecommunications
6.	Operations
7.	Facilities Engineering
8.	Logistics
9.	Manpower and Organization
10.	Personnel Training
11.	Application of Directives and Policy

II. PREPARATION GUIDELINES

Project Summary and Authorization (Section 1)

This section briefly describes the requirements, the project, and the management approach to be used to ensure that participating organizations and management officials understand the key features of the project. It also summarizes the background of the project and the rationale for the approach being taken.

This section should also include a summary of or reference to the source of project approval and the documents that establish project parameters, identify resources, and otherwise govern the continued actions of participating organizations.

Project Management (Section 2)

This section provides a more detailed description of the overall management concept and approach used to meet the requirements of the project. The management methods should ensure

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sufficient visibility to allow for continuous assessment of project progress and technical performance, including schedule and costs. This section should include the following major subsections:

1. **Project Manager's Charter.** This subsection summarizes the manager's authority, responsibility, and accountability as established in the formal charter issued by the sponsoring authority. Typically, the following items covered in the charter should be summarized here:
   - Name of the project manager
   - Reporting channels
   - Project manager's authority
   - Interfaces and other agencies involved in the project
   - Support to be provided to the project manager
   - Peculiar relationships not covered by existing policy or procedure
   - Special instructions
   - Special reporting requirements
   - Structure of the project management office and project management organization
   - Conditions under which the project manager will transfer responsibility to the operational staff
2. **Performance**. This subsection develops a management approach that provides for continuous assessment of project accomplishments in relation to the stated requirements.
3. **Schedules**. Participating organizations should assist in preparing a master schedule or major milestones, key events, and any critical actions essential to timely execution of the project. Detailed schedules should also be included in this subsection, such as:
   - Master Project/Overall Milestone Schedule
   - Acquisition and Development Schedules
   - Facilities and Site Activation Schedules
   - Test Schedules
   - Training Schedules
   - Any other specialized schedules

The project manager should ensure that the scheduled activities of participating organizations are compatible and consistent with the project schedules, and that the schedules are refined and updated as the project proceeds.

4. **Interrelationships**. This subsection defines the responsibilities and interrelationships of organizations that provide major support to the project. Reference should be made to written agreements with participating organizations. The use of any independent assessment teams or contractor-selected key milestones in the project should be described.

5. **Reporting Requirements**. This subsection identifies the reports (especially milestone reports) needed to meet the requirements of higher management and other participating organizations. It also indicates the requirements for contractor reporting.

6. **Financial**. This subsection summarizes the total cost of the project, including the costs of acquisition, logistic support, related construction, and user operation. The project manager is responsible for the overall development, collection, analysis, and presentation of financial data for the program management plan. The participating and support organizations are the source of financial estimates for their areas of responsibility, and they normally furnish the project management office with cost data and information on the methods, techniques, and factors used in developing their estimates.

7. **Acquisition**. This subsection includes a description of the resources to be contractually acquired and a summary of the project's acquisition strategy, types of contracts, and major contractual features that may be required.

System Engineering and Configuration Management (Section 3)

This section describes the system engineering and configuration management approaches to be used throughout the life of the project.

1. **System Engineering Management**. This subsection describes the effort for defining the preferred system design, the engineering/technical management approach, and the integration of engineering disciplines. It includes summaries or plans for risk reduction, technical reviews, and studies and analyses; particularly life cycle cost analyses, if appropriate. System engineering resources and organizational responsibilities should be identified.

2. **Configuration Management**. This subsection describes the configuration management approach, including those management tools to be used to apply the fundamental principles of configuration management (identification of configuration items, change control, and status accounting). Organizational responsibilities for configuration management and preparation of the configuration management plan should be addressed.

Test and Evaluation (Section 4)

This section describes the test management concept, including the organizational structure and responsibilities. All participating organizations should be identified, as well as critical issues and areas of risk, and specific test objectives and strategies.

Telecommunications (Section 5)

This section should identify telecommunications support requirements individually for the following items:

- Project Management (any special communications requirements of the project manager/ project management office)
- Development and Testing
- Deployment and Operations
- Privacy and security issues

Operations (Section 6)

This section should incorporate inputs from the operating organization and expand the operational concept for the use of the system or equipment as further formulated during the project life cycle. It should include information on the operational use of the system, as appropriate, including the following elements:

- Deployment and operations
- Training
- Conversion and phase-out
- Maintenance (system and hardware)
- Documentation
- Logistics support

Facilities Engineering (Section 7)

Where appropriate, this section includes or refers to a master plan prepared for each installation or sub-installation that outlines the proposed site development for the total facilities required. This section describes the management of responsibilities and procedures for programming, design, modification, construction, and maintenance and acceptance of real property facilities.

Logistics (Section 8)

This section requires inputs from the responsible logistics organizations and other participating agencies. It should provide a comprehensive description of the tailored logistics concepts for the project, including provision for maintenance of equipment, spare parts, and operating supplies.

Manpower and Organization (Section 9)

This section describes the organization and staffing of the project office and summarizes the relationships and roles of the other organizations involved in the acquisition project. It should refer-

ence any formal agreements with participating organizations and the extent and characteristics of matrix tasking and relationships.

Personnel Training (Section 10)

This section requires inputs from the operating and training organizations. It summarizes the personnel training required for system testing, deployment, operations, and support, and it should cross-reference other sections to reflect related actions where appropriate. It should also include the following items:

- Requirements for trained personnel for the system/equipment in terms of numbers and skills
- Types, location, and key dates of individual training courses, emphasizing early planning for training courses
- Required training equipment
- Major training facility requirements

Application of Directives and Policy (Section 11)

This section describes the policy and directives that apply, wholly or in part, to the project and to which all participants must adhere or which they must observe. There are many directives that may require action by the project office in managing a project. The project manager is responsible for determining and enforcing directives that apply to a particular project, as well as for requesting waivers for directives that will not be enforced, even though they may be required. Before approving the project management plan, the project manager should ensure that any requests for necessary waivers are submitted to the appropriate authority.

Summary

The project management plan is a living document that is intended to:

- Explain the management approach selected for the project.
- Identify the activities, strategies, schedules, and resources for the project effort.
- Serve as the single baseline management document used by all participating organizations and outside parties to establish project objectives, assign responsibilities, define tasks, and publish schedules.
- Be revised throughout the life of the project to reflect the project's current status and the latest plan and resource information. Major revisions and updates are usually associated with milestone reviews.©

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APPENDIX 6. CONTACTS FOR MORE INFORMATION

GSA IT Policy web site - Modular Contracting
http://www.itpolicy.gsa.gov/mks/moddir/modtoc.htm

Software Engineering Institute's Software Capability Maturity Model
http://www.sei.cmu.edu/technology/cmm.html

Practical Software Management, A Guide to Objective Program Insight, sponsored by the Joint Logistics Commanders, Joint Group on Systems Engineering (JLC-JGSE),
http://www.cards.com.psm

Software Engineering Institute's *Software Measurement for DOD Systems: Recommendations for Initial Core Measures* (Technical Report CMU/SEI-92-TR-19
http://www.sei.cmu.edu

Department of the Air Force, Software Technology Support Center's *Guidelines for Successful Acquisition and Management of Software Intensive Systems V2.0*
http://stsc.hill.af.mil/stscdocs.html

CROSSTALK. "The Journal of Defense Software Engineering"
http://stsc.hill.af.mil/CrossTalk/crostalk.html

Integrated Product Teams
http://www.dsmc.dsm.mil/jdam/contents/ipt.htm

The Canadian Plan: Common Purpose Procurement Framework
http://www.itpolicy.gsa.gov/mks/whitepr/cppfrpt.htm

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