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DEPARTMENT OF DEFENSE HANDBOOK

WORK BREAKDOWN STRUCTURE

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AMSC N/A **AREA MISC**

Foreword

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

3. A work breakdown structure (WBS) provides a consistent and visible framework for defense materiel items and contracts within a program. This handbook offers uniformity in definition and consistency of approach for developing the top three levels of the work breakdown structure. The benefit of uniformity in the generation of work breakdown structures and their application to management practices will be realized in improved communication throughout the acquisition process.

4. This handbook addresses mandatory procedures for those programs subject to DOD Regulation 5000.2-R. It also provides guidance to industry in extending contract work breakdown structures.

5. This handbook is a conversion of MIL-STD-881B, Work Breakdown Structures for Defense Materiel Items, with no substantive changes in work breakdown structure definition. MIL-STD-881B was based on the cooperative efforts of the military services, with assistance from industrial associations.

6. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: OUSD(A&T)API/PM, 3020 DEFENSE PENTAGON, ROOM 3E1025, WASHINGTON, DC 20301-3020 by using the self-addressed Standardization Document Improvement Proposal (DOD Form 1426) appearing at the end of this document or by letter.

CONTENTS

FIGURES

APPENDICES

ACRONYMS

ACAT	Acquisition Category
CARD	Cost Analysis Requirements Description
CCDR	Contractor Cost Data Reporting
CDRL	Contract Data Requirements List
CPR	Cost Performance Reports
CFSR	Contract Funds Status Reports
CLIN	Contract Line Item Number
CSCI	Computer Software Configuration Item
C/SSR	Cost/Schedule Status Reports
ESWBS	Extended Ship Work Breakdown Structure
EVMS	Earned Value Management System
MIL-STD	Military Standard
R&D	Research and Development
RFP	Request for Proposal
SOW	Statement of Work
WBS	Work Breakdown Structure

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CHAPTER 1:

GENERAL INFORMATION

1.1 HANDBOOK PURPOSE AND STRUCTURE

This handbook presents guidelines for preparing, understanding, and presenting a work breakdown structure (WBS). After the general purpose of work breakdown structures is discussed in Chapter 1, the handbook provides instructions on how to develop a program work breakdown structure (Program WBS) in Chapter 2. Chapter 3 offers guidance for developing and implementing a contract work breakdown structure (Contract WBS). Chapter 4 examines the role of the work breakdown structure in contract negotiation and award and in post-contract performance. The appendices present definitions of work breakdown structures for specific applications. The handbook's primary objective is to achieve a consistent application of the work breakdown structure. The information it contains is intended to provide guidance to contractors and direction to government project managers.

1.2 SUPPORT DOCUMENTATION

The foundation for work breakdown structures is contained in DoD Directive 5000.1 and DoD Regulation 5000.2-R. These documents identify responsibilities in the acquisition process from the Office of the Secretary of Defense to the Department of Defense (DoD) component field activities. Preparing a work breakdown structure is generally discussed in the context of planning and monitoring a defense materiel system program.

1.3 INTENDED USE OF HANDBOOK

This handbook is directed primarily at the preparation of a work breakdown structure for a defense materiel item. This includes all materiel items or major modifications established as an integral program element of the Future Years Defense Program or otherwise designated by the DoD component or the Under Secretary of Defense (Acquisition and Technology).

The guidance is appropriate for use with any work breakdown structure developed at any phase—Concept Exploration, Program Definition and Risk Reduction, Engineering and Manufacturing Development, or Production—during the acquisition process.

The handbook clearly delineates the overlapping responsibilities of DoD program managers and contractors relative to work breakdown structures.

1.4 WHAT DOES A WORK BREAKDOWN STRUCTURE ACCOMPLISH?

1.4.1 Applications

This handbook addresses two fundamental and interrelated types of work breakdown structures—the Program WBS and the Contract WBS. The Program WBS provides a framework for specifying the objectives of the program. It defines the program in terms of hierarchically related product-oriented elements. Each element provides logical summary points for assessing technical accomplishments and for measuring cost and schedule performance.

The Contract WBS is the government-approved work breakdown structure for reporting purposes and its discretionary extension to lower levels by the contractor, in accordance with government direction and the contract work statement. It includes all the elements for the products (hardware, software, data, or services) which are the responsibility of the contractor.

Further, the work breakdown structure serves as a coordinating medium. Through the Program WBS and the Contract WBS, work is documented as resources are allocated and expended. Technical, schedule, and cost data are routinely generated for reporting purposes. The work breakdown structures summarize data for successive levels of management and provide the appropriate information on the projected, actual, and current status of the elements for which they are responsible. The WBS keeps the program's status constantly visible so that the program manager, in cooperation with the contractor, can identify and implement changes necessary to assure desired performance.

1.4.2 Benefits

The work breakdown structure assists in several ways during the life of a program. A WBS:

- Separates a defense materiel item into its component parts, making the relationships of the parts clear and the relationship of the tasks to be completed—to each other and to the end product—clear.
- Significantly affects planning and the assignment of management and technical responsibilities.
- Assists in tracking the status of engineering efforts, resource allocations, cost estimates, expenditures, and cost and technical performance.
- Helps ensure that contractors are not unnecessarily constrained in meeting item requirements.

1.4.3 Challenges

The primary challenge is to develop a work breakdown structure which defines the logical relationship between all the elements of the program and its natural extension with the contract. Defining the Contract WBS to the third level of indenture does not constrain the contractor's ability to define or manage the program and resources. However, if the government considers elements of the program to be high cost or high risk, the system may be defined to a lower level of the WBS. This is reasonable as long as the product-oriented logical extension is maintained. In any event the contractor should extend all other elements to the level and form that the contractor desires based on the way the system is developed, produced, or managed.

A second challenge is to balance the program definition aspects of the WBS with its data-generating aspects. Using available data to build historic files to aid in the future development of similar defense materiel items is a very valuable resource. Remember, however, that the primary purpose of the work breakdown structure is to define the program's structure, and the need for data should not distort or hinder the program definition.

1.5 HOW IS THE WBS RELATED TO OTHER CONTRACT REQUIREMENTS?

The work breakdown structure provides the basis for communication throughout the acquisition process. It is the common link which unifies the planning, scheduling, cost estimating, budgeting, contracting, configuration management, and performance reporting disciplines. Through consistent communications it permits the government and industry managers to evaluate progress in terms of contract performance.

The work breakdown structure forms the basis for reporting structures used for contracts requiring compliance with the Earned Value Management System (EVMS) Criteria and reports placed on contract such as Contractor Cost Data Reporting (CCDR), Cost Performance Reports (CPR), Contract Funds Status Reports (CFSR), and Cost/Schedule Status Reports (C/SSR).

1.6 DEFINITIONS

The definitions provided in the following paragraphs are intended to improve continuity throughout the acquisition process and support a common understanding of program expectations.

1.6.1 Program Element

This term—the basic building block of the Future Years Defense Program—describes the mission to be undertaken and lists the organizational entities identified to perform the mission assignment. A program element may consist of

forces, manpower, materiel (both real and personal property), services, and associated costs, as applicable.

1.6.2 Defense Materiel item

This term identifies a system or item usually established as an integral program element or identified as a project within an aggregated program element.

1.6.3 Work Breakdown Structure

This term is defined as:

- A **product-oriented family tree** composed of hardware, software, services, data, and facilities. The family tree results from systems engineering efforts during the acquisition of a defense materiel item.
- A WBS displays and defines the product, or products, to be developed and/or produced. It **relates the elements** of work to be accomplished to each other and to the end product.
- A WBS can be expressed down to any level of interest. However the top **three levels** are as far as any program or contract need go unless the items identified are high cost or high risk. Then, and only then, is it important to take the work breakdown structure to a lower level of definition.

Work breakdown structures apply to seven specific categories of defense materiel items. Summaries of those categories are provided below; complete definitions are included as Appendices A-H. Just as the system is defined and developed throughout its life cycle, so is the work breakdown structure. The WBS will be developed and maintained based on the systems engineering efforts throughout the system's life cycle.

1.6.4 Common Elements

This term identifies the elements that are applicable to all seven major systems. Common elements are:

- integration, assembly, test, and checkout efforts
- systems engineering and program management
- training
- data
- system test and evaluation
- peculiar support equipment
- common support equipment
- operational and site activation
- industrial facilities
- initial spares and repair parts

In addition to these common elements, each defense system has a unique complex of equipment (hardware and software) which defines the capability or end product of that system.

- **aircraft system**—applies to fixed or movable wing, rotary wing, or compound wing manned/unmanned air vehicles designed for powered or unpowered (glider) guided flight
- **electronic/automated software system**—applies to electronic, automated, or software system capability
- **missile system**—applies to a weapon in an operational environment which produces a destructive effect on selected targets
- **ordnance system**—applies to all munitions (nuclear, biological, chemical, psychological, and pyrotechnic) and the means of launching or firing them
- **ship system**—applies to naval weapons, or performing other naval tasks at sea
- **space system**—applies to developing, delivering, and maintaining mission payloads in specific orbit placement, operation, and recovery of manned and unmanned space systems
- **surface vehicle system**—applies to navigation over the surface

1.6.5 Level Identification

The top three levels are specified in a work breakdown structure.

- Level 1 is the **entire defense materiel item**; for example, an electronic system. An "electronic system" might be a command and control system, a radar system, a communications system, an information system, a sensor system, a navigation or guidance system, or an electronic warfare system. Level 1 is usually directly identified as a program or a sub-element of a program.
- Level 2 elements are the **major elements** of the defense materiel item; for example, a fire control system or an automatic flight control system. These prime mission products include all hardware and software elements, aggregations of system level services (like system test and evaluation, or systems engineering and program management), and data.
- Level 3 elements are **elements subordinate** to level 2 major elements. For example, a radar data processor, a signal processor, an antenna, a type of service (like development test and evaluation, contractor technical support, or training services), or a type of data (like technical publications) would be typical level 3 elements for an electronic system. Lower levels follow the same process.

1.6.6 Program WBS

The Program WBS is the structure that encompasses an entire program. It consists of at least three levels of the program with associated definitions and is used by the government program manager and contractor to develop and extend a Contract WBS. The Program WBS has uniform terminology, definitions, and placement in the product-oriented family tree structure.

1.6.7 Contract WBS

The Contract WBS is the complete work breakdown structure for a contract. It includes the DoD-approved Program WBS extended to the agreed contract reporting level and any discretionary extensions to lower levels for reporting or other purposes. It includes all the elements for the products (hardware, software, data, or services) which are the responsibility of the contractor. This comprehensive work breakdown structure forms the framework for the contractor's management control system.

1.7 WBS EVOLUTION

Throughout the life cycle of any system, the systems engineering function takes the lead in system development. This includes the development of system specifications, functional specifications, or a set of configuration items. The systems engineering process impacts requirements analysis, functional analysis and allocation, synthesis and systems analysis, and controls. Satisfying total systems cost, schedule, and performance requirements at an acceptable level of risk is the important factor. The purpose of these efforts is to define and design system product and process solutions in terms of design requirements that satisfy the functional architecture, and then to define and integrate the system as a physical architecture. The DoD program manager plays a key role in this process, and as the system is defined and developed throughout the life cycle, the program manager can better understand the work breakdown structure. Figure 1-1 provides an illustration of the system life cycle. The work breakdown structure follows the same path.

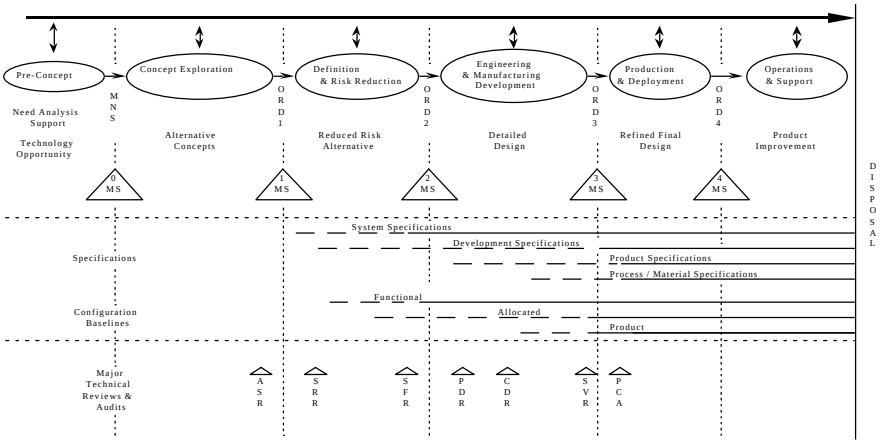


Figure 1-1: System Life Cycle

Through the conceptual phase, program work breakdown structures are usually in an early stage of development. Since the system is mainly a concept, it is not until the Program Definition and Risk Reduction phase that the system is described in terms of its specifications, and—if the program is large enough—contract work breakdown structures could be defined. In this phase, configuration items that describe the program work breakdown structure are first identified and contracts approved to develop these items. By the end of development, the work breakdown structure is fully defined to its lowest levels, and contract work breakdown structures are extended to those levels that best define the system. Figure 1-2 displays the evolution of this process.

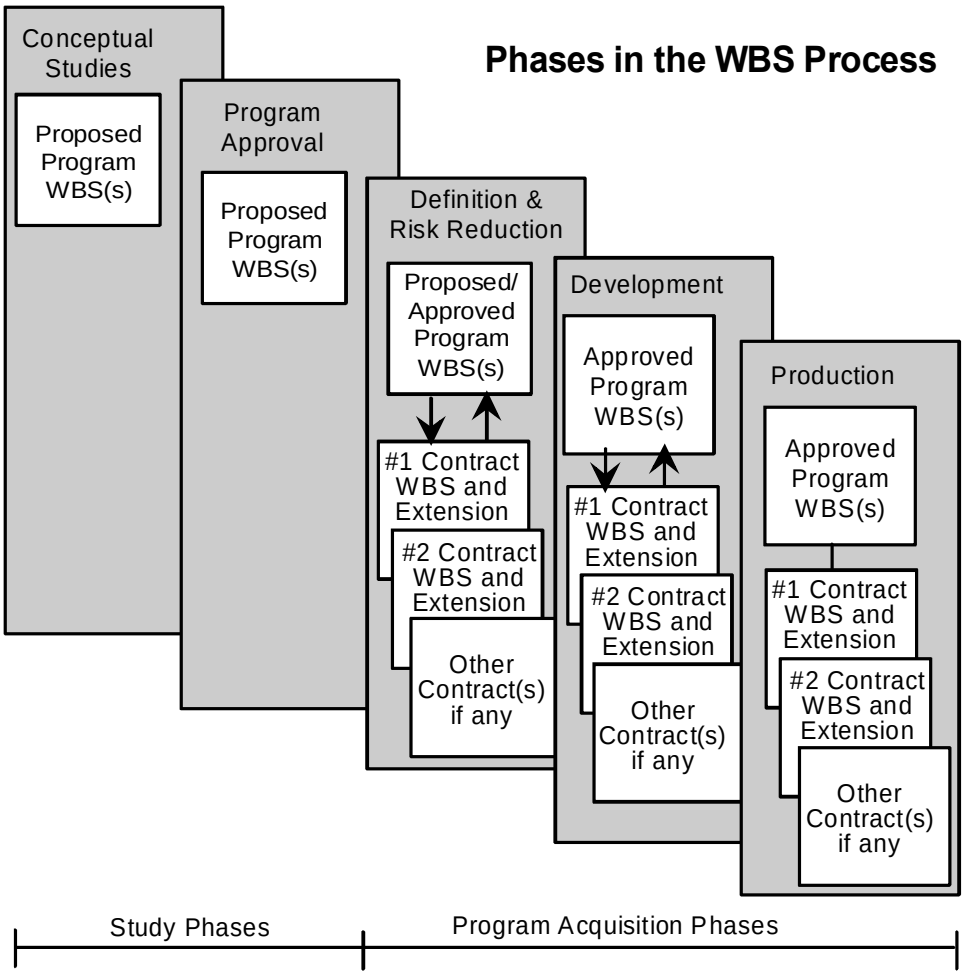


Figure 1-2: WBS Evolution

After the Program WBS has been approved, contract work breakdown structures may then be extended to lower levels by the contractor to define the complete contract scope. When it is integrated with the Program WBS, the extended Contract WBS forms a complete work breakdown structure which will be used throughout the acquisition cycle. Figure 1-2 displays this process in the Definition and Risk Reduction, Development, and Production blocks.

CHAPTER 2:

PROGRAM MANAGEMENT INSTRUCTIONS

2.1 PROGRAM WBS ATTRIBUTES

The Program WBS is intended to achieve a clear understanding and statement of the technical objectives and the end item(s) or end product(s) of the work to be performed.

In order to use the work breakdown structure as a framework for the technical objectives of a program (in addition to its use as a management tool for cost and schedule control), the work breakdown structure must be product oriented. Its elements should represent identifiable work products whether they be equipment, data, or related service products. Because any work breakdown structure is a product structure, not an organization structure, complete definition of the effort encompasses the work to be performed by all participants.

2.2 PREPARING A PROGRAM WBS

The program manager is responsible for maintaining the Program WBS as it develops through systems engineering and management planning processes. The work breakdown structure may span one or more of the categories or elements defined in Appendices A through G. While these elements normally provide a basis for the Program or Contract WBS, deviations may occur when a unique requirement exists which these appendices have not addressed. In addition, although each appendix relates to a specific category of defense items, any item from any appendix which is applicable to the program may be used, as long as the integrity of the level of placement is maintained.

2.2.1 Developing a Program WBS

The Program WBS should be developed early in the conceptual stages of the program. It evolves through iterative analysis of the program objective, functional design criteria, program scope, technical performance requirements, proposed methods of performance (including acquisition strategy, drawings, process flow charts), and other technical documentation. It is important that documentation describe the DoD plan to build, integrate, field, and support the system throughout its life cycle until it is removed from the inventory.

The Cost Analysis Requirements Document (CARD) will be the recording document for this program plan. Ultimately, the Program WBS is approved through the Contractor Cost Data Reporting (CCDR) plan process. In this process, the levels of reporting and elements for appropriate RFP selection are determined.

2.2.2 Selecting Program WBS Elements

The work breakdown structure provides a framework for specifying the technical objectives of the program by first defining the program in terms of hierarchically related, product-oriented elements and the work processes required for their completion. Each element of the work breakdown structure provides logical summary points for assessing technical accomplishments and for measuring the cost and schedule performance accomplished in attaining the specified technical objectives.

2.2.3 Determining Levels of Program WBS

For each work breakdown structure element, the detailed technical objectives are defined and specified work tasks are assigned to each contractor's organization elements, and assigned for the resources, materials, and processes required to attain the objectives. The linkage between the specification requirements, the work breakdown structure, the statement of work, and the master and detailed schedules provides specific insights into the relationship between cost, schedule, and performance. This relationship allows all items to be tracked to the same work breakdown structure element. Therefore, the levels of the Program WBS should be related to these requirements and conform to its product-oriented family tree.

When developing a Program WBS, the efforts of the systems engineers throughout the life cycle will aid in defining the description of the system and its related levels. Early in the Concept Exploration phase the systems engineering efforts are aimed at trying to establish the user's need. For example, suppose that need has been established as "Kill Tank." The objective is clear and can be met through numerous scenarios. The engineers perform tradeoffs for each scenario, and the preliminary system level functions are defined. In this case, the system that will "Kill Tank" must be able to maneuver to get into position, detect the tank by some means, and shoot. (See Figure 2-1.) The work breakdown structure is not formed around these functional requirements, but is developed out of the products which are considered to meet these requirements. Therefore, during the Concept Exploration phase, no formal work breakdown structure is defined.

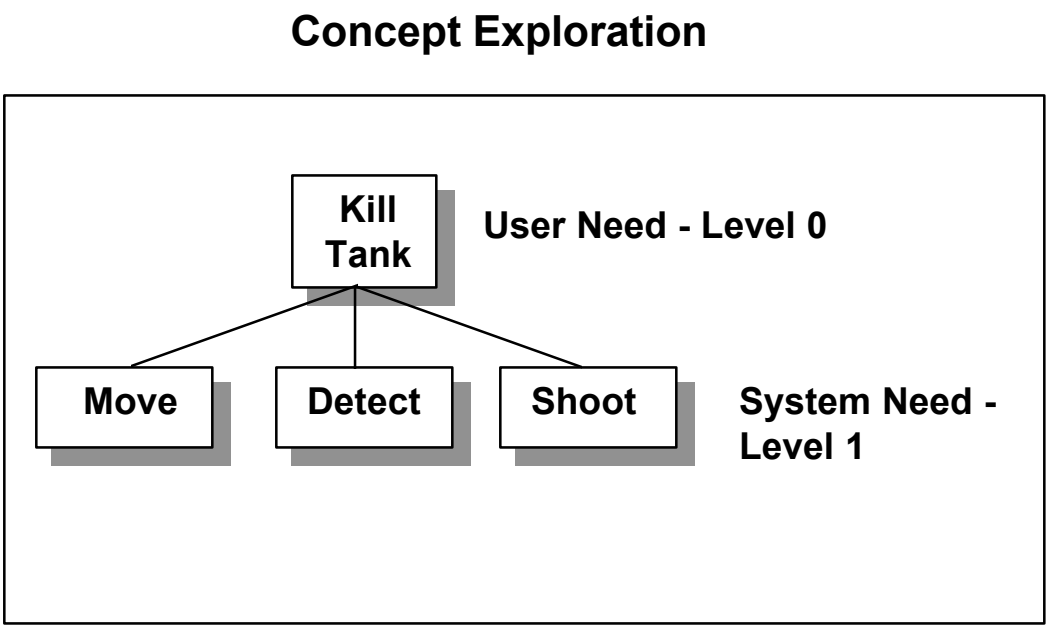


Figure 2-1: Functional Requirements in the Concept Exploration Phase

When the Program Definition and Risk Reduction phase is initiated, an Operational Requirements Document is published. This is one of the first documents which shows that the program is approved. With that approval the systems engineering efforts will focus on system level performance requirements, specifically proving critical technologies and processes, and developing top level specifications. Configuration items are assigned under a functional architecture all meeting the mission need of "Kill Tank." If government laboratories or in-house engineering support is accomplishing this work, a contractual statement of work may be prepared for formal request for proposal release in the Engineering and Manufacturing Development phase. Otherwise, this may have already been accomplished at the end of Concept Exploration to obtain contractual support for the Program Definition and Risk Reduction phase.

The work breakdown structure is better defined at this point. Before release of a formal request for proposal, the government identifies the work breakdown structure for the program and contract efforts and must approve a Contractor Cost Data Reporting plan. It is at this time that the preliminary Program WBS will be defined to level 3.

The Program Definition and Risk Reduction phase should describe the system in terms of its specifications and the configuration items that make up the system. Once the system concept is determined, then major subsystems and configuration items can be identified and lower level functions defined, so that lower level system elements can be defined.

Again these are not work breakdown structure elements since they do not reflect a product. In this example, using a cost effectiveness tradeoff process determined that the fire control system of an aircraft can meet the mission need. The fire control system is functionally able to detect, aim, track, and fire. (See Figure 2-2.)

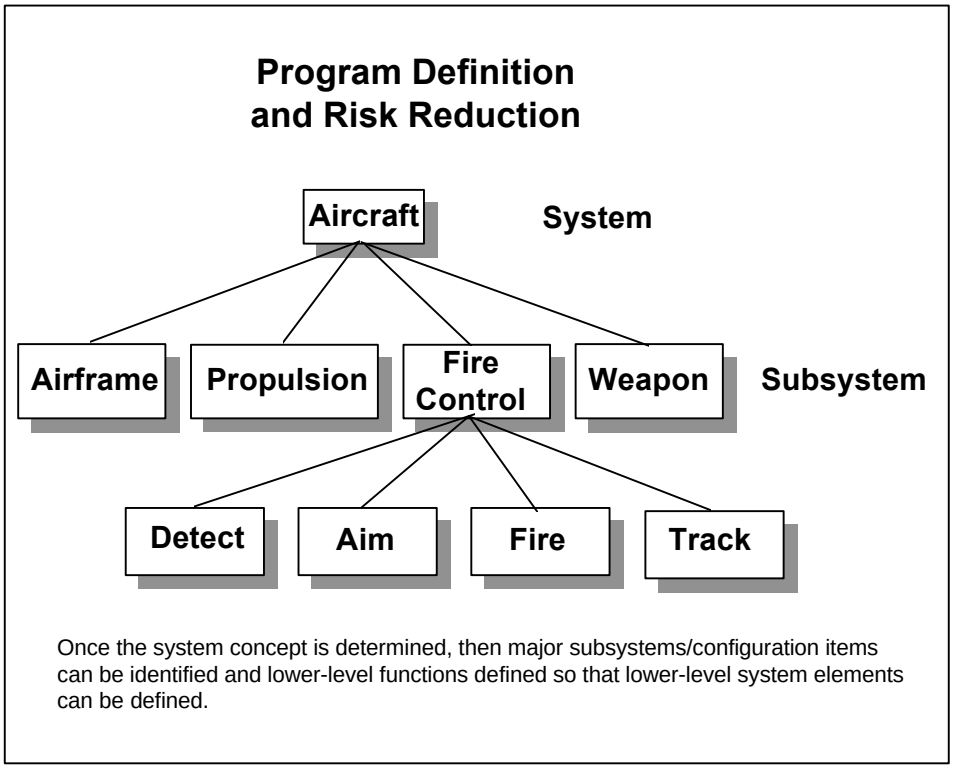


Figure 2-2: Identification of Major Subsystems and Configuration Items

The relationship of the functions shown in the previous example can now be translated into products that will meet the mission need requirement. The result is a program work breakdown structure defined to level 3. Generically, the work breakdown structure is defining the solution to the problem in terms of a product (See Figure 2-3). This figure shows the hierarchical relationship of the Aircraft System to the Fire Control Subsystem and other elements. When Program Definition and Risk Reduction units are being developed and produced, the Program WBS should be approved by submitting a Contractor Cost Data Reporting plan, as is currently required by DoD Regulation 5000.2-R. The plan describes the Program WBS being used and defines the approach the government activity plans to use for collecting cost data.

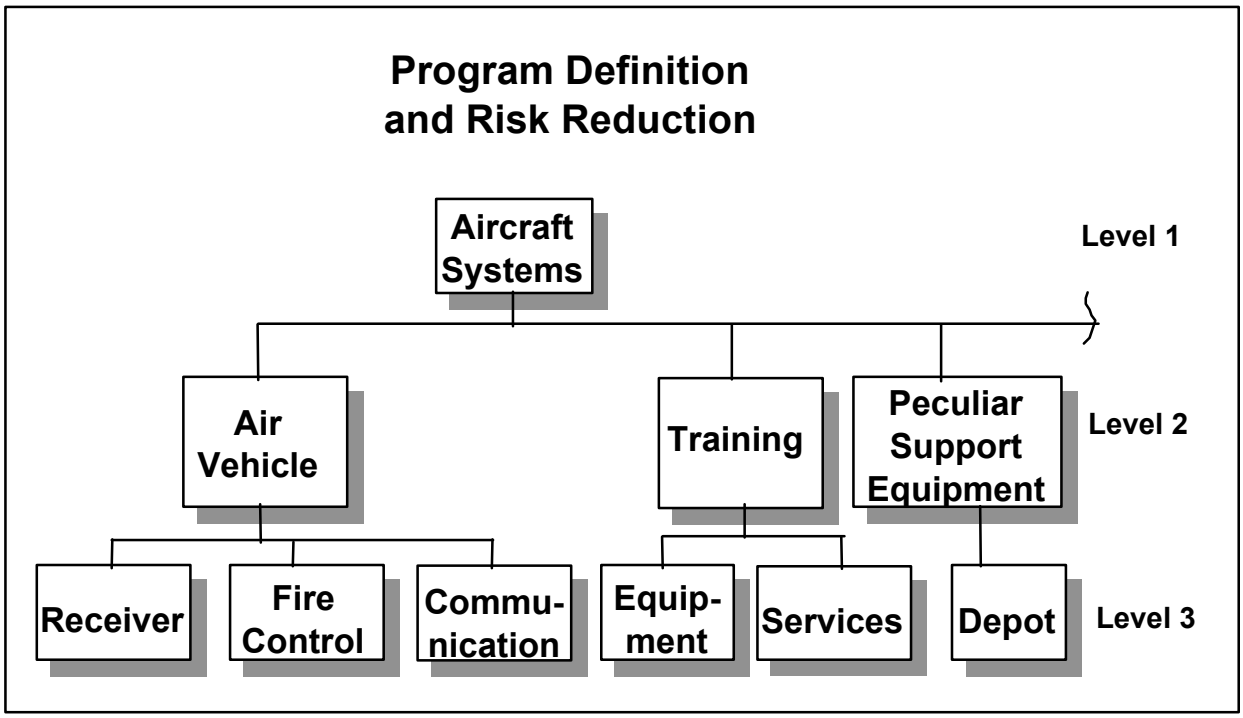
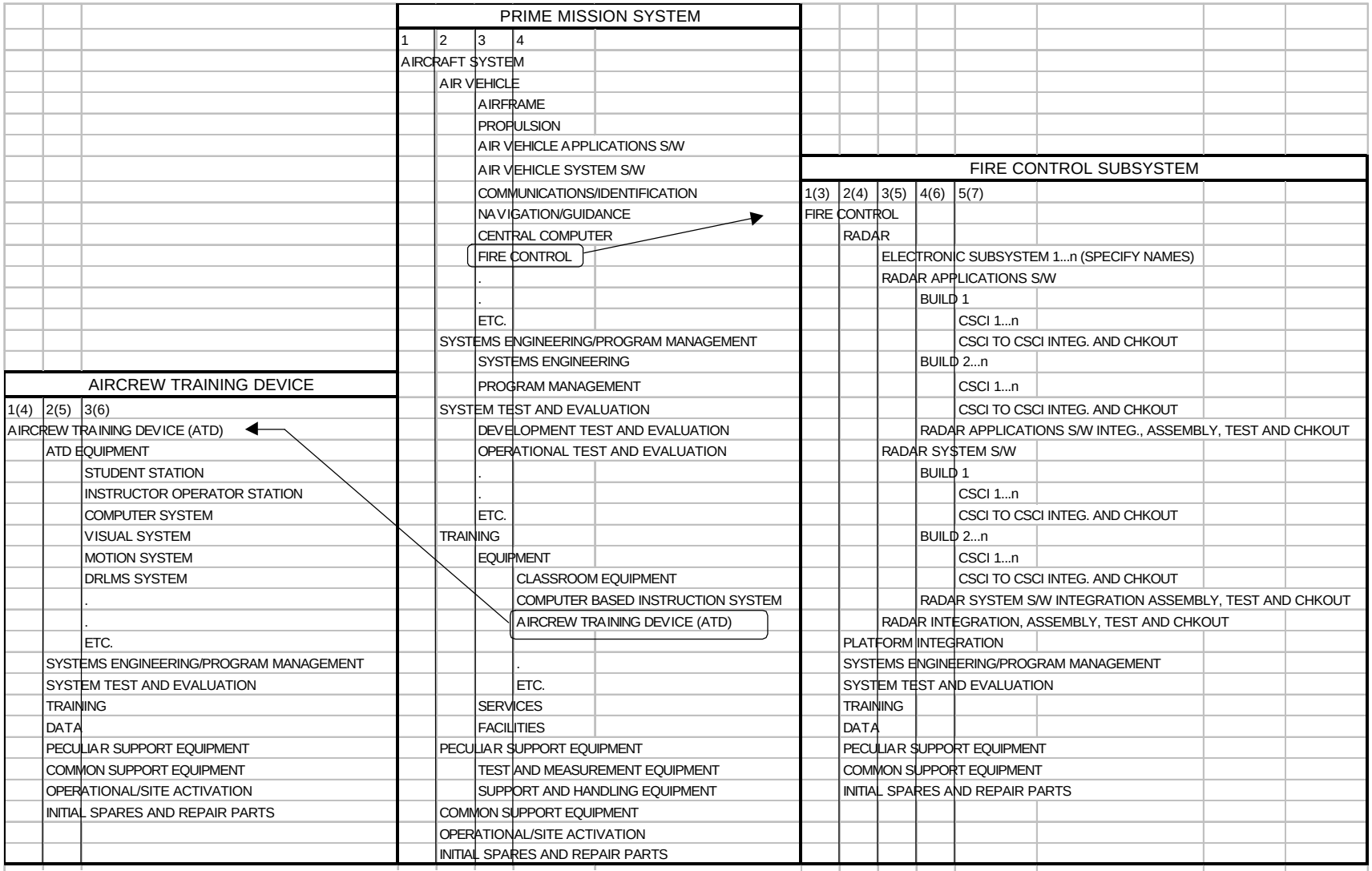


Figure 2-3: Program WBS Description

During the Engineering and Manufacturing Development phase of the program, systems engineering efforts include updating the Operational Requirements Document and defining the system configuration to its lowest level. Detailed design activities are ongoing, and by the end of this phase the total system definition is complete. The government has approved the Program WBS and each Contract WBS. As the system becomes better defined, the contractor extends the Contract WBS to the level and form reflecting the way business is planned and managed. The levels of the work breakdown structure are directly linked with the detailed configuration of the system.

Now that the system has been defined, the relationship of the Program WBS to the Contract WBS can be shown. The example assumes that the government activity is responsible for the FX Aircraft System. As a result, a contract must be awarded for the fire control system. Figure 2-4 depicts this relationship. If the FX Aircraft were awarded as a contract to a prime contractor, one could also assume that this is a Prime/Subcontract relationship. Replacing the words “Program” and “Contract” with “Prime” and “Subcontractor” respectively, the flowdown to the work breakdown structure requirement can be shown. In this case the Program WBS could be both the Program and the Contract WBS. The relationships are still the same; the difference is in how they relate to the government activity.



NOTES: 1. WBS LEVELS IN PARENTHESES INDICATE RELATIVITY TO PRIME MISSION SYSTEM (PMS).
2. LEVEL 2 ELEMENTS (SYSTEM ENGINEERING/PROGRAM MANAGEMENT, SYSTEM TEST AND EVALUATION, ETC.) FOR SUBSYSTEMS OF THE PMS ARE CONTAINED IN (I.E., ARE SUBELEMENTS OF) THE SUBSYSTEM ELEMENT-NOT THE PMS LEVEL 2 ELEMENT.
3. PLACEMENT OF THE SUBSYSTEM IN THE PROGRAM WORK BREAKDOWN STRUCTURE IS RELATIVE TO ITS WBS BREAKOUT FOR CONTRACT APPLICATION.

Figure 2-4: Work Breakdown Structure Matrix (Contract WBS)

During the production phase of the program, the system is produced as defined throughout the previous phases. Production usually includes the actual fabrication, modification, purchase, or some combination thereof, of hardware/software/firmware. The systems engineering efforts are actively involved in maintaining the configuration of the system being produced. The work breakdown structure is defined to the level appropriate for contract management and maintenance. When major modifications occur, the same WBS can be used; or, if the changes are substantial, a new work breakdown structure can be developed according to the same rules identified.

2.2.4 Creating The WBS Dictionary

As part of developing a Program WBS, the program manager will also develop a WBS Dictionary. The dictionary lists and defines the work breakdown structure elements. Although initially prepared by the Government Program Manager, the dictionary is expanded by the contractor as the Contract WBS is developed. The initial WBS Dictionary should be based on the generic definitions in this handbook, made program specific to define the products being acquired.

The dictionary shows the hierarchical relationship of the elements and describes each work breakdown structure element and the resources and processes required to produce it. It also provides a link to the detailed technical definition documents. The work breakdown structure dictionary should be routinely revised to incorporate changes and should reflect the current status of the program throughout the program's life.

2.2.5 Avoiding Pitfalls in Constructing a Work Breakdown Structure

A sound work breakdown structure clearly describes what the program manager wants to acquire. It has a logical structure and is tailored to a particular defense materiel item. It can tie the statement of work, CLIN structure, and the system description documents together. Remember: the work breakdown structure is product oriented. It addresses the products required, NOT the functions or costs associated with those products.

Elements not to include

The following paragraphs expand the explanation of what elements are to be excluded from the WBS elements:

Do not include elements which are not products. A signal processor, for example, is clearly a product, as are mock-ups and Computer Software Configuration Items (CSCIs). On the other hand, things like design engineering, requirements analysis, test engineering, aluminum stock, and

direct costs, are not products. Design engineering, test engineering, and requirements analysis are all engineering functional efforts; aluminum is a material resource; and direct cost is an accounting classification. Thus none of these elements are appropriate work breakdown structure elements.

Program phases (e. g., design, development, production, and types of funds, or research, development, test and evaluation) **are inappropriate as elements in a work breakdown structure.**

Rework, retesting and refurbishing are not separate elements in a work breakdown structure. They should be treated as part of the appropriate work breakdown structure element affected.

Non-recurring and recurring classifications are not work breakdown structure elements. The reporting requirements of the CCDR will segregate each element into its recurring and non-recurring parts.

Cost saving efforts such as total quality management initiatives, could cost, and warranty are not part of the work breakdown structure. These efforts should be included in the cost of the item they affect, not captured separately.

Do not use the structure of the program office or the contractor s organization as the basis of a work breakdown structure.

Do not treat costs for meetings, travel, computer support, etc. as separate work breakdown structure elements. They are to be included with the work breakdown structure elements with which they are associated.

Use actual system names and nomenclature. Generic terms are inappropriate in a work breakdown structure. The work breakdown structure elements should clearly indicate the character of the product to avoid semantic confusion. For example, if the Level 1 system is Fire Control, then the Level 2 item (prime mission product) is Fire Control Radar.

Treat tooling as a functional cost, not a work breakdown structure element. Tooling (e.g., special test equipment, and factory support equipment like assembly tools, dies, jigs, fixtures, master forms, and handling equipment) should be included in the cost of the equipment being produced. If the tooling cannot be assigned to an identified subsystem or component, it should be included in the cost of integration, assembly, test, and checkout.

Include software costs in the cost of the equipment. For example, when a software development facility is created to support the development of software, the effort associated with this element is considered part of the CSCI it supports or, if more than one CSCI is involved, the software effort should be included under integration, assembly, test, and checkout.

Software developed to reside on specific equipment must be identified as a subset of that equipment.

Additional Considerations

Integration, assembly, test, and checkout includes production acceptance testing (including first article test) of R&D and production units but excludes all systems engineering/program management and system test and evaluation that are associated with the overall system. The appendices identify integration, assembly, test, and checkout separately, except for the aircraft system appendix (Appendix A). For aircraft systems, to be consistent with the historical data sets that are maintained on airframe, integration, assembly, test, and checkout is a sub-element of, and included in, the airframe work breakdown structure element.

This handbook does not identify level 3 elements for the systems engineering/program management work breakdown structure element. This allows the program manager and contractor flexibility to identify efforts that are important to the specific program. The definition given provides typical systems engineering or program management efforts.

System test and evaluation always separately identifies those tests performed in the development of a system, i.e., development test and evaluation, and those tests performed by the operational user, i.e., operational test and evaluation.

2.3 SOLICITATION AND PROPOSAL

The work breakdown structure used for a solicitation is structured by selecting appropriate elements from the approved Program WBS. The contract line items, configuration items, contract statement of work tasks, contract specifications, and contractor responses will be expressed in terms of the work breakdown structure to enhance its effectiveness in satisfying the objectives of the particular acquisition. While the relationship of the Contract WBS elements to the statement of work tasks and the contract line items should be clearly traceable, there may not be a one-to-one relationship, nor is it required.

2.3.1 Specifications and Drawings

The family of specifications and drawings resulting from the progressive steps of systems engineering will provide the basis for the Program WBS, the Contract WBS, and its extensions.

2.3.2 Contractor Management Control System

The Contract WBS should serve as the framework for the contractor's management control system which will provide auditable and traceable

summaries of internal data generated by its performance measurement procedures.

2.3.3 Acquisition Logistics

The acquisition logistics element should be accommodated as indicated in the upper levels of the work breakdown structure. Areas for consideration include management and reporting; peculiar support equipment; and initial spares, support data, and training.

2.3.4 Planning, Programming and Budgeting System

The Program WBS should be used whenever it is necessary to subdivide the program element data for the planning, programming and budgeting system.

2.3.5 Life-Cycle Cost

Life-cycle cost is the total cost for the research and development, investment, operation and support, and disposition of a weapon or support system. It commences at the start of the conceptual stage and ends with the retirement or demilitarization of the system. The work breakdown structure requirements established are associated solely with those elements of research and development and investment that are applicable to all contracted efforts.

2.3.6 Procurement

The following areas should be relatable to elements of the Program WBS: structure of work statements, contract work breakdown structures, contract line items, configuration items, technical and management reports, and government-furnished equipment.

2.3.7 Reporting

All reporting requirements for the program should be consistent with the Program WBS.

2.4 CONTRACT STATEMENT OF WORK

The work breakdown structure provides a framework for defining the technical objectives of the program. Together with the contract statement of work, the work breakdown structure aids in establishing an indentured data listing (specification tree), defining configuration items, and planning support tasks. The statement of work (SOW) is the document which describes in clear understandable terms what products are to be delivered or what services are to be performed by the contractor. Preparation of an

effective statement of work requires a thorough understanding of the products and services needed to satisfy a particular requirement.

A statement of work expressed in explicit terms will facilitate effective contractor evaluation after contract award when the SOW becomes the standard for measuring contractor performance. Using a standardized work breakdown structure as a template when constructing the statement of work for a system acquisition will help streamline the process. Use of the work breakdown structure will also facilitate a logical arrangement of the SOW elements, provide a convenient checklist to ensure all necessary elements of the program are addressed, and direct the contractor to meet specific contract reporting needs.

2.4.1 Specification Tree

A specification tree, developed by systems engineering, structures the performance parameters for the system or systems being developed. It subdivides the system into its component elements and identifies the performance objectives of the system and its elements. The performance characteristics are explicitly identified and quantified. Completed, the data listing represents a hierarchy of performance requirements for each component element of the system for which design responsibility is assigned. Because specifications may not be written for each product on the work breakdown structure, the specification tree may not match the work breakdown structure completely.

2.4.2 Configuration Management

Configuration management is the process of managing the technical configuration of items being developed whose requirements are specified and tracked. Configuration items are designated in the work breakdown structure, which may need to be extended beyond the third level to clearly define all elements subject to configuration management. Configuration management involves defining the baseline configuration for the configuration items, controlling the changes to that baseline, and accounting for all approved changes. In establishing the requirement for configuration management on a program, the program manager needs to designate which contract deliverables are subject to configuration management controls. A contract deliverable designated for configuration management is called a Configuration Item. For software, this item is called a Computer Software Configuration Item (CSCI).

2.5 REQUEST FOR PROPOSAL

2.5.1 Preparing a Preliminary Contract WBS

The individual work breakdown structure elements from the Program WBS that apply to the contract will be selected by the DoD program manager for inclusion in a draft request for proposal (RFP). This is the initial time for open dialogue between the government and potential contractors. Innovative ideas or alternative solutions should be collected for inclusion in the final RFP. It will include a Contract WBS and the initial WBS Dictionary prepared by the program manager. The RFP should instruct potential contractors to extend the selected Contract WBS elements to define the complete contract scope.

2.5.2 RFP Solicitation Requirements

As previously stated, the contract line items, configuration items, contract work statement tasks, contract specifications, and contractor responses will be relatable to the work breakdown structure to enhance its effectiveness in satisfying the objectives of the particular acquisition. It is important to coordinate the development of the Program WBS and the CCDR plan with the development of the statement of work so as to form consistency in document structure. When aggregated with the Program WBS, the extended Contract WBS will form a complete work breakdown structure of the program for use throughout the acquisition cycle.

2.5.3 Extended Contract Work Breakdown Structure

Contractors extend the Contract WBS included in the RFP and submit the complete Contract WBS with their proposal. The proposal should be based on the work breakdown structure in the RFP, although contractors may suggest changes needed to meet an essential requirement of the RFP or to enhance the effectiveness of the Contract WBS in satisfying program objectives. Contractors are expected to extend the Contract WBS to the appropriate level—the level which satisfies the critical visibility requirements and does not overburden the management control system.

2.6 INTEGRATED COST, SCHEDULE, AND TECHNICAL PERFORMANCE MANAGEMENT

Planning work by work breakdown structure elements serves as the basis for estimating and scheduling resource requirements. The work breakdown structure assists in managing cost, schedule and technical performance. By breaking the total product into successively smaller entities, management can ensure that all required products are identified in terms of cost, schedule and performance goals. Assigning performance budgets to work

segments and identifying responsible units produces a time-phased plan against which actual performance can be measured. Corrective action can be taken when deviations from the plan are identified. This integrated approach to work planning also simplifies identifying the potential cost and schedule impacts of proposed technical changes.

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CHAPTER 3:

CONTRACTOR GUIDANCE

3.1 DEVELOPING THE CONTRACT WBS

The Contract WBS provides the framework for the management control system. An auditable and traceable summary of internal data is provided by its performance measurement procedures.

3.1.1 Relationship of Program WBS to Contract WBS

Contracts for work breakdown structure elements that are in the Program WBS will become Level 1 Contract WBS elements with all applicable Level 2 Common WBS elements included. The result is the contract work breakdown structure. Figure 3-1 depicts the development and relationship of the Program WBS with the Contract WBS.

3.1.2 Subcontractors

Contractors may require subcontractors to use the work breakdown structure to fulfill contractual requirements and control the subcontract. These subcontractors (whose work accounts for a major segment of the subcontracted portion of the prime contract) are delineated in contracts at the time of award. The prime or associate contractor is responsible for incorporating the work breakdown structure requirements into the contract with the affected subcontractors. Figure 3-2 provides an example of a prime work breakdown structure and its relationship to a subcontract work breakdown structure.

Figure 3-2 also shows how the contractor may further break down the Contract WBS to manage any subcontracted work such as software. It is the contractor’s decision as to how this will be done.

Relationship of Program WBS with Contract WBS

PROGRAM WBS				
1	2	3	4	5
FX AIRCRAFT				
	AIR VEHICLE			
		AIRFRAME		
		PROPULSION (SK-PW-52D)		
		COMMUNICATIONS/IDENTIFICATION		
		NAVIGATION/GUIDANCE		
		FIRE CONTROL		
			RADAR	
				RECEIVER
				TRANSMITTER
				ANTENNA
				RADAR APPLICATIONS S/W (TO CSCI LEVEL)
				RADAR SYSTEM S/W (TO CSCI LEVEL)
				RADAR INTEG, ASSY, TEST AND CHECKOUT
	SYSTEMS TEST AND EVALUATION			
		DEVELOPMENT TEST AND EVALUATION		
		OPERATIONAL TEST AND EVALUATION		
		MOCKUPS		
		TEST AND EVALUATION SUPPORT		
		TEST FACILITIES		
	SYSTEMS ENGINEERING/PROGRAM MANAGEMENT			
		SYSTEMS ENGINEERING		
		PROGRAM MANAGEMENT		
		ACQUISITION LOGISTICS		
	PECULIAR SUPPORT EQUIPMENT			
		TEST AND MEASUREMENT EQUIPMENT		
		SUPPORT AND HANDLING EQUIPMENT		
	COMMON SUPPORT EQUIPMENT			
	TRAINING			
		MAINTENANCE TRAINING		
		AIRCREW TRAINING DEVICE		
		TRAINING COURSE MATERIALS		
	DATA			
		TECHNICAL PUBLICATIONS		
		ENGINEERING DATA		
		MANAGEMENT DATA		
		SUPPORT DATA		
		DATA REPOSITORY		
	OPERATIONAL/SITE ACTIVATION			
		CONTRACTOR TECHNICAL SUPPORT		
	INITIAL SPARES AND REPAIR PARTS			

CONTRACT WBS				
1(3)	2(4)	3(5)	4(6)	5(7)
FIRE CONTROL				
	RADAR			
		RECEIVER		
		TRANSMITTER		
		ANTENNA		
		RADAR APPLICATIONS S/W		
			BUILD 1	
				CSCI 1...n
				CSCI TO CSCI INTEG. AND CHKOUT
			BUILD 2...n	
				CSCI 1...n
				CSCI TO CSCI INTEG. AND CHKOUT
			RADAR APPLICATIONS S/W INTEG., ASSEMBLY, TEST, & CHKOUT	
		RADAR SYSTEM S/W		
			BUILD 1	
				CSCI 1...n
				CSCI TO CSCI INTEG. AND CHKOUT
			BUILD 2...n	
				CSCI 1...n
				CSCI TO CSCI INTEG. AND CHKOUT
			RADAR SYSTEM S/W INTEG. ASSEMBLY, TEST AND CHECKOUT	
		RADAR INTEG., ASSEMBLY, TEST AND CHECKOUT		
	PLATFORM INTEGRATION			
	SYSTEMS ENGINEERING/PROGRAM MANAGEMENT			
	SYSTEM TEST AND EVALUATION			
	TRAINING			
	DATA			
	PECULIAR SUPPORT EQUIPMENT			
	COMMON SUPPORT EQUIPMENT			
	INITIAL SPARES AND REPAIR PARTS			

Figure 3-1: Relationship of Program WBS with Contract WBS

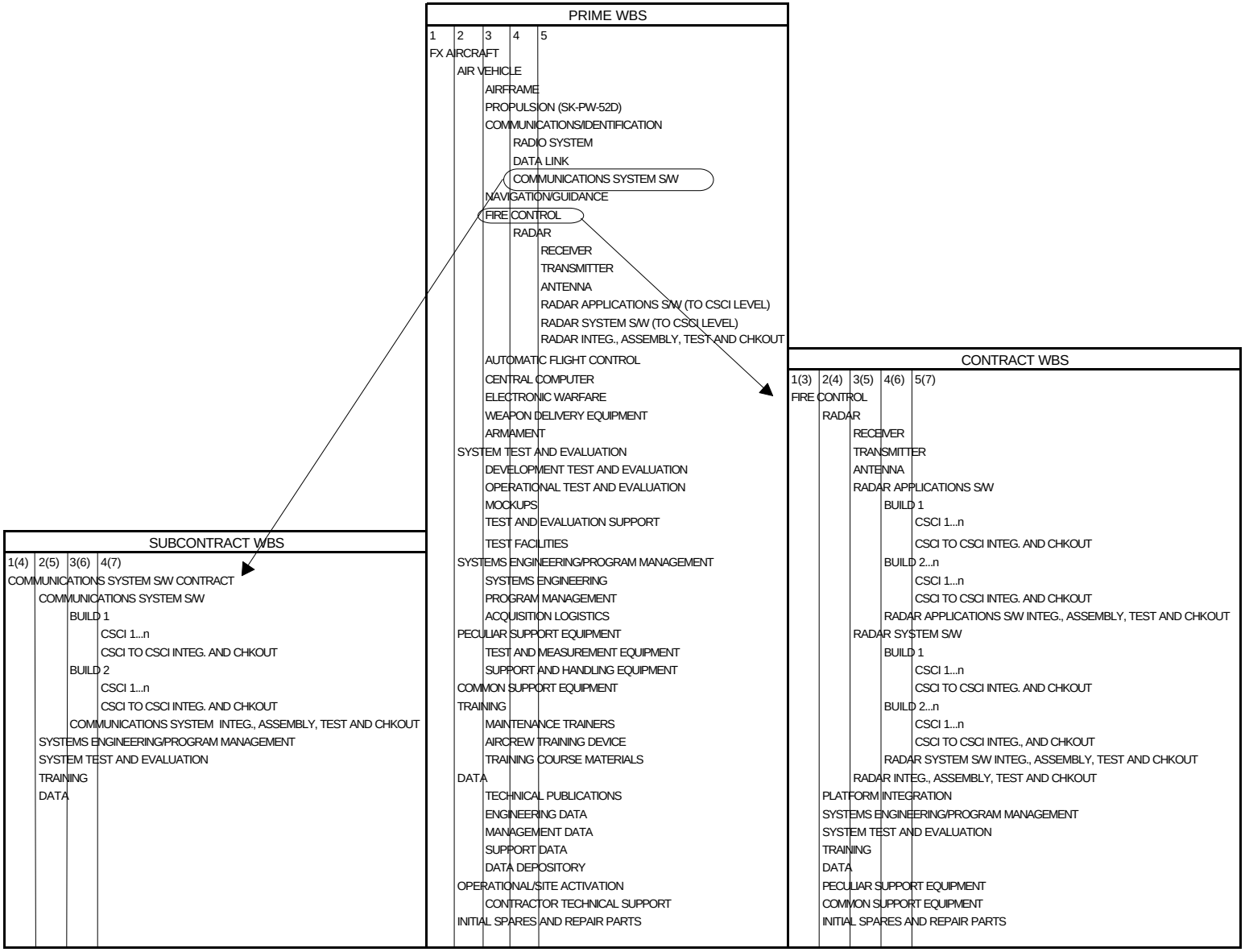

Figure 3-2: Relationship of Contract WBS to Subcontract WBS

3.1.3 Organizational Structure

A WBS should not influence or in any way affect the contractor's program organization. That is, a contractor can be organized in any way (e.g., by function, process, or integrated product team) and effectively use a valid, product-oriented WBS. As Figure 3-3 illustrates, at some level in an organization there is the point at which a control account (also referred to as a cost account) is managed. Likewise, in any WBS the same point exists. Therefore every part of a WBS is visible or accessible regardless of the contractor's organization. For example, the management information needed by the government to manage the development of a radar receiver is available from the control accounts that are part of that effort's WBS. So too, the information the contractor needs to manage the development is available from the same control accounts, which in this example are a part of the contractor's Electrical Design Department. Figure 3-4 illustrates the same example but using an Integrated Product Team (IPT) structured organization and its interface with the Contract WBS.

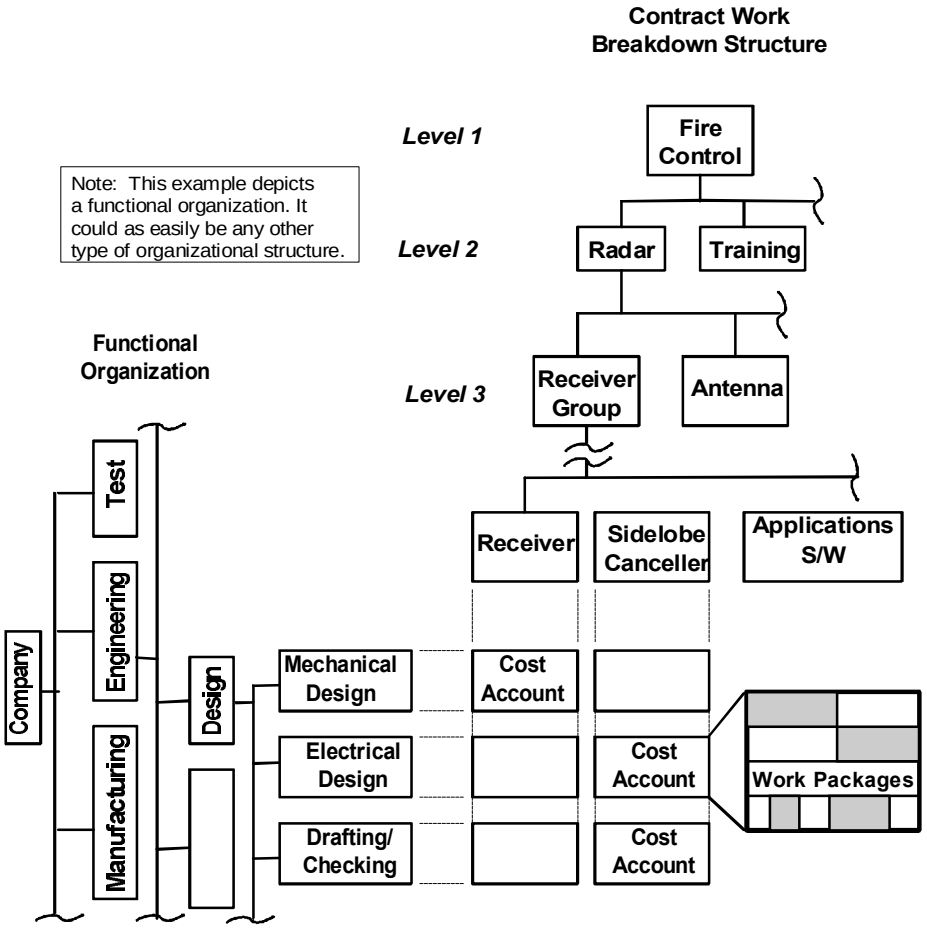

Figure 3-3: Translation from Function to Product

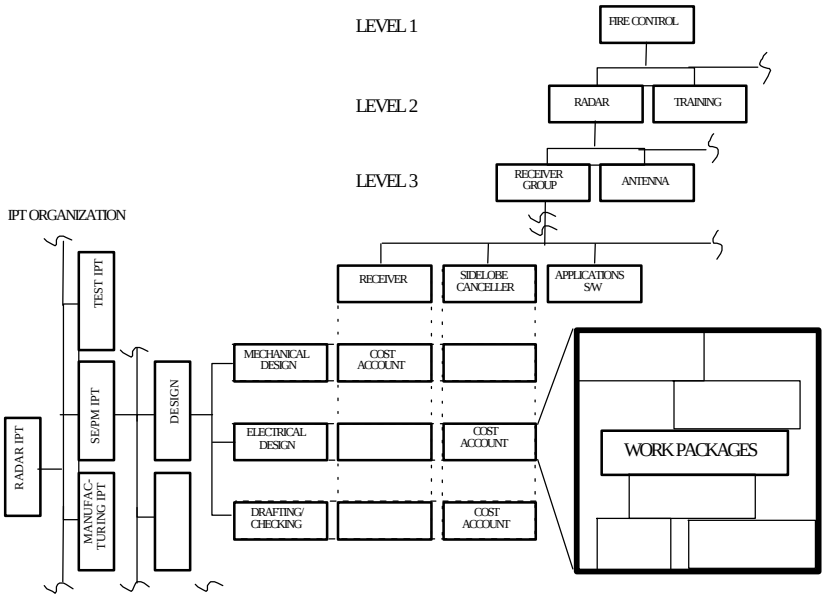

Figure 3-4: IPT Intersection with Contract WBS

3.1.4 Control Account Level

To provide the responsible contract manager with technical, schedule, and other needed resource information, the management control system must be keyed to the same work breakdown structure element and organization unit. The WBS level at which the management control system is established is primarily a function of the magnitude of the program and the type of product. The responsible organizational level is a function of the company’s management span of control and its upper management's desire to delegate the responsibility for WBS elements to lower management levels. In identifying control accounts, the contractor is expected to establish organizational responsibilities at meaningful and appropriate levels. Otherwise the contractor's existing management control systems and responsibility assignments may be affected adversely.

Virtually all aspects of the contractor's management control system—technical definition, budgets, estimates, schedules, work assignments, accounting, progress assessment, problem identification, and corrective

actions—come together at the control account level. Performance visibility is directly relatable to this level and content.

As the end product is subdivided into smaller subproducts at lower work breakdown structure levels, the work effort required by each element can be identified to functional organization units. At some point within the work breakdown structure, the contractor will assign management responsibility for technical, schedule, and other performance. The management control system will keep the lower levels of the work breakdown structure visible as it interfaces with the organization. At the juncture of the work breakdown structure element and organization unit, control accounts are established and performance is planned, measured, recorded, and controlled. To this end, the technical requirements for the work and work product must be specified; the work scheduled, budgeted, and performed; and attainment of specified technical requirements verified.

Because the work breakdown structure is a product-oriented hierarchy, its progressive subdivision will result in common management or functional tasks occurring in many work breakdown structure elements. For example, software may be widespread throughout the work breakdown structure and represent high risk in the contract. In such cases, when the program manager may require specific visibility into software performance, care must be taken to not unnecessarily complicate the Contract WBS and the contractor’s management system. Appropriate reporting requirements should be specified in the statement of work. As Figure 3-5 shows, the contractor’s management system and the work breakdown structure can provide needed detail and visibility without extending the work breakdown structure to excessively low levels or developing a separate work breakdown structure for software. The required information can be aggregated for reporting as needed.

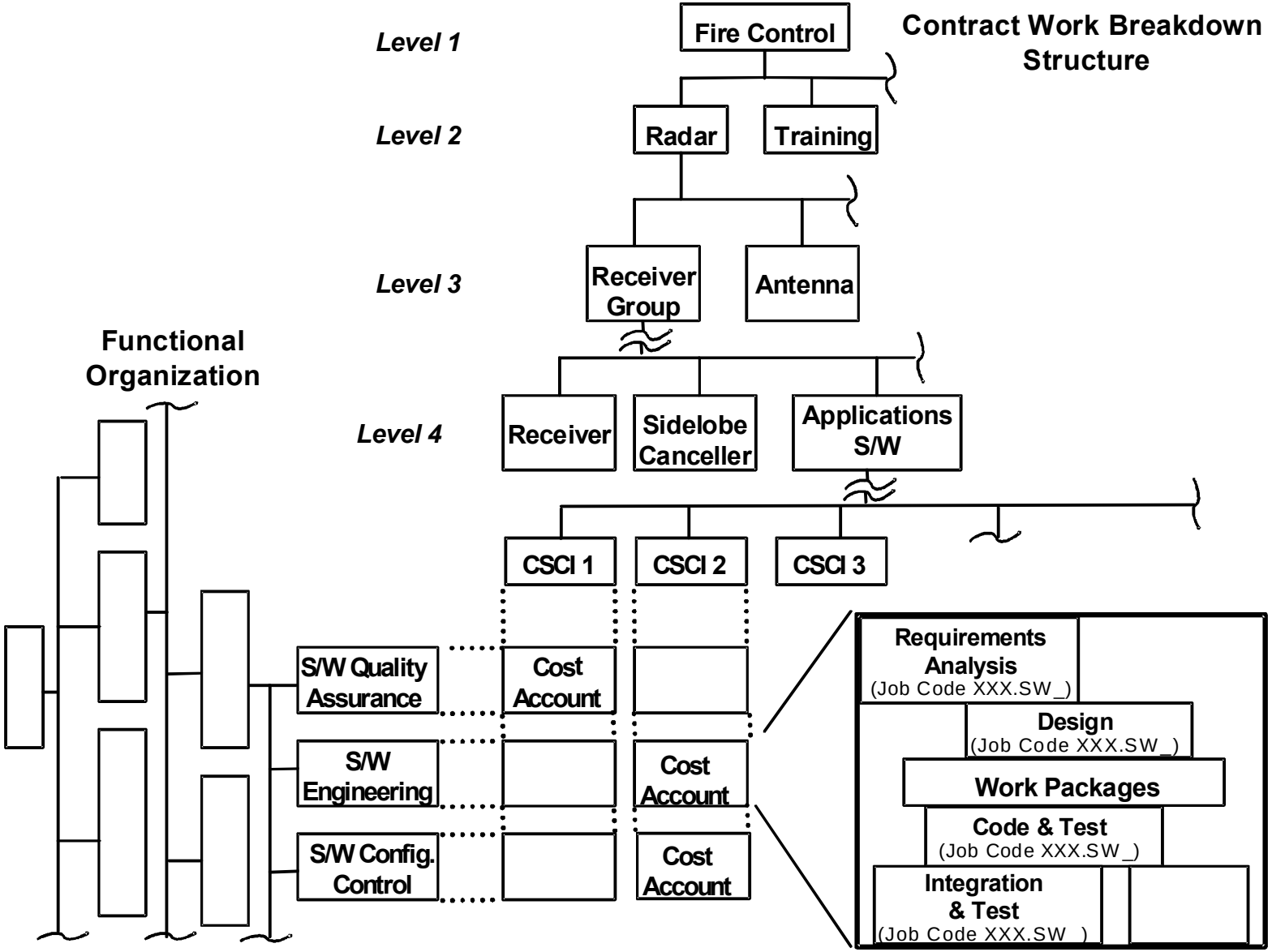

Figure 3-5: Linkage Between Contractor WBS and Contractor Management Systems

3.2 CONTRACTUAL ISSUES

The contractor's expanded work breakdown structure must address all Program WBS elements. Contractors should include lower breakdown levels where they identify risk associated with technical issues or resources, and identify control plans whether or not the items are reported back to the government. For example, software development tends to be high technical risk and high cost. Since all software that is an integral part of any specific equipment system and subsystem specification or specifically designed and developed for system test and evaluation should be identified with that system, subsystem, or effort, it may be appropriate to collect lower level information when it exists. In such cases, the following structure and definitions could be used:

LEVEL 4	LEVEL 5
Build 1...n (Specify names)	CSCI 1...n (Specify names)
	CSCI to CSCI Integration and Checkout
Integration, Assembly, Test and Checkout	

3.2.1 Software and Software Intensive Systems

The importance of software in today's government acquisition environment is growing. As a result software is identified in two ways for development of a work breakdown structure: the first type of software is that which operates or runs on a specific piece of equipment, and the second type of software is that which may be contracted for separately from the operating equipment or is a stand alone (software intensive system). Software that is being developed to reside on specific equipment must be identified as a subset of that equipment. Multi-function software will be identified as a subset of the equipment work breakdown structure element which either includes the software in the element specification or exercises the most critical performance constraint. Refer to Figure 3-1 for an example of how software should be addressed as part of a specific equipment. In cases where the application of this rule results in a conflict in the selection of the proper element, the specification relationship will take precedence. For example, an aircraft's electronic equipment typically has software included in each of the subsystem elements. Software that resides and interfaces with more than one equipment, i.e., applications software, and overall system software which facilitates the operation and maintenance of the computer systems and associated programs (e.g., operating systems,

compilers, and utilities) will be called out at the appropriate work breakdown level within the program.

It is incorrect to summarize all software on a program or contract in a work breakdown structure. By separating these elements from the hardware they support, performance measurement and management control over each equipment is difficult to maintain. The true cost of each equipment is not readily available for decision concerning that equipment. Rather than separately summarizing software, it is important to identify software with the hardware it supports. (When needed, a contractor's management systems can use an identifier for each software element to produce summaries for software management purposes.)

A separately contracted or stand alone software will include the software, data, services, and facilities required to develop and produce a software product for a command and control system, radar system, information system, etc. Where software is considered stand alone (i.e., does not reside or support a specific equipment, or is considered a pure software upgrade, etc.), the government should use the same product-oriented work breakdown structure format. Figure 3-6 provides an example of a work breakdown structure for a stand alone software system.

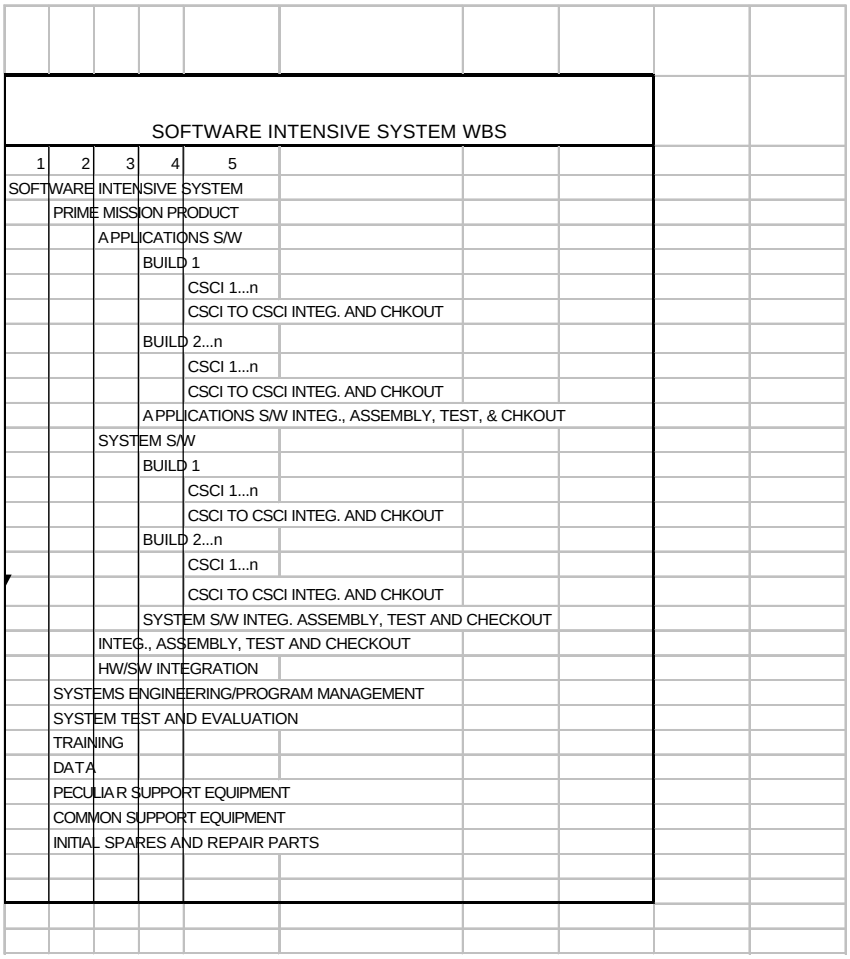

Figure 3-6: Example of Software Intensive System WBS

3.2.2 Integrated Management Plan and Integrated Management Schedule (IMP/IMS)

The Integrated Management (or Master) Plan (IMP) is the keystone of the technical control concept. It is an integral part of the Systems Engineering process and identifies key events, milestones, reviews, all integrated technical tasks, and risk reduction activities. In addition the IMP is the specific tool used to track and measure successful task completion—a progress measurement tool. The contractor identifies key events and tasks along with entry and exit criteria. The contractor proposed events are negotiated and placed on contract. These events can be used as the basis for quantitative requirements for award fees.

The contractor will also prepare an Integrated Management (or Master) Schedule (IMS) to support these events and tasks. The IMS depicts the

work to be done in terms of supporting activities, schedules, and completion dates as it is tied to the IMP (i.e., Initiate PDR or Complete PDR, etc.) The linkage between the specification requirements, work breakdown structure, contractor's statement of work, technical performance measurements, events, and the IMS provide traceability and serve as a significant risk management tool. Figure 3-7 illustrates these interrelationships.

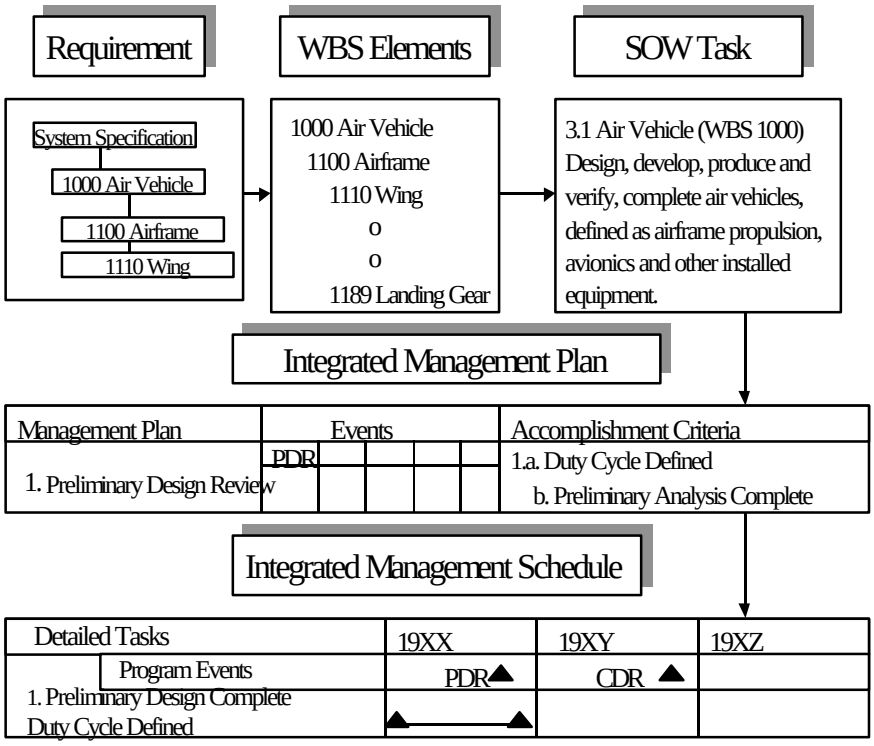

Figure 3-7: Integrated Management Plan and Integrated Management Schedule

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CHAPTER 4:

POST CONTRACT AWARD

4.1 IMPLEMENTATION OF CONTRACT WORK BREAKDOWN STRUCTURE

The contract work breakdown structure included in the successful proposal serves as the basis for negotiating an approved Contract WBS. The contractor may have proposed alternate approaches to accomplish the contract objectives. If the alternatives are accepted by the project manager, the Program WBS will require revision to reflect the changes. Those revisions may, in turn, affect the contractor's proposal.

4.1.1 Contract Work Breakdown Structure Approval and Contract Award

Following approval of the negotiated contract, including Contract WBS, the contract is awarded. The requirement for providing the WBS Dictionary is placed in the contract data requirements list (CDRL). While early and accurate work breakdown structure planning should be emphasized, additional work breakdown structure revisions may result from expansion or contraction of the program or the contract during various stages. That is, further elements selected for the contract will become the basis for contractor extension during the contracted effort as both parties become more knowledgeable about the effort. Although there is no limitation on the number of additional elements that could be added, each should be justified in terms of its contribution to efficient decision making. All extensions must be incorporated into the Contract WBS reporting level in the contract.

NOTE*:* Normally, once work is underway after contract award, changes to the work breakdown structure should not be made unless major rescoping of the program occurs.

Users of this handbook should understand that the sequence described in the preceding paragraphs may be repeated as the program evolves, contracts are awarded, and the work effort progresses through major program phases. Revisions to the work breakdown structure are an essential component of this process. Whenever the work breakdown structure is revised, the ability to crosswalk and track back to the previous work breakdown structure needs to be maintained.

4.2 SPECIFICATION OF RELATIONSHIPS

The contractor maintains the Contract WBS, including change traceability. In accordance with the contract terms, only changes approved by the program manager may be incorporated. The contract will indicate the levels of contract work breakdown structure at which costs will be reported to the government. The contractor should determine those extended Contract WBS levels which are used to trace the cost accumulations for cost control purposes. In the extensions, consideration should be given to the specific contractual, technical, and managerial requirements of the defense materiel item. The contractor has complete flexibility to extend the Contract WBS below the reporting requirement to reflect how work is to be accomplished, assuming the additional elements are meaningful product- or management-oriented indentures of a higher-level element.

4.3 BASIS FOR SCHEDULING RESOURCES

Within the scope of the Contract WBS, the contractor has flexibility to use the work breakdown elements to support on-going management activities. These may include contract budgeting, cost estimating, and the development of historic data bases.

4.3.1 Contract Budgeting

Funds management involves periodic comparison of actual costs with time-phased budgets, analysis of performance variances, and follow-up corrective action. When work breakdown structure elements and the supporting work are scheduled, a solid base for time-phased budgets is made. Assigning planned resource cost estimates to scheduled activities (tasks) and summarizing by work breakdown structure element by time period results in a time phased program/contract budget, which becomes the performance measurement baseline.

4.3.2 Cost Estimating

Use of the work breakdown structure for cost estimating facilitates program and contract management. The work breakdown structure aids the program office in planning, coordinating, controlling, and estimating the various program activities. It provides a common framework for tracking the estimated and actual costs during the performance of each contract. The data from the various program contracts support the DoD program manager in evaluating contractor performance, preparing budgets, and preparing program life-cycle costs.

4.3.3 Data Bases

Cost information collected by work breakdown structure element can be used for pricing and negotiating contracts and contract changes and for follow-on procurement. DoD is accumulating a growing cost data base of similar work breakdown structure elements from different programs. This historical cost data can be used for regression analysis, developing learning curves, and other techniques for estimating the cost requirements for like elements of new programs. Actual cost data collected by DoD on each program when compared to the original estimates can identify trends and establish the validity of estimating techniques. Contractors will similarly benefit from such data bases. The cost history accumulated on their programs can assist them in estimating and bidding future contracts and in budgeting new work.

4.3.4 Summary

In conclusion, the contract work breakdown structures that result from procurements like these are not intended to be standardized. Any logical product-oriented WBS developed by the contractor will meet DoD needs for reasonably consistent program data.

The work breakdown structure format was never intended to be enforced verbatim, but rather to be used as a starting point for continued tailoring. Rigidity of task procedures and superfluity of data are issues to be resolved before solicitation release, or at least before contract award.

After contract award, at each point in the acquisition cycle, the Contract WBS provides the framework for delineating the areas of responsibility regarding funding, schedules, and future contract performance, and for integrating total program requirements.

CONCLUDING MATERIAL

Preparing Activity:
OSD-WB

(Project No. MISC-0246)

Custodians:
Army - MI
Navy - NW
Air Force - 10

Review Activities:
Army - AR, AT, AV, CR
Navy - AS, MC, OS, SH
Air Force - 11, 16, 19, 70, 71, 80, 82, 84

APPENDIX A:

AIRCRAFT SYSTEMS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

A.1 SCOPE

This appendix provides the aircraft system work breakdown structure. Definitions for the aircraft air vehicle are provided in this appendix. Definitions for WBS elements common to all defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

A.2 APPLICABLE DOCUMENTS

Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE STD 610.12, *Standard Glossary of Software Engineering Terminology*

(Application for copies should be addressed to ANSI Customer Service, 11 West 42nd Street, New York, NY 10036.)

A.3 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Aircraft System		
	Air Vehicle (AV)	
		Airframe
		Propulsion
		AV Applications Software
		AV System Software
		Communications/Identification
		Navigation/Guidance
		Central Computer
		Fire Control
		Data Display and Controls
		Survivability
		Reconnaissance
		Automatic Flight Control
		Central Integrated Checkout
		Antisubmarine Warfare
		Armament
		Weapons Delivery
		Auxiliary Equipment
	Sys Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)

	Initial Spares and Repair Parts	

A.4 DEFINITIONS

A.4.1 Aircraft System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce air vehicles.

Includes:

- those employing fixed, movable, rotary, or compound wing
- those manned/unmanned air vehicles designed for powered or unpowered (glider) guided flight

A.4.2 Air Vehicle

The complete flying aircraft.

Includes:

- airframe, propulsion, and all other installed equipment
- design, development, and production of complete units—prototype and operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use
- Sub-elements to the air vehicle (A.4.2.1 - A.4.2.17)

A.4.2.1 Airframe

The assembled structural and aerodynamic components of the air vehicle that support subsystems essential to designated mission requirements.

Includes, for example:

- basic structure—wing, empennage, fuselage, and associated manual flight control system
- rotary wing pylons, air induction system, thrust reversers, thrust vector devices, starters, exhausts, fuel management, inlet control system
- alighting gear—tires, tubes, wheels, brakes, hydraulics, etc.
- secondary power, furnishings—crew, cargo, passenger, troop, etc.
- instruments—flight, navigation, engine, etc.
- environmental control, life support and personal equipment, racks, mounts, intersystem cables and distribution boxes, etc., which are inherent to, and nonseparable from, the assembled structure
- dynamic systems—transmissions, gear boxes, propellers, if not furnished as an integral part of the propulsion unit
- rotor group and other equipment homogeneous to the airframe

In addition to the airframe structure and subsystems, this element includes:

1) Integration, assembly, test, and checkout:

Includes:

- all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide the integration, assembly, test, and checkout of all elements into the airframe to form the air vehicle as a whole
- all administrative and technical engineering labor to perform integration of level 3 air vehicle and airframe elements; development of engineering layouts; determination of overall design characteristics, and determination of requirements of design review
  - overall air vehicle design and producibility engineering
  - detailed production design; acoustic and noise analysis
  - loads analysis; stress analysis on interfacing airframe elements and all subsystems
  - design maintenance effort and development of functional test procedures
  - coordination of engineering master drawings and consultation with test and manufacturing groups
  - tooling planning, design, and fabrication of basic and rate tools and functional test equipments, as well as the maintenance of such equipment
  - production scheduling and expediting
  - joining or installation of structures such as racks, mounts, etc.
  - installation of seats, wiring ducting, engines, and miscellaneous equipment and painting
  - set up, conduct, and review of testing assembled components or subsystems prior to installation
- all effort associated with the installation, integration, test, and checkout of the avionic systems into the air vehicle including:
  - design of installation plans
  - quality assurance planning and control including material inspection
  - installation
  - recurring verification tests
  - integration with nonavionics airframe subsystems
- ground checkout prior to flight test; production acceptance testing and service review; quality assurance activities and the cost of raw

materials, purchased parts, and purchased equipment associated with integration and assembly

2) Nonrecurring avionics system integration which is associated with the individual avionics equipment boxes and avionics software in a functioning system.

Includes:

- the labor required to analyze, design, and develop avionics suite interfaces and establish interface compatibility with non-avionics support equipment systems, aircraft systems, and mission planning systems
- drawing preparation and establishment of avionics interface equipment requirements and specifications
- technical liaison and coordination with the military service, subcontractors, associated contractors, and test groups

Excludes:

- development, testing, and integration of software (which should be included in air vehicle applications and system software)
- avionics system testing (included in System Test and Evaluation) and aircraft systems engineering efforts (included in Systems Engineering/Program Management).
- all effort directly associated with the remaining level 3 WBS elements

A.4.2.2 Propulsion

That portion of the air vehicle that pertains to installed equipment (propulsion unit and other propulsion) to provide power/thrust to propel the aircraft through all phases of powered flight.

Includes, for example:

- the engine as a propulsion unit within itself (e.g., reciprocating, turbo with or without afterburner, or other type propulsion) suitable for integration with the airframe
- thrust reversers, thrust vector devices, transmissions, gear boxes, and engine control units, if furnished as integral to the propulsion unit
- other propulsion equipment required in addition to the engine but not furnished as an integral part of the engine, such as booster units
- the design, development, production, and assembly efforts to provide the propulsion unit as an entity

Excludes:

- all effort directly associated with the elements and the integration, assembly, test, and checkout of these elements into the air vehicle
- all ancillary equipments that are not an integral part of the engine required to provide an operational primary power source—air inlets, instruments, controls, etc.

A.4.2.3 Air Vehicle Applications Software

Includes, for example:

- all the software that is specifically produced for the functional use of a computer system or multiplex data base in the air vehicle
- all effort required to design, develop, integrate, and checkout the air vehicle applications Computer Software Configuration Items (CSCIs)

Excludes:

- the non-software portion of air vehicle firmware development and production (ref. ANSI/IEEE Std 610.12)
- software that is an integral part of any specific subsystem and software that is related to other WBS level 2 elements

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

A.4.2.4 Air Vehicle System Software

That software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs for the air vehicle.

Includes, for example:

- operating systems—software that controls the execution of programs
- compilers—computer programs used to translate higher order language programs into relocatable or absolute machine code equivalents
- utilities—computer programs or routines designed to perform the general support function required by other application software, by the operating system, or by system users (ref. ANSI/IEEE Std 610.12)
- all effort required to design, develop, integrate, and checkout the air vehicle system software including all software developed to support any air vehicle applications software development
- air vehicle system software required to facilitate development, integration, and maintenance of any air vehicle software build and CSCI

Excludes:

- all software that is an integral part of any specific subsystem specification or specifically designed and developed for system test and evaluation
- software that is an integral part of any specific subsystem, and software that is related to other WBS level 2 elements

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

A.4.2.5 Communications/Identification

That equipment (hardware/software) installed in the air vehicle for communications and identification purposes.

Includes, for example:

- intercoms, radio system(s), identification equipment (IFF), data links, and control boxes associated with the specific equipment
- integral communication, navigation, and identification package (if used)

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.6 Navigation/Guidance

That equipment (hardware/software) installed in the air vehicle to perform the navigational guidance function.

Includes:

- radar, radio, or other essential navigation equipment, radar altimeter, direction finding set, doppler compass, computer, and other equipment homogeneous to the navigation/guidance function

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.7 Central Computer

The master data processing unit(s) responsible for coordinating and directing the major avionic mission systems.

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.8 Fire Control

That equipment (hardware/software) installed in the air vehicle which provides the intelligence necessary for weapons delivery such as bombing, launching, and firing.

Includes, for example:

- radars and other sensors including radomes
- apertures/antennas, if integral to the fire control system, necessary for search, target identification, rendezvous and/or tracking
- self-contained navigation and air data systems
- dedicated displays, scopes, or sights
- bombing computer and control and safety devices

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.9 Data Display and Controls

The equipment (hardware/software) which visually presents processed data by specially designed electronic devices through interconnection (on- or off-line) with computer or component equipment and the associated equipment needed to control the presentation of the data necessary flight and tactical information to the crew for efficient management of the aircraft during all segments of the mission profile under day and night all-weather conditions.

Includes, for example:

- multi-function displays, control display units, display processors, and on-board mission planning systems

Excludes:

- indicators and instruments not controlled by keyboard via the multiplex data bus and panels and consoles which are included under the airframe

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.10 Survivability

Those equipments (hardware/software) installed in, or attached to, the air vehicle which assist in penetration for mission accomplishment.

Includes, for example:

- ferret and search receivers, warning devices and other electronic devices, electronic countermeasures, jamming transmitters, chaff, infra-red jammers, terrain-following radar, and other devices typical of this mission function

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.11 Reconnaissance

Those equipments (hardware/software) installed in, or attached to, the air vehicle necessary to the reconnaissance mission.

Includes, for example:

- photographic, electronic, infrared, and other sensors
- search receivers
- recorders
- warning devices
- magazines
- data link

Excludes:

- gun cameras

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.12 Automatic Flight Control

Those electronic devices and sensors, which, in combination with the flight controls subsystem (under airframe), enable the crew to control the flight path of the aircraft and provide lift, drag, trim, or conversion effects.

Includes, for example:

- flight control computers, software, signal processors, and data transmitting elements that are devoted to processing data for either primary or automatic flight control functions
- electronic devices required for signal processing, data formatting, and interfacing between the flight control elements; the data buses, optical links, and other elements devoted to transmitting flight control data
- flight control sensors such as pressure transducers, rate gyros, accelerometers, and motion sensors

Excludes:

- devices—linkages, control surfaces, and actuating devices—covered under the airframe WBS element

- avionics devices and sensors--central computers, navigation computers, avionics data buses and navigation sensors—which are included under other avionics WBS elements

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.13 Central Integrated Checkout

That equipment (hardware/software) installed in the air vehicle for malfunction detection and reporting.

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.14 Antisubmarine Warfare

That equipment (hardware/software) installed in the air vehicle peculiar to the antisubmarine warfare mission.

Includes, for example:

- sensors, computers, displays, etc.

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.15 Armament

That equipment (hardware/software) installed in the air vehicle to provide the firepower functions.

Includes, for example:

- guns, high energy weapons, mounts, turrets, weapon direction equipment, ammunition feed and ejection mechanisms, and gun cameras

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.16 Weapons Delivery

That equipment (hardware/software) installed in the air vehicle to provide the weapons delivery capability.

Includes, for example:

- launchers, pods, bomb racks, pylons, integral release mechanisms, and other mechanical or electro-mechanical equipments specifically oriented to the weapons delivery function

Excludes:

- bombing/navigation system (included in the fire control element)

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

A.4.2.17 Auxiliary Equipment

Auxiliary airframe, electronics, and/or armament/weapons delivery equipment not allocable to individual element equipments, or which provides the ancillary functions to the applicable mission equipments.

Includes, for example:

- auxiliary airframe equipment such as external fuel tanks, pods, and rotodomes
- multi-use equipment like antennas, control boxes, power supplies, environmental control, racks, and mountings, not homogeneous to the prescribed WBS elements

NOTE 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

NOTE 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software software defined in the item specification and provided by the supplier.

NOTE 3: Auxiliary armament/weapons delivery equipment includes flares and ejection mechanisms, ejector cartridges, and other items peculiar to the mission function that are not identifiable to the armament or weapons delivery elements set forth in A.4.2.15 and A.4.2.16 of this appendix.

A.4.3 Common Elements

WBS Levels 2 and 3. Definitions for common WBS elements applicable to the aircraft as well as all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX B:

ELECTRONIC/AUTOMATED SOFTWARE SYSTEMS WORK BREAKDOWN STRUCTURE AND DEFINITIONS

B.1 SCOPE

This appendix provides the electronic/automated software system work breakdown structure. Definitions for the prime mission product (PMP) and platform integration are provided in this appendix. Definitions for WBS elements common to all defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

B.2 APPLICABLE DOCUMENTS

The following standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

STANDARDS

MIL-STD-196, *Joint Electronics Type Designation System*
MIL-STD-498, *Software Development and Documentation*
MIL-STD-1464, *Army Nomenclature System*
MIL-STD-1661, *Mark and Mod Nomenclature System*
MIL-STD-1812, *Type Designation, Assignment and Method for Obtaining*

Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the

Standardization Documents Order Desk
700 Robbins Avenue
Building #4, Section D
Philadelphia, PA 19111-5094

Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE STD 610.12, *Standard Glossary of Software Engineering Terminology*

(Application for copies should be addressed to ANSI Customer Service, 11 West 42nd Street, New York, NY 10036.)

B.3 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Electronic/Automated Software System		
	Prime Mission Product (PMP)	
		Subsystem 1...n (Specify Names)
		PMP Applications Software
		PMP System Software
		Integration, Assembly, Test and Checkout
	Platform Integration	
	Systems Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)
	Initial Spares and Repair Parts	

B.4 DEFINITIONS

B.4.1 Electronic/Automated Software System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce an electronic, automated, or software system capability such as a command and control system, radar system, communications system, information system, sensor system, navigation/guidance system, electronic warfare system, support system, etc.

NOTE: To differentiate between the Electronic/Automated Software System category and other defense materiel item categories, use the following rule:

When the item is a stand-alone system or used on several systems but not accounted for within the system, use the Electronic/ Automated Software System category.

NOTE: When the opportunity to collect lower level information on electronic and software items exists, regardless of which defense materiel item category is selected, the structure and definitions in this appendix apply.

B.4.2 Prime Mission Product (PMP)

The hardware and software used to accomplish the primary mission of the defense materiel item.

Includes, for example:

- all integration, assembly, test and checkout, as well as all technical and management activities associated with individual hardware/software elements
- integration, assembly, test and checkout associated with the overall PMP. When the electronic/automated software system comprises several PMPs, each will be listed separately at level 2
- all whole and partial prime contractor, subcontractor, and vendor breadboards, brassboards, and qualification test units
- the design, development and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specification(s), regardless of end use)
- factory special test equipment, special tooling, and production planning required to fabricate the PMP

Excludes:

- only those "less than whole" units (e.g., test, spares, etc.) consumed or planned to be consumed in support of system level tests
- duplicate or modified factory special test equipment delivered to the government for depot repair (should be included in the peculiar support equipment element)

B.4.2.1 Subsystem 1...n (Specify Names)

The hardware and software components of the specific electronic/ automated software subsystem.

Includes, for example:

- all associated special test equipment, special tooling, production planning, and all technical and management activities
- the software components, consisting of the applications and system software required to direct and maintain the specific electronic/ automated software subsystem
- all in-plant integration, assembly, test, and checkout of hardware components and software into an electronic/automated software subsystem, including the subsystem hardware and software integration and test
- interface materials and parts required for the in-plant integration and assembly of other level 4 components into the electronic/automated software subsystem and all materials and parts or other mating equipments furnished by/to an integrating agency or contractor
- cables, conduits, connectors, shelters, and other devices associated with the operational electronic/automated software subsystem
- the design, development, production, and assembly efforts to provide each electronic/automated software subsystem as an entity

Excludes:

- All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the prime mission product

B.4.2.2 Prime Mission Product Applications Software

The software that is specifically produced for the functional use of a computer system (ref. ANSI/IEEE Std 610.12).

Includes, for example:

- battle management, weapons control, and data base management

- all effort required to design, develop, integrate, and checkout the PMP applications computer software configuration items (CSCIs), not including the non-software portion of PMP firmware development and production

Excludes:

- all software that is an integral part of any specific hardware subsystem specification

NOTE: All software that is an integral part of any specific equipment system and subsystem specification or specifically designed and developed for system test and evaluation should be identified with that system, subsystem, or effort. It may be appropriate to collect lower level information when it exists. In such cases, the following structure and definitions should be used:

LEVEL 4	LEVEL 5
Build 1...n (Specify names)	CSCI 1...n (Specify names)
	CSCI to CSCI Integration and Checkout
Integration, Assembly, Test and Checkout	

a) Build 1...n (Specify names)

A software build is an aggregate of one or more CSCIs that satisfies a specific set or subset of requirements.

When incremental, spiral, or other software development method is used, multiple builds may be necessary to meet program requirements.

A build is a separately tested and delivered product. Within builds are CSCIs. When a build is complete, a portion or all of one or more CSCIs will be completed. Therefore, a CSCI may appear in more than one build, but will be successively more functional as each build is completed.

b) Computer Software Configuration Item (CSCI) 1...n (Specify names)

An aggregation of software or any of its discrete portions which satisfies an end use function and has been designated by the government for configuration management. CSCIs are the major software products of a system acquisition which are developed in accordance with standard DoD or commercial practices and process.

Includes, for example:

- reusable software components, such as commercial off-the-shelf software, government furnished software, or software specifically developed for reuse
- Computer Software Components (CSCs) which are functionally or logically a distinct part of a CSCI, distinguished for convenience in designing and specifying a complex CSCI as an assembly of subordinate elements
- effort associated with the requirements analysis, design, coding and testing, CSCs integration and testing, CSCI formal qualification testing, and software problem resolution of each CSCI

c) CSCI to CSCI Integration and Checkout

Includes, for example:

- integration and test, verification and validation and the systems engineering and technical control of the CSCIs
- integration and test is the planning, conducting and analysis of tests that verify correct and proper performance of each CSCI operating as a whole with other CSCIs

  Planning includes:
  - defining test scope and objectives
  - establishing the test approach, acceptance criteria, verification methods, order of integration, inputs, and methods to record results
  - establishing test locations, schedules, and responsibilities of those involved

  Conduct and analysis of tests encompasses:
  - developing test procedures
  - preparing test data and expected results
  - executing the test procedures and recording test results
  - reducing test results, identifying errors, and preparing test data sheets
  - reporting results

NOTE: Verification and validation may be accomplished to insure the performance and quality of each CSCI in comparison with other CSCIs.

Excludes:

- the software integration and checkout associated with the individual CSCIs

NOTE: The defined software structure for lower level information is appropriate whether it is associated with a specific system or subsystem or considered software intensive or stand alone.

B.4.2.3 Prime Mission Product System Software

The software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs.

Includes, for example:

- operating systems, compilers, and utilities (ref. ANSI/IEEE Std 610.12)
- all effort required to design, develop, integrate, and checkout the PMP system software including all software developed to support PMP-applications-software development
- PMP system software which is required to facilitate development, integration, and maintenance of any PMP software build and CSCI

Excludes:

- software that is an integral part of any specific hardware subsystem specification or is specifically designed and developed for system test and evaluation

NOTE: The structure shown in paragraph B.4.2.2 should be used when lower level information is desired.

B.4.2.4 Integration, Assembly, Test, and Checkout

The effort as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements to provide a complete PMP system. The integration, assembly, test, and checkout element includes hardware and PMP software integration and test.

B.4.3 Platform Integration

WBS Level 2: the effort involved in providing technical and engineering services to the platform manufacturer or integrator during the installation and integration of the PMP into the host vehicle.

Includes, for example:

- the labor required to analyze, design, and develop the interfaces with other host vehicle subsystems
- drawing preparation and establishment of equipment requirements and specifications
- technical liaison and coordination with the military services subcontractors, associated contractors, and test groups

Excludes:

- all integration effort not directly associated with the host vehicle and management liaison with the military services, subcontractors, and associated contractors

B.4.4 WBS Common Elements

Definitions for common WBS elements applicable to the electronic/ automated software system and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX C:

MISSILE SYSTEMS

WORK BREAKDOWN

STRUCTURE AND DEFINITIONS

C.1 SCOPE

This appendix provides the missile system work breakdown structure. Definitions for the missile air vehicle and command and launch equipment are provided in this appendix. Definitions for WBS elements common to all defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

C.2 APPLICABLE DOCUMENTS

Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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(Application for copies should be addressed to ANSI Customer Service, 11 West 42nd Street, New York, NY 10036.)

C.3 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Missile System	Air Vehicle	
		Propulsion (Stages I...n,]
		Payload
		Airframe
		Reentry System
		Post Boost System
		Guidance and Control
		Ordnance Initiation Set
		Airborne Test Equipment
		Airborne Training Equipment
		Auxiliary Equipment
		Integration, Assembly, Test and Checkout
	Command and Launch	
		Surveillance, Identification and Tracking Sensors
		Launch and Guidance Control
		Communications
		Command and Launch Applications Software
		Command and Launch System Software
		Launcher Equipment
		Auxiliary Equipment
	Systems Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)

	Initial Spares and Repair Parts	

C.4 DEFINITIONS

C.4.1 Missile System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce the capability of employing a missile weapon in an operational environment to produce the destructive effect on selected targets.

C.4.2 Air Vehicle

The primary means for delivering the destructive effect to the target.

Includes:

- the capability to generate or receive intelligence, to navigate and penetrate to the target area, and to detonate the warhead
- the design, development, and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements to the air vehicle (C.4.2.1 - C.4.2.11)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.1 Propulsion (Stages I...n, As Required)

The thrust to propel the air vehicle on its intended flight. The propulsion system may be composed of one or more stages which ignite, burn, and are jettisoned sequentially over the course of missile flight. The propulsion element may be solid, liquid, or air-breathing.

Includes, for example:

- structure (integral to the propulsion system), propellant, controls, instrumentation, and all other installed subsystem equipment integral to the rocket motor or engine as an entity within itself
- design, development, production, and assembly efforts to provide each stage as an entity

1) Rocket Motor/Booster. The solid propulsion system which carries within it both the fuel and oxygen required for its operation.

Includes, for example:

- an arm and firing device, solid propellant, movable nozzles, casings, integration, etc.

2) Engine

The engine includes both liquid propulsion systems and air breathing systems.

- Liquid propulsion engine includes, for example:
  - the main engines, verniers/auxiliary engines, fluid supply system, liquid propellant, attitude control equipment, structure (integral to the engine), raceway, interstage, combustion section, turbines, nozzles, rotors, etc.
- Air breathing engines obtain oxygen from the surrounding atmosphere to support the combustion of its fuel. Includes, for example:
  - Ramjets and turbojets which may be used to provide propulsion for cruise type missiles
  - mainframe, compressor, combustion section, air inlets/exhaust ducts, turbine nozzle assembly, turbine rotor, bearings and housings, and fuel subsystem
  - air breathing systems which require various accessory components such as pumps, injectors, turbines, motors, diffusers, and igniters

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.2 Payload

The warhead and its support assemblies where no reentry system exists. Normally, payload consists only of the warhead and its associated arming and fuzing equipment. However, with complex munitions containing submunitions, the payload subsystem may mimic the larger system by having its own guidance and control, fuze, safe-arm, and propulsion.

Includes, for example:

- arming and fuzing device, warhead, and target detection device

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.3 Airframe

The structural framework that provides the aerodynamic shape, mounting surfaces and environmental protection for the missile components which are not directly applicable to other specific level 3 air vehicle subsystems.

Includes, for example:

- endo-atmospheric missiles
  - wings and fins which provide aerodynamic flight control in response to electro-mechanical signals and are attached to the missile body
  - structural body assemblies including the structure, covers, such as passive nosepieces, skins, adhesives, and fairings not directly applicable to any other level 3 air vehicle subsystem

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.4 Reentry System

For exo-atmospheric missiles, the reentry system is the aggregate of prime equipment items consisting of a deployment module, reentry vehicles, payload, penetration aids and ascent shroud, which provide structural support and environmental protection of nuclear payloads during the ground deployment and flight. Includes, for example:

- reentry vehicle (aero-structure) which provides reentry protection for the internally carried warheads
  - for independent maneuvers, the reentry vehicle will contain navigation, guidance, control, sensors, and processing systems which provide the reentry systems capability to acquire and track targets and execute the necessary flight path to the selected target
- the arming and fuzing system which provides the proper electrical signals to detonate the warhead

Excludes:

- All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle

C.4.2.5 Post Boost System

- exo-atmospheric missiles—provides the roll rate control and the final velocity to adjust and deploy the payload
- single warhead missile—structure, external protection material, velocity control system, and deployment group
- multiple warhead missile—structure, axial engines, attitude control equipment, propellant storage assembly, and pressurized system

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.6 Guidance and Control

The equipment used to control the missile flight to the target.

Includes, for example:

- functions—acquiring and tracking targets, receiving guidance intelligence data from various sources (including sensors and feedback from control commands) to follow the necessary flight path to intercept the target
  - inputs—interface status, inertial acceleration, and attitude changes
  - outputs—missile control, ordnance firing commands, status, instrumentation, and timing signals
- flight electrical power, missile electrical interconnection, and structure to contain the guidance and control components when the structure is not part of a separately identified airframe element

1) exo-atmospheric missiles

missile cables, stage cables, stage connectors, airborne power supply, electronic battery, ordnance battery, ordnance initiation set, missile electronic and computer assembly, inertial measurement unit, the guidance and control software, in-flight coolant assembly, and guidance and control integration, assembly, test, and checkout

2) endo-atmospheric missiles

seekers, mission computer, global positioning receiver, inertial platform, inertial sensors, altimeter, data link, power subsystems, windows/domes, distributive systems, autopilot, flight control actuators, guidance and control software, and guidance and control integration, assembly, test, and checkout

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.7 Ordnance Initiation Set

In exo-atmospheric missiles, the ordnance initiation set initiates all ordnance events throughout the missile and ground system (except reentry system components). Upon receipt of an electrical signal from the missile

guidance and control system, the ordnance initiation set firing units convert the signal into ordnance outputs to the detonating cords. Among these ordnance events are stage separation, motor ignition, gas generator ignition, shroud separation, etc.

Includes, for example:

- through bulkhead initiators, ordnance test harnesses, and firing units/exploding bridgewires

Excludes:

- All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the air vehicle

C.4.2.8 Airborne Test Equipment

The instrumented payload that is interchangeable with the live warhead and suitable for developmental test firing.

Includes, for example:

- recovery systems, special instrumentation, telemetry equipment, etc.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.9 Airborne Training Equipment

The exercise payload that is interchangeable with the live warhead and suitable for training firing.

Includes, for example:

- recovery systems, special instrumentation, telemetry equipment, etc., associated with the training mission

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.10 Auxiliary Equipment

The additional equipment generally excluded from other specific level 3 elements.

Includes, for example:

- environmental control, safety and protective subsystems, destruct systems, etc., if these were not accounted for in other WBS elements

- equipment of a single purpose and function which is necessary for accomplishing the assigned mission

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.

C.4.2.11 Integration, Assembly, Test and Checkout

The integration, assembly, test and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete missile.

C.4.3 Command and Launch

The subsystems installed at a launch site or aboard launch vehicles required to store, make ready, and launch the air vehicles of the missile system.

Includes:

- those equipments required to acquire and condition the necessary intelligence of selected targets, reach launch decisions, command the launch, and provide guidance and control where such capability is not self contained aboard the air vehicle
- design, development and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specification(s), regardless of end use)
- Sub-elements to the command and launch element (C.4.3.1 - C.4.3.7)

C.4.3.1 Surveillance, Identification, and Tracking Sensors

The sensors required to support missile systems by maintaining surveillance against incoming targets and providing the data required for targeting, launch, midcourse guidance, and homing where such capability is not self-contained aboard a missile system air vehicle. For all classes of missiles:

Includes, for example:

- tracking of the missile system air vehicles as required for guidance and control or range safety
- sensors of any spectrum (radar, optical, infrared, etc.) which are external to the air vehicle

Excludes:

- Subsystems used in safety, destruct, test, or training activities unless they are required operational items

C.4.3.2 Launch and Guidance Control

The equipment to target air vehicles, make launch decisions, and command launch.

Includes, for example:

- control and checkout console, data displays, secure code device, programmer group, communication control console, command message processing group, and digital data group
- equipment at the launch facility/vehicle and/or the launch control center(s) (air, sea, or mobile)
- launch code processing system

C.4.3.3 Communications

The equipment, not resident on the air vehicle, which distributes intelligence between the air vehicle and the command and launch equipment.

Includes, for example:

- inter-communication subsystems of launch sites for tactical and administrative message flow and ties between sensor, data processing, launch, and guidance control subsystems
- communications may interface with existing fixed communication facilities or communication subsystems of launch platforms which are associated systems to the missile system

C.4.3.4 Command and Launch Applications Software

All the software required to direct and perform the operations of the command and launch equipment (ref. ANSI/IEEE Std 610.12).

Includes, for example:

- effort required to design, develop, integrate, and checkout the command and launch applications computer software configuration items (CSCIs)

Excludes:

- non-software portion of command and launch firmware development and production

NOTE: When the opportunity to collect lower level information exists, the structure and definitions in Appendix B, Electronic/Automated Software Systems, will be used.

C.4.3.5 Command and Launch System Software

The software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs; for example, operating systems, compilers, and utilities (ref. ANSI/IEEE Std 610.12).

Includes, for example:

- all effort required to design, develop, integrate, and checkout the command and launch system software
- all software developed to support any command and launch applications software development
- command and launch system software which is required to facilitate development, integration, and maintenance of any command and launch software CSCI

Excludes:

- all software that is an integral part of any specific hardware subsystem specification or specifically designed and developed for system test and evaluation

NOTE: When the opportunity to collect lower level information exists, the structure and definitions in Appendix B, Electronic/Automated Software Systems, will be used.

C.4.3.6 Launcher Equipment

The means to launch the missile air vehicle from stationary sites or mobile launch platforms.

Includes, for example:

- vehicles, rail launchers, canisters, capsules, tubes, pods, and devices which support, suspend, or encase the air vehicle for firing
- associated hardware such as umbilicals, harnesses, pyrotechnics, and electronics
- storage facilities and checkout stations for readiness verification when these are integral to the launcher
- safety and protective elements when these are not integral to the launch platform or site facilities

C.4.3.7 Auxiliary Equipment

The general purpose/multi-usage ground equipment utilized to support the various operational capabilities of the command and launch equipments which is generally excluded from other specific level 3 elements.

Includes, for example:

- power generators, power distribution systems, environmental control, cabling, malfunction detection, fire prevention, security systems, and other common-usage items not applicable to specific elements of the ground based equipment

C.4.4 Common WBS Elements

Definitions for common WBS elements applicable to the missile and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX D:

ORDNANCE SYSTEMS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

D.1 SCOPE

This appendix provides the ordnance system work breakdown structure. Definitions for the complete round and launch system are provided in this appendix. Definitions for WBS elements common to the ordnance system and all other defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

D.2 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Ordnance System		
	Complete Round	
		Structure
		Payload
		Guidance and Control
		Fuze
		Safety/Arm
		Propulsion
		Integration, Assembly, Test and Checkout
	Launch System	
		Launcher
		Carriage
		Fire Control
		Ready Magazine
		Adapter Kits
		Integration, Assembly, Test and Checkout
	Systems Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)
	Initial Spares and Repair Parts	

D.3 DEFINITIONS

D.3.1 Ordnance System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce the capability for applying munitions to a target.

Includes:

- munitions (nuclear, biological, chemical, psychological, and pyrotechnic); means of launching or firing the munitions; represented by MK48 torpedo system, SNAKEYE bomb, Combined Effects Munitions, GATOR, Sensor Fuzed Weapon, 8-inch Howitzer, and .223 caliber ammunition

Excludes:

- aerospace guided missiles and land, sea, or air delivery vehicles

D.3.2 Complete Round

The components that are necessary for firing one shot, such as mines, bombs, rockets, torpedoes, naval guns, rifles, and artillery ammunition.

Includes:

- structural elements, warhead or payload, fuze, safety/arming devices, guidance equipment, and propellant/propulsion equipment
  - (for artillery ammunition) projectile including structure, warhead, fuze, guidance and control (if applicable), safety/arming devices, propelling charge, and rocket motor (if applicable)
- design, development, and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements of the complete round element (D.3.2.1 - D.3.2.7)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.1 Structure

Portion of the complete round which carries the payload to the target; the basic housing of a bomb or rocket, casing of a projectile, body of a torpedo, or the tactical munitions dispenser containing submunitions.

Includes, for example:

- those structural devices which provide stability and control (i.e., fins, parachutes, anchors)

Excludes:

- all effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round.

D.3.2.2 Payload

The subsystem that contains the warhead and its support assemblies.

1) small arms ammunition

Payload may only be the warhead (i.e., a projectile assembly containing the kill mechanism of the round and its associated high explosives, chemicals, biological agents, nuclear devices, and pyrotechnics).

2) complex munitions containing submunitions

Payload subsystem may include guidance and control, fuze, safety/arm, and propulsion as defined in D.3.2.3, D.3.2.4, D.3.2.5, and D.3.2.6 of this appendix.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.3 Guidance and Control

The complex of electronic equipment (hardware/software) which evaluates and correlates the path of the complete round with target information, and which performs the necessary functions to enable the payload to intercept the target.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.4 Fuze

The mechanical or electronic device in the complete round designed to detonate or to set forces into action to detonate the charge or primer under desired conditions.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.5 Safety/Arm

The device in the complete round which controls the capability of initiating the explosive sequence (e.g., mechanical, hydrostatic, inertial, counters, and timers).

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.6 Propulsion

The chemical, mechanical, or electrical devices (such as explosive powder charges, chemical precision initiation charges, electric power modules, and rocket motors) which provide the forces to transport the complete round from the launch position to the target.

Includes, for example: (for artillery ammunition) cartridge case, if applicable, primer, and explosive charge

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the complete round is excluded.

D.3.2.7 Integration, Assembly, Test, and Checkout

The integration, assembly, test, and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete round.

D.3.3 Launch System

The equipment (hardware/software) for controlling or sending forth the munitions on a desired course or trajectory—the ordnance system less the complete round.

Includes, for example:

- rifles, artillery pieces, naval guns, mortar cannons, machine guns, and the equipment for launching torpedoes and rockets or dropping bombs (e.g., the launcher, fire control equipment, and the ready magazine).
- all effort associated with the design, development, and production of complete units (i.e., the prototype or operationally configured units

which satisfy the requirements of their applicable specifications, regardless of end use).

D.3.3.1 Launcher

The structural device designed to support and hold munitions in position for firing or release.

Includes, for example:

- suspension and release systems, rail, rocket pods, mine racks or dispensers, and torpedo tubes
- (for guns and artillery) tubes, recoil assemblies, breech mechanisms, mounts, and rifle stocks

D.3.3.2 Carriage

The primary equipment (hardware/software) which serves as a platform to accommodate the other level 3 elements and provides mobility to the complete launch system (e.g., T-frame, hull/chassis, wheels, tires, tubes, brakes, hydraulics, and secondary power batteries/generators), which are an integral part of the carriage itself and not directly a part of other level 3 elements.

D.3.3.3 Fire Control

The equipment (hardware/software) for controlling the direction, volume, and time of fire or release of munitions through the use of electrical, electronic, optical, or mechanical systems, devices or aids.

Includes, for example:

- (for rifles and small arms) sighting devices and trigger mechanisms
- (for artillery, naval guns, and heavy mortars) aiming mechanisms in traverse and elevation, radar and other sensors, computers and other equipment for performing fire control computations
- (for air-dropped munitions) gunsights, intervalometers, and other sensor and computational devices for controlling the release of the munitions
- (for torpedoes) sonar and other sensors, computers, control consoles, and devices for presetting torpedo speed and direction

D.3.3.4 Ready Magazine

The structure or compartment for storing ammunition or explosives in a ready-for-use condition or position (e.g., the part of a gun or firearm which holds the ammunition ready for chambering and feed mechanisms for placing the ammunition in a position ready for chambering).

D.3.3.5 Adapter Kits

The equipment (hardware/software) for adapting the launch system to particular applications (e.g., vehicle adapter kits for adaptation to different aircraft models, kits for backpacking, etc.).

D.3.3.6 Integration, Assembly, Test and Checkout

The integration, assembly, test and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete launch system.

D3.4 Common WBS Elements

Definitions for common WBS elements applicable to the ordnance system and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX E:

SHIP SYSTEMS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

E.1 SCOPE

This appendix provides the ship system work breakdown structure. Definitions for the ship are provided in this appendix. Definitions for WBS elements common to the ship and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

E.2 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Ship System		
	Ship	
		Hull Structure
		Propulsion Plant
		Electric Plant
		Command and Surveillance
		Auxiliary Systems
		Outfit and Furnishings
		Armament
		Integration/Engineering
		Ship Assembly and Support Services
	Systems Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)
	Initial Spares and Repair Parts	

E.3 DEFINITIONS

E.3.1 Ship System

The complex of equipment (hardware/software), data, services, and facilities required to attain the capability of operating or supporting the operation of naval weapons, or performing other naval tasks at sea.

E.3.2 Ship

The waterborne vehicle of a ship system.

Includes:

- all types of surface and subsurface water vehicles such as combatants, auxiliaries, amphibious, and special-purpose ships
- design, development, and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements to the ship (E.3.2.1 - E.3.2.9)

E.3.2.1 Hull Structure

The assembled main hull body with all structure subdivision.

Includes, for example:

- shell plating, longitudinal and transverse framing, platforms and decks, superstructure, foundations, structural bulkheads, enclosures and sponsors
- castings, forgings, and welds; fixed ballast; doors and closures; king-posts, masts, and service platforms; and sonar domes
- compartment testing.

E.3.2.2 Propulsion Plant

The major components installed primarily for propulsion and the systems necessary to make these components operable

Includes, for example:

- boilers and energy converters, propulsion units, main condensers and air ejectors, shafting, bearings, propellers, combustion air supply system, uptakes, propulsion control equipment, main stream, feed water and condensate, circulating and cooling water, fuel oil service and lubricating oil system

- nuclear steam generators, reactors, reactor coolant and auxiliary systems, nuclear power plant control, and radiation shielding

E.3.2.3 Electric Plant

The power generating and distribution systems installed primarily for ship service and emergency power and lighting.

Includes, for example:

- electric power generation, power distribution switchboards, power distribution system, and lighting system

E.3.2.4 Command and Surveillance

The equipment (hardware/software) and associated systems installed to receive information from off-ship source, to transmit to off-ship receivers, and to distribute information throughout the ship.

Includes, for example:

- sensing and data systems required for navigation and weapon fire control
- navigation equipment, interior communication systems and equipment, gun fire control system, nonelectronic countermeasure systems, electronic countermeasure systems, missile fire control systems, antisubmarine warfare fire control and torpedo fire control systems, radar systems, radio communication systems, electronic navigation systems, space vehicle electronic tracking systems, sonar systems, electronic tactical data systems, and all associated software

E.3.2.5 Auxiliary Systems

The systems required for ship control, safety, provisioning, and habitability.

Includes, for example:

- the auxiliary machinery and piping systems; the hull mechanical handling systems; and ship control surfaces such as rudders, hydrofoils, and driving planes
- heating, ventilation, and air conditioning systems; refrigerating spaces
- plant and equipment
- gasoline, JP-5, all liquid cargo piping, oxygen-nitrogen and aviation lubricating oil systems

- plumbing installation, saltwater service systems, fire extinguishing systems, drainage, ballast, trimming, heating, and stabilizer tank systems
- fresh water system, scuppers and deck drains
- fuel and diesel oil filling, venting, stowage and transfer systems
- tank heating systems, compressed air system, auxiliary steam, exhaust steam and steam drains, buoyancy control system, distilling plant
- steering system; mooring, towing, anchor and aircraft handling systems; deck machinery; elevators; moving stairways; stores strikedown and stores handling equipment; operating gear for retracting and elevating units; aircraft elevators
- aircraft arresting gear, barriers, and barricades
- catapults and jet blast deflectors, replenishment at sea and cargo handling systems

E.3.2.6 Outfit and Furnishings

The outfit equipments and furnishings required for habitability and operability which are not specifically included in other ship elements.

Includes, for example:

- hull fittings
- boats, boat stowage and handlings
- rigging and canvas; ladders and gratings; nonstructural bulkheads and doors; painting, deck covering, hull insulation; storerooms, stowage and lockers
- equipment for utility space, workshops, laboratories, test areas, alley, pantry, scullery and commissary outfit
- furnishings for living spaces, offices, control centers, machinery spaces, medical, dental and pharmaceutical spaces; and nonpropulsion space shielding

E.3.2.7 Armament

The complex of armament and related ammunition handling, stowage, and support facilities; and cargo munitions handling, stowage, and support facilities.

Includes, for example:

- guns, and gun mounts; ammunition handling systems and stowage; special weapons handling and storage

- rocket and missile launching devices, handling systems and stowage
- air launched weapons handling systems and stowage; and cargo munitions handling and stowage

E.3.2.8 Integration/Engineering

The engineering effort and related material associated with the design, development, and rework to provide the ship as a whole exclusive of that included under the Systems Engineering/Program Management element.

Includes, for example:

- construction drawings, engineering calculations, weighing and weight calculation, photographs, models, and shipbuilders information drawings.

E.3.2.9 Ship Assembly and Support Services

The efforts and material associated with construction which cannot be logically and practicably identified with, or related to, other level 3 elements.

Includes, for example:

- staging, scaffolding, and cribbing; temporary utilities and services; molds, templates, jigs, fixtures, and special production tools; dry-docking, inspection, insurance, launching, and delivery.

E.3.3 WBS Common Elements

Definitions for common WBS elements applicable to the ship and all other defense materiel items are found in Appendix H: Work Breakdown Structure Definitions, Common Elements.

APPENDIX F:

SPACE SYSTEMS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

F.1 SCOPE

This appendix provides the space system work breakdown structure. Definitions for the launch vehicle; the orbital transfer vehicle; the space vehicle; and for ground command, control, communications and mission equipment; flight support operations and services; and storage are provided in this appendix. Definitions for WBS elements common to the space system and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

F.2 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Space System		
	Launch Vehicle	
		Propulsion (Single Stage Only)
		Stage I
		Stage II...n (As Required)
		Strap-On Units (As Required)
		Shroud (Payload Fairing)
		Guidance and Control
		Integration, Assembly, Test and Checkout
	Orbital Transfer Vehicle	
		Propulsion (Single Stage Only)
		Stage I
		Stage II...n (As Required)
		Strap-On Units (As Required)
		Guidance and Control
		Integration, Assembly, Test and Checkout
	Space Vehicle	
		Spacecraft
		Payload I...n (As Required)
		Reentry Vehicle
		Orbit Injector/Dispenser
		Integration, Assembly, Test and Checkout
	Ground Command, Control, Communications and Mission Equipment	
		Sensor I...n (As Required)
		Telemetry, Tracking and Control
		External Communications
		Data Processing Equipment
		Launch Equipment
		Auxiliary Equipment
	Flight Support Operations and Services	
		Mate/Checkout/Launch
		Mission Control
		Tracking and C^3
		Recovery Operations and Services
		Launch Site Maintenance/Refurbishment
	Storage	
		Planning and Preparation
		Storage
		Transfer and Transportation
	Systems Engineering/Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
	Training	
		Equipment
		Services
		Facilities

Level 1	Level 2	Level 3
Space System (cont d)	Data	Technical Publications Engineering Data Management Data Support Data Data Depository
	Peculiar Support Equipment	Test and Measurement Equipment Support and Handling Equipment
	Common Support Equipment	Test and Measurement Equipment Support and Handling Equipment
	Operational/Site Activation	System Assembly, Installation and Checkout on Site Contractor Technical Support Site Construction Site/Ship/Vehicle Conversion
	Industrial Facilities	Construction/Conversion/Expansion Equipment Acquisition or Modernization Maintenance (Industrial Facilities)
	Initial Spares and Repair Parts	

F.3 DEFINITIONS

F.3.1 Space System

The complex of equipment (hardware/software), data, services, and facilities required to attain and/or maintain an operational capability in space. This operational capability requires the ability to develop, deliver, and maintain mission payload(s) in specific orbit, which further requires the ability to place, operate, and recover manned and unmanned space systems.

Includes:

- launch vehicles, orbital transfer vehicles, shrouds, space vehicles, communications, command and control facilities and equipment, and any mission equipment or other items necessary to provide an operational capability in space.

F.3.2 Launch Vehicle

The primary means for providing initial thrust to place a space vehicle into its operational environment. The launch vehicle is the prime propulsion

portion of the complete flyaway (not to include the orbital transfer vehicle and space vehicle). The launch vehicle may be single-stage or multiple-stage configuration.

Includes:

- the structure, propulsion, guidance and control, and all other installed equipment integral to the launch vehicle as an entity within itself
- the design, development, and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specification, regardless of end use)
- Sub-elements to the launch vehicle (F.3.2.1 - F.3.2.7)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.1 Propulsion (Single Stage Only)

The means for generating the launch vehicle into its operational orbit or its intended path.

Includes, for example:

- engine, structure, propellant and fuel, distribution and control of propellant and fuel, starting means, safety devices, and internal environmental control grouped as a functional entity
- design, development, production, and assembly efforts to provide the propulsion subassembly

F.3.2.2 Stage I

The launch vehicle stage which provides initial lift-off propulsion for the complete launch vehicle (flyaway) and cargo.

Includes, for example:

- structure, propulsion, controls, instrumentation, and all other installed subsystem equipment integral to Stage 1 as an entity
- design, development, production, and assembly efforts to provide Stage I as an entity

Excludes:

- strap-on units

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.3 Stage II...n (As Required)

The second and subsequent launch vehicle stages (if applicable) used to place a space vehicle into its operational environment.

Includes, for example:

- propulsion following separation of the first stage and subsequent stages (if applicable)
- structure, propulsion, controls, instrumentation, separation subsystems, and all other installed subsystem equipment integral to the stage as an entity
- design, development, production, and assembly efforts to provide each individual stage as an entity

Excludes:

- strap-on units

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.4 Strap-On Units (As Required)

Solid or liquid propulsion assemblies that provide additional thrust or propellant to assist the launch vehicle in placing a spacecraft into its operational orbit if strap-on units are employed.

Includes, for example:

- complete set of strap-on units—case, nozzle, igniter, tanks, mounting structure, cordage, etc.
- design, development, production, and assembly efforts to provide the strap-on units as an entity

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.5 Shroud (Payload Fairing)

The protective covering and equipment mated to the launch vehicle which protects the cargo (i.e., orbital transfer vehicle or space vehicle/orbital transfer vehicle combination) prior to and during the launch vehicle ascent phase.

Includes, for example:

- structure—the shroud structure, mechanisms and hinges
- instrumentation—the hardware and software required to measure the environment and loads being experienced by the shroud during the ascent phase until shroud separation and deployment
- separation subsystem—the sequencers, ordnance, and other necessary mechanisms to assure a successful shroud separation from the launch vehicle and cargo
- power system—the necessary generation, storage, and distribution of electrical power and signals, hydraulic power, and any other power required by the shroud
- thermal control systems—thermal paint, insulation, heat shield tiles, or any other active or passive means necessary to maintain appropriate temperature of the shroud and mission equipment within it
- integration, assembly, test and checkout

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.6 Guidance and Control

The means (hardware/software) for generating or receiving guidance intelligence, conditioning the intelligence to produce control signals, and generating appropriate control forces.

Controllers may interface with the structure by actuating moveable aero surfaces or with the propulsion system to produce control reaction forces or may independently produce reaction forces for control.

If the design is such that electronics are packaged into a single rack or housing as an assembly, this rack or housing will be considered part of the guidance and control system.

Includes, for example:

- guidance intelligence system, computer, sensing elements, etc.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the launch vehicle is excluded.

F.3.2.7 Integration, Assembly, Test, and Checkout.

The integration, assembly, test, and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete launch vehicle.

F.3.3 Orbital Transfer Vehicle

Any transportation system utilized for placing spacecraft in an operational environment following launch vehicle separation or deployment. Orbital transfer vehicle includes, for example, "upper-stages" and orbital maneuvering vehicles. The orbital transfer vehicle may be single-stage or multiple-stage configuration.

Includes:

- structure, propulsion, guidance and control; all other installed equipment; and all software integral to the vehicle
- design development, and production of complete units (i.e., prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements to the orbital transfer vehicle—Propulsion, Stage I, Stage II...n, Strap-On Units, Guidance and Control, Integration, Assembly, Test and Checkout (Sections F.3.3.1 through F.3.3.4)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the orbital transfer vehicle is excluded.

F.3.3.1 Propulsion (Single Stage Only).

The means for generating the orbital transfer vehicle into its operational orbit.

Includes, for example:

- engine, structure, propellant and fuel, distribution and control of propellant and fuel, starting means, safety devices, and internal environmental control grouped as a functional entity
- design, development, production, and assembly efforts to provide the propulsion structure as an entity

F.3.3.2 Stage I

The orbital transfer vehicle stage which provides initial propulsion for the orbital transfer vehicle following separation or deployment from the launch vehicle.

Includes, for example:

- structure, propulsion, controls, instrumentation, separation, and all other installed subsystem equipment integral to Stage 1 as an entity
- design, development, production, and assembly efforts to provide Stage I as an entity

Excludes:

- strap-on units

F.3.3.3 Stage II...n (As Required)

The second orbital transfer vehicle stage and subsequent stages (as required) used to place a space vehicle into its operational environment. This stage provides propulsion following separation of the first stage.

Includes, for example:

- structure, propulsion, controls, instrumentation, separation subsystems, and all other installed subsystem equipment integral to the stage as an entity
- design, development, production, and assembly efforts to provide each stage as an entity

Excludes:

- strap-on units

F.3.3.4 Strap-On Units (As Required)

The solid or liquid propulsion assemblies that provide additional thrust or propellant to assist the orbital transfer vehicle in placing a space vehicle into its operational orbit if strap-on units are employed.

Includes, for example:

- complete set of strap-on units—the case, nozzle, igniter, tanks, mounting structure, cordage, etc.
- design, development, production, and assembly efforts to provide the strap-on units as an entity

F.3.3.5 Guidance and Control

The means (hardware/software) for generating or receiving guidance intelligence, conditioning the intelligence to produce control signals, and generating appropriate control forces.

Controllers may interface with the structure by actuating moveable aero surfaces or with the propulsion system to produce control reaction forces or may independently produce reaction forces for control.

If the design is such that electronics are packaged into a single rack or housing as an assembly, this rack or housing will be considered part of the guidance and control element.

Includes, for example:

- guidance intelligence system, computer, sensing elements, etc.

F.3.3.6 Integration, Assembly, Test, and Checkout

The integration, assembly, test, and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete orbital transfer vehicle.

F.3.4 Space Vehicle

The complete vehicle, or group of vehicles placed into space (operational orbit environment).

Includes:

- spacecraft, payload, reentry vehicle and orbit injection/dispenser, and integration, assembly, test, and checkout
- design, development, and production of complete units—(i.e., prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- sub-elements to the space vehicle—Spacecraft, Payload I...n, Reentry Vehicle, Orbit Injector/Dispenser, Integration, Assembly, Test and Control (F.3.4.1 - F.3.4.5)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the space vehicle is excluded.

F.3.4.1 Spacecraft

The principal operating space vehicle which serves as a housing or platform for carrying a payload and other mission-oriented equipments in space.

Includes, for example:

- structure, power, attitude determination and control, and other equipments characteristic of spacecraft
- all design, development, production, and assembly efforts to provide the spacecraft as an entity

F.3.4.2 Payload

The equipment provided for special purposes in addition to the normal equipment integral to the spacecraft or reentry vehicle.

Includes, for example:

- experimental equipment placed on board the vehicle and flight crew equipment (space suits, life support, and safety equipment)
- communications, displays and instrumentation, telemetry equipment and other equipments specifically to collect data for future planning and projection purposes

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the space vehicle is excluded.

F.3.4.3 Reentry Vehicle

The principal operating vehicle specifically designed to safely reenter the atmosphere in order to land a payload (experimental equipment or crew).

Includes, for example:

- navigation and guidance, power supply, command and control, attitude control, environmental control, propulsion, and other equipments homogeneous to the reentry vehicle
- all design, development, production, and assembly efforts to provide the reentry vehicle as an entity

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the space vehicle is excluded.

F.3.4.4 Orbit Injector/Dispenser

The function of placing orbiting objects in the planned orbital path.

Includes, for example:

- structure, propulsion, instrumentation and stage interface, separation subsystem, and other equipment necessary for integration with other level 3 elements

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the space vehicle is excluded.

F.3.4.5 Integration, Assembly, Test, and Checkout

The integration, assembly, test, and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete space vehicle.

F.3.5 Ground Command, Control, Communications, and Mission Equipment

The ground hardware/software equipment used for communicating between control and tracking facilities, monitoring the health and status of space vehicles, commanding the space vehicle's hardware, and adjusting the space vehicle's orbit as required for space vehicle health or mission purpose.

Two configurations for the ground command, control, communications and mission equipment are the parabolic dish-based antenna system and the phased array-based antenna system.

If a ground site has multiple antenna configurations, each will have its own separate command and control equipment, communications equipment, data processing equipment and test equipment.

Includes:

- the design, development, and production of complete units—(i.e., prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- sub-elements to the ground command, control, communications, and mission equipment (F.3.5.1 - F.3.5.6)

F.3.5.1 Sensor I...n (As Required)

Those hardware and software elements/components which comprise the sensor system.

Includes, for example:

- antenna, platform/pedestal, radome, transmission equipment, reception equipment, and other sensor subsystems

- design, development, production, and assembly efforts to provide each sensor as an entity

F.3.5.2 Telemetry, Tracking and Control

The hardware/software elements that facilitate launch decisions and command and control of the aerospace vehicle.

Includes, for example:

- supplementary means for guidance of those aerospace vehicles not having completely self-contained guidance and control and means to command destruct
- control and check-out consoles, data displays, and mission records

F.3.5.3 External Communications

The hardware and software components that allow the ground station to communicate with any external data link or source like telephone (analog) lines, digital data lines, nonsatellite radio receivers. While the terrestrial data lines may connect to radio of other satellite communications stations, the external communications subsystem ends where these links physically connect to the secure communications, modulation/demodulation (modem) or coder/decoder equipment.

F.3.5.4 Data Processing Equipment

The hardware and software components that provide the activities and means to condition data generated at the launch site or aboard the space vehicle, or data received from associated systems to accommodate the needs of command and control or mission data processing.

Includes, for example:

- central processing unit (computer), peripheral equipment, and the software required to operate the data processing equipment.

F.3.5.5 Launch Equipment

The means to launch the aerospace vehicle from stationary sites.

Includes, for example:

- storage facilities and checkout stations for readiness verification when these are integral to the launcher
- safety and protective elements when these are not integral to the launch platform or facilities

F.3.5.6 Auxiliary Equipment

The general purpose/multi-usage ground equipment utilized to support the various operational capabilities of the command and launch equipments.

Includes, for example:

- power generators, power distribution systems, environmental control, cabling, malfunction detection, fire prevention, security systems, and other common-usage items not applicable to specific elements of the ground based equipment

F.3.6 Flight Support Operations and Services

Mate/checkout/launch; mission control; tracking; and command, control and communications (C^3); recovery operations and services; and launch site maintenance/refurbishment. This element supports the launch vehicle, orbital transfer vehicle, and/or space vehicle during an operational mission.

Sub-elements to the flight operations and services (F.3.6.1 - F.3.6.5).

F.3.6.1 Mate/Checkout/Launch

The preflight operations and services subsequent to production and/or storage, and the actual launch of the complete system and payload.

Includes, for example:

- materials to conduct equipment receiving and checkout at launch site, preflight assembly and checkout, pre/post flight data reduction and analysis, and any prelaunch flight control/mission control planning

F.3.6.2 Mission Control

The personnel and materiel required to operate individual mission control centers and to perform ground command and control with the space vehicles.

Includes, for example:

- mission control centers such as Constellation Command Center, Battle Management/Command Control Center (BM/C^3), Space Asset Support System Control Center, and Space Transportation Control Center

Excludes:

- tracking and communications centers (these are included in WBS element F.3.6.3)

F.3.6.3 Tracking and C^3

The personnel and materiel required to perform the functions of telemetry, tracking, controlling, and data retrieval for the mission control systems.

Includes, for example:

- mission control systems, on the ground or in space, including Satellite Control Facility; Remote Tracking Station; Tracking, Data, Relay Satellite System; and other ground/space tracking systems

Excludes:

- initial acquisition of tracking and C^3 (acquisition of these systems is included in WBS element F.3.6.4)

F.3.6.4 Recovery Operations and Services

The contractor effort and materiel necessary to effect recovery of the space vehicle or other mission equipment.

Includes:

- the launch site recovery forces, reentry site recovery forces, logistics support to recovery forces, logistics support to the recovery operations, communications, and transportation of recovered equipment to assigned facilities

F.3.6.5 Launch Site Maintenance/Refurbishment

The organization, maintenance, and management of launch vehicle facilities and mission equipment, and support at the launch base.

Includes, for example:

- requirements to clean up and refurbish each launch site after each launch

F.3.7 Storage

Those costs of holding portions of the space system while awaiting use of the system being stored, prepared for storage, or recovered from storage. Periods of holding result from schedule changes and/or technological problems exogenous to the portion of the space system.

Includes:

- Sub-elements to storage (F.3.7.1 - F.3.7.3)

F.3.7.1 Planning and Preparation

The planning and preparation costs for storage of all systems/subsystems associated with the launch vehicle, orbital transfer vehicle, and space vehicle equipment.

Includes, for example:

- generation of any storage or maintenance instructions and documents necessary for repairable systems or subsystems

F.3.7.2 Storage

The cost incurred while the systems or subsystems of the launch vehicle, orbital transfer vehicle, and space vehicle equipment are in storage.

F.3.7.3 Transfer and Transportation

The transfer and storage costs incurred when the systems/subsystems of the launch vehicle, orbital transfer vehicle, and space vehicle equipment are moved from one location to another.

Includes, for example:

- costs of relocation necessitated by mission requirements

F.3.8 WBS Common Elements

Definitions for common WBS elements applicable to the space system and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX G:

SURFACE VEHICLE SYSTEMS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

G.1 SCOPE

This appendix provides the surface vehicle system work breakdown structure. Definitions for the primary vehicle and secondary vehicle are provided in this appendix. Definitions for WBS elements common to the surface vehicle and all other defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

G.2 WORK BREAKDOWN STRUCTURE LEVELS

Level 1	Level 2	Level 3
Surface Vehicle System		
	Primary Vehicle	
		Hull/Frame
		Suspension/Steering
		Power Package/Drive Train
		Auxiliary Automotive
		Turret Assembly
		Fire Control
		Armament
		Body/Cab
		Automatic Loading
		Automatic/Remote Piloting
		Nuclear, Biological, Chemical
		Special Equipment
		Navigation
		Communications
		Integration, Assembly, Test and Checkout
	Secondary Vehicle	
		(Same as Primary Vehicle)
	Systems Engineering/ Program Management	
	System Test and Evaluation	
		Development Test and Evaluation
		Operational Test and Evaluation
		Mock-ups
		Test and Evaluation Support
		Test Facilities
	Training	
		Equipment
		Services
		Facilities
	Data	
		Technical Publications
		Engineering Data
		Management Data
		Support Data
		Data Depository
	Peculiar Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Common Support Equipment	
		Test and Measurement Equipment
		Support and Handling Equipment
	Operational/Site Activation	
		System Assembly, Installation and Checkout on Site
		Contractor Technical Support
		Site Construction
		Site/Ship/Vehicle Conversion
	Industrial Facilities	
		Construction/Conversion/Expansion
		Equipment Acquisition or Modernization
		Maintenance (Industrial Facilities)
	Initial Spares and Repair Parts	

G.3 DEFINITIONS

G.3.1 Surface Vehicle System

The complex of equipment, data, services, and facilities required to develop and produce a vehicle system with the capability to navigate over the surface. Surface vehicle category includes vehicles primarily intended for general purpose applications and those intended for mating with specialized payloads.

Includes:

- cargo and logistics vehicles, mobile work units and combat vehicles
- combat vehicles serving as armored weapons platforms, reconnaissance vehicles, and amphibians

G.3.2 Primary Vehicle

The mobile element of the system embodying means for performing operational missions.

Includes:

- means of propulsion and structure for adaptation of mission equipment or accommodations for disposable loads
- design, development, and production of complete units (i.e., prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements to the primary vehicle (G.3.2.1 - G.3.2.15)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.1 Hull/Frame

The vehicle's primary load bearing component which provides the structural integrity to withstand the operational loading stresses generated while traversing various terrain profiles.

Includes, for example:

- simple wheeled vehicle frame or combat vehicle hull which satisfies the structural requirements and also provides armor protection

- structural subassemblies and appendages which attach directly to the primary structure
- towing and lifting fittings, bumpers, hatches, and grilles
- provision to accommodate other subsystems such as mountings for suspension, weapons, turret, truck body, cab, special equipment loads, etc.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.2 Suspension/Steering

The means for generating tractive efforts, thrust, lift, and steering forces generally at or near the earth's surface and adapting the vehicle to the irregularities of the surface.

Includes, for example:

- wheels, tracks, brakes, and steering gears for traction and control functions
- rudder thrust devices and trim vanes for amphibians
- springs, shock absorbers, skirts, and other suspension members

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.3 Power Package/Drive Train

The means for generating and delivering power in the required quantities and driving rates to the driving member.

Includes, for example:

- engine-mounted auxiliaries such as air ducting and manifolds, controls and instrumentation, exhaust systems, and cooling means
- power transport components as clutches, transmission, shafting assemblies, torque converters, differentials, final drivers, and power takeoffs
- brakes and steering when integral to power transmission rather than in the suspension/steering element

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.4 Auxiliary Automotive

The group of hardware and software subsystems which provide services to all of the primary vehicle subsystems (as distinguished from the special equipment subsystems) and which outfit the chassis.

Includes, for example:

- the vehicle electrical or electronics system, on-board diagnostics/ prognostics system, fire extinguisher system and controls, chassis mounted accessories
- the winch and power take-off, tools and on-vehicle equipment
- crew accommodations (when otherwise not provided for)

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.5 Turret Assembly

The structure and equipment installations required to provide the fighting compartment element of combatant vehicles.

Includes, for example:

- turret armor and radiological shielding, turret rings, slip rings
- attachments and appendages such as hatches and cupolas
- accommodations for personnel, weapons, and command and control

Excludes:

- fire control and stabilization system

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.6 Fire Control

The equipment (hardware and software) installed in the vehicle which provides intelligence necessary for weapons delivery such as launching and firing.

Includes, for example:

- radars and other sensors necessary for search, recognition and/or tracking
- controls and displays
- sights or scopes
- range finders, computers, computer programs, turret and gun drives, and stabilization systems

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.7 Armament

The means for combatant vehicles to deliver fire on hostile targets and for logistics and other vehicles to exercise self-defense.

Includes, for example:

- main gun, launchers, and secondary armament

Excludes:

- Fire control systems

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.8 Body/Cab

The major component to be mated to a chassis to provide a complete vehicle having a defined mission capability.

Includes, for example:

- accommodations for personnel, cargo, and such subsystems as need to be placed in proximity to operators

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.9 Automatic Loading

The equipment (hardware and software) for selecting ammunition from a stored position in the vehicle, transferring it, and loading the armament system.

Includes, for example:

- the means to eject spent cases and misfired rounds
- ammunition storage racks, transfer/lift mechanisms, ramming and ejecting mechanisms, as well as specialized hydraulic and electrical controls

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.10 Automatic/Remote Piloting

The equipment (hardware and software) installed in the vehicle used to plan and control vehicle speed and direction either autonomously or via tele-operation.

Includes, for example:

- equipment which senses, processes and displays imagery data—stereo vision systems; laser scanners; multiple sensor-fusion algorithms and processors; image-enhancement algorithms and processors, etc.
- equipment which performs intelligence analysis and planning functions—automated route planners; image-understanding algorithms and processors; computer-aided-driving algorithms and processors, etc.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.11 Nuclear, Biological, Chemical

The subassemblies or components which provide nuclear, biological, chemical protection and survivability to the vehicle crew, either individually or collectively, during a nuclear, biological, chemical attack.

Includes, for example:

- a positive pressure system; micro-climate cooling; air conditioning and purification system; ventilated face piece (mask); nuclear, biological,

chemical detection and warning devices; decontamination kits; and chemical resistant coatings

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.12 Special Equipment

The special equipment (hardware and software) to be mated to a chassis or a chassis/body/cab assembly to achieve a special mission capability.

Includes, for example:

- all items required to convert basic vehicle configurations to special-purpose configurations
- blades, booms, winches, robotic arms or manipulators, etc., to equip wreckers, recovery vehicles, supply vehicles and other field work units
- furnishings and equipment for command, shop, medical and other special-purpose vehicles

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.13 Navigation

The equipment (hardware and software) installed in the vehicle which permits the crew to determine vehicle location and to plot the course of the vehicle.

Includes, for example:

- navigation systems such as dead reckoning, inertial, and global positioning systems
- landmark recognition algorithms and processors

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.14 Communications

The equipment (hardware and software) within the system for commanding, controlling, and transmitting information to vehicle crews and other personnel exterior to operating vehicles.

Includes, for example:

- radio frequency equipment, microwave and fiber optic communication links, networking equipment for multiple vehicle control, and intercom and external phone systems
- means for supplementary communication like visual signaling devices
- Navigation system and data displays not integral to crew stations in the turret assembly or the driver's automotive display in the cab.

NOTE: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the primary vehicle is excluded.

G.3.2.15 Integration, Assembly, Test, and Checkout

The integration, assembly, test, and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete surface vehicle.

G.3.3 Secondary Vehicle

The vehicles required to supplement, expand, or otherwise contribute to the capabilities of primary vehicles to provide the vehicle system with the required operational characteristics.

Secondary vehicles are not necessarily self-contained operational units capable of operating outside the system.

Includes:

- cargo and tank trainers of truck-trailers systems; carriers and tanker units of articulated train-type systems; and transporters as employed in systems when the primary vehicle has limited roadability
- the design, development, and production of complete units (i.e., prototype or operationally configured units which satisfy the requirements of their applicable specification(s), regardless of end use)

NOTE: Work breakdown structure and definitions for Secondary Vehicle are the same as those for the primary vehicle.

G.3.4 WBS Common Elements

Definitions for common WBS elements applicable to the surface vehicle and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.

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APPENDIX H:

COMMON ELEMENTS

WORK BREAKDOWN STRUCTURE AND DEFINITIONS

H.1 SCOPE

This appendix provides the WBS elements common to all types of systems. Applicable government and non-government documents are listed. Definitions for the common WBS elements are provided in this appendix.

H.2 APPLICABLE DOCUMENTS

The following standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications (DODISS) and supplement thereto, cited in the solicitation.

STANDARDS

ML-STD-1464, *Army Nomenclature System*
MIL-STD-1661*, Mark and Mod Nomenclature System*
MIL-STD-1812, *Type Designation, Assignment and Method for Obtaining*

The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DOD 5010.12-L, *Acquisition Management Systems and Data Requirements Control List (AMSDL)*

Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the:

Standardization Documents Order Desk
700 Robbins Avenue
Building #4, Section D
Philadelphia, PA 19111-5094

H.3 DEFINITIONS

H.3.1 Integration, Assembly, Test, and Checkout

In those instances in which an integration, assembly, test, and checkout element is used (Appendices A through G), this element includes all effort of technical and functional activities associated with the design, development, and production of mating surfaces, structures, equipment, parts, materials, and software required to assemble the level 3 equipment (hardware/software) elements into a level 2 mission equipment (hardware/software) as a whole and not directly part of any other individual level 3 element.

Includes:

- the development of engineering layouts, determination of overall design characteristics, and determination of requirements of design review
- the set up, conduct, and review of testing assembled components or subsystems prior to installation
- the detailed production design, producibility engineering planning (PEP), and manufacturing process capability, including the process design development and demonstration effort to achieve compatibility with engineering requirements and the ability to produce economically and consistent quality
- inspection activities related to receiving, factory and vendor liaison
- design maintenance effort
- quality planning and control
- tooling (initial production facilities, factory support equipment) including planning, design, and fabrication
- administrative engineering
- the joining or mating and final assembly of level 3 equipment elements to form a complete prime mission equipment when the effort is performed at the manufacturing facility
- integration of software (including loading and verification of firmware)
- conduct of production acceptance testing

Excludes:

- all systems engineering/program management and system test and evaluation which are associated with the overall system

NOTE: When an integration, assembly, test, and checkout element is utilized at lower levels of the contract work breakdown structure, it will be summarized into the next higher level equipment (hardware/software) work breakdown structure element and should never be summarized directly into a level 3 integration, assembly, test, and checkout element.

H.3.2 Systems Engineering/Program Management

The systems engineering and technical control as well as the business management of particular systems and programs. Systems engineering/ program management elements to be reported and their levels will be specified by the requiring activity.

Includes:

- the overall planning, directing, and controlling of the definition, development, and production of a system or program including supportability and acquisition logistics, e.g., maintenance support, facilities, personnel, training, testing, and activation of a system

Excludes:

- systems engineering/program management effort that can be associated specifically with the equipment (hardware/software) element

Systems Engineering

The technical and management efforts of directing and controlling a totally integrated engineering effort of a system or program.

Includes but not limited to:

- effort to define the system and the integrated planning and control of the technical program efforts of design engineering, specialty engineering, production engineering, and integrated test planning
- effort to transform an operational need or statement of deficiency into a description of system requirements and a preferred system configuration
- technical planning and control effort for planning, monitoring, measuring, evaluating, directing, and replanning the management of the technical program

- (all programs, where applicable) value engineering, configuration management, human factors, maintainability, reliability, survivability/ vulnerability, system safety, environmental protection, standardization, system analysis, logistic support analysis, etc.
- (for ships) the extended Ship Work Breakdown Structure (ESWBS), Configuration Management (811), Human Factors (892), Standardization (893), Value Engineering (894), and Reliability and Maintainability (895) elements

Excludes:

- actual design engineering and the production engineering directly related to the WBS element with which it is associated

Examples of systems engineering efforts are:

1) System definition, overall system design, design integrity analysis, system optimization, system/cost effectiveness analysis, and intra-system and inter-system compatibility assurance, etc.; the integration and balancing of reliability, maintainability, producibility, safety, human health, environmental protection, and survivability; security requirements, configuration management and configuration control; quality assurance program, value engineering, preparation of equipment and component performance specifications, design of test and demonstration plans; determination of software development or software test facility/ environment requirements.

2) Preparation of the Systems Engineering Management Plan (SEMP), specification tree, program risk analysis, system planning, decision control process, technical performance measurement, technical reviews, subcontractor and vendor reviews, work authorization, and technical documentation control.

3) Reliability engineering—the engineering process and series of tasks required to examine the probability of a device or system performing its mission adequately for the period of time intended under the operating conditions expected to be encountered.

4) Maintainability engineering—the engineering process and series of tasks required to measure the ability of an item or system to be retained in or restored to a specified condition of readiness, skill levels, etc., using prescribed procedures and resources at specific levels of maintenance and repair.

5) Human factors engineering—the engineering process and the series of tasks required to define, as a comprehensive technical and engineering effort, the integration of doctrine, manpower, and personnel integration, materiel development, operational effectiveness, human characteristics, skill

capabilities, training, manning implication, and other related elements into a comprehensive effort.

6) Supportability analyses—an integral part of the systems engineering process beginning at program initiation and continuing throughout program development. Supportability analyses form the basis for related design requirements included in the system specification and for subsequent decisions concerning how to most cost effectively support the system over its entire life cycle. Programs allow contractors the maximum flexibility in proposing the most appropriate supportability analyses.

Program Management

The business and administrative planning, organizing, directing, coordinating, controlling, and approval actions designated to accomplish overall program objectives which are not associated with specific hardware elements and are not included in systems engineering.

Includes for example:

- cost, schedule, performance measurement management, warranty administration, contract management, data management, vendor liaison, subcontract management, etc.
- support element management, defined as the logistics tasks management effort and technical control, and the business management of the support elements. The logistics management function encompasses the support evaluation and supportability assurance required to produce an affordable and supportable defense materiel system
- planning and management of all the functions of logistics. Examples are:
  - maintenance support planning and support facilities planning; other support requirements determination; support equipment; supply support; packaging, handling, storage, and transportation; provisioning requirements determination and planning; training system requirements determination; computer resource determination; organizational, intermediate, and depot maintenance determination management; and data management
- (for ships) the Extended Ship Work Breakdown Structure (ESWBS), Project Management (897); Data Management (896); and Supply Support (853) elements.

H.3.3 System Test and Evaluation

The use of prototype, production, or specifically fabricated hardware/ software to obtain or validate engineering data on the performance of the system during the development phase (normally funded from RDT&E) of the program.

Includes:

- detailed planning, conduct, support, data reduction and reports (excluding the Contract Data Requirements List data) from such testing, and all hardware/software items which are consumed or planned to be consumed in the conduct of such testing
- all effort associated with the design and production of models, specimens, fixtures, and instrumentation in support of the system level test program

NOTE: Test articles which are complete units (i.e., functionally configured as required by specifications) are excluded from this work breakdown structure element.

Excludes:

- all formal and informal testing up through the subsystem level which can be associated with the hardware/software element
- acceptance testing

NOTE: These excluded efforts are to be included with the appropriate hardware or software elements.

H.3.3.1 Development Test and Evaluation

This effort is planned, conducted and monitored by the developing agency of the DoD component. It includes test and evaluation conducted to:

- demonstrate that the engineering design and development process is complete.
- demonstrate that the design risks have been minimized.
- demonstrate that the system will meet specifications.
- estimate the system's military utility when introduced.
- determine whether the engineering design is supportable (practical, maintainable, safe, etc.) for operational use.

- provide test data with which to examine and evaluate trade-offs against specification requirements, life cycle cost, and schedule.
- perform the logistics testing efforts to evaluate the achievement of supportability goals, the adequacy of the support package for the system, (e.g., deliverable maintenance tools, test equipment, technical publications, maintenance instructions, and personnel skills and training requirements, etc.).

Includes, for example:

- all contractor in-house effort
- (all programs, where applicable) models, tests and associated simulations such as wind tunnel, static, drop, and fatigue; integration ground tests; test bed aircraft and associated support; qualification test and evaluation, development flight test, test instrumentation, environmental tests, ballistics, radiological, range and accuracy demonstrations, test facility operations, test equipment (including its support equipment), chase and calibrated pacer aircraft and support thereto, and logistics testing
- (for aircraft) avionics integration test composed of the following:
  - test bench/laboratory, including design, acquisition, and installation of basic computers and test equipments which will provide an ability to simulate in the laboratory the operational environment of the avionics system/subsystem
  - air vehicle equipment, consisting of the avionics and/or other air vehicle subsystem modules which are required by the bench/lab or flying test bed in order to provide a compatible airframe avionics system/subsystem for evaluation purposes
  - flying test bed, including requirements analysis, design of modifications, lease or purchase of test bed aircraft, modification of aircraft, installation of avionics equipment and instrumentation, and checkout of an existing aircraft used essentially as a flying avionics laboratory
  - avionics test program, consisting of the effort required to develop test plans/procedures, conduct tests, and analyze hardware and software test results to verify the avionics equipments' operational capability and compatibility as an integrated air vehicle subsystem
  - software, referring to the effort required to design, code, de-bug, and document software programs necessary to direct the avionics integration test

- (for engines) engine military qualification tests and engine preliminary flight rating tests
- (for ships) model basin, hydrostatic, fatigue, shock, special sea tests and trials, etc., including the Extended Ship Work Breakdown Structure (ESWBS), Trials Agenda Preparation, Data Collection & Analysis (842); Dock and Sea Trials (9823); and Hull Vibration Survey (9825) elements

H.3.3.2 Operational Test and Evaluation

The test and evaluation conducted by agencies other than the developing command to assess the prospective system's military utility, operational effectiveness, operational suitability, logistics supportability (including compatibility, inter-operability, reliability, maintainability, logistic requirements, etc.), cost of ownership, and need for any modifications.

Includes, for example:

- Initial operational test and evaluation conducted during the development of a weapon system
- such tests as system demonstration, flight tests, sea trials, mobility demonstrations, on-orbit tests, spin demonstration, stability tests, qualification operational test and evaluation , etc., and support thereto, required to prove the operational capability of the deliverable system
- contractor support (e.g., technical assistance, maintenance, labor, material, etc.) consumed during this phase of testing
- logistics testing efforts to evaluate the achievement of supportability goals and the adequacy of the support for the system (e.g., deliverable maintenance tools, test equipment, technical publications, maintenance instructions, personnel skills and training requirements, and software support facility/environment elements)

H.3.3.3 Mock-ups

The design engineering and production of system or subsystem mock-ups which have special contractual or engineering significance, or which are not required solely for the conduct of one of the above elements of testing.

H.3.3.4 Test and Evaluation Support

The support elements necessary to operate and maintain, during test and evaluation, systems and subsystems which are not consumed during the testing phase and are not allocated to a specific phase of testing.

Includes, for example:

- repairable spares, repair of reparables, repair parts, warehousing and distribution of spares and repair parts, test and support equipment, test bed vehicles, drones, surveillance aircraft, tracking vessels, contractor technical support, etc.

Excludes:

- operational and maintenance personnel, consumables, special fixtures, special instrumentation, etc., which are utilized and/or consumed in a single element of testing and which should be included under that element of testing

H.3.3.5 Test Facilities

The special test facilities required for performance of the various developmental tests necessary to prove the design and reliability of the system or subsystem.

Includes, for example:

- test tank test fixtures, propulsion test fixtures, white rooms, test chambers, etc.

Excludes:

- brick and mortar-type facilities identified as industrial facilities

H.3.4 Training

Deliverable training services, devices, accessories, aids, equipment, and parts used to facilitate instruction through which personnel will learn to operate and maintain the system with maximum efficiency.

Includes:

- all effort associated with the design, development, and production of deliverable training equipment as well as the execution of training services

Excludes:

- overall planning, management, and task analysis function inherent in the WBS element Systems Engineering/Program Management

H.3.4.1 Equipment

Distinctive deliverable end items of training equipment, assigned by either a contractor or military service, required to meet specific training objectives.

Includes, for example:

- operational trainers, maintenance trainers, and other items such as cutaways, mock-ups, and models

H.3.4.2 Services

Deliverable services, accessories, and aids necessary to accomplish the objectives of training.

Includes:

- training course materials; contractor-conducted training (in-plant and service training); and the materials and curriculum required to design, execute, and produce a contractor developed training program
- materiel, courses, and associated documentation (primarily the computer software, courses and training aids)

Excludes:

- deliverable training data associated with the WBS element Support Data

H.3.4.3 Facilities

The special construction necessary to accomplish training objectives.

Includes, for example:

- modification or rehabilitation of existing facilities used to accomplish training objectives

Excludes:

- installed equipment used to acquaint the trainee with the system or establish trainee proficiency
- the brick and mortar-type facilities identified as industrial facilities

H.3.5 Data

The deliverable data required to be listed on a Contract Data Requirements List, DD Form 1423.

Includes:

- only such effort that can be reduced or avoided if the data item is eliminated

- (government-peculiar data) acquiring, writing, assembling, reproducing, packaging and shipping the data
- transforming into government format, reproducing and shipping data identical to that used by the contractor but in a different format

H.3.5.1 Technical Publications

Technical data, providing instructions for installation, operation, maintenance, training, and support, formatted into a technical manual. Data may be presented in any form (regardless of the form or method of recording). Technical orders that meet the criteria of this definition may also be classified as technical manuals.

Includes, for example:

- operation and maintenance instructions, parts lists or parts breakdown, and related technical information or procedures exclusive of administrative procedures
- data item descriptions set forth in categories selected from the Acquisition Management Systems and Data Requirements Control List (DoD 5010.12-L)
- (for ships) Extended Ship Work Breakdown Structure (ESWBS), Technical Manuals and Other Data (856) element

H.3.5.2 Engineering Data

Recorded scientific or technical information (regardless of the form or method of recording) including computer software documentation. Engineering data defines and documents an engineering design or product configuration (sufficient to allow duplication of the original items) and is used to support production, engineering and logistics activities.

Includes, for example:

- all final plans, procedures, reports, and documentation pertaining to systems, subsystems, computer and computer resource programs, component engineering, operational testing, human factors, reliability, availability, and maintainability, and other engineering analysis, etc.
- Technical data package (reprocurement package) which includes all engineering drawings, associated lists, process descriptions, and other documents defining physical geometry, material composition, and performance procedures
- (for ships) Extended Ship Work Breakdown Structure (ESWBS), Design Support, Ship's Selected Records (8302); Design Support,

Services, Reproduction (8303); and Engineering Drawings and Specifications (855) elements

Excludes:

- computer software or financial, administrative, cost or pricing, or management data or other information incidental to contract administration

H.3.5.3 Management Data

The data items necessary for configuration management, cost, schedule, contractual data management, program management, etc., required by the government in accordance with functional categories selected from the DODISS and DoD 5010.12-L.

Includes, for example:

- contractor cost reports, cost performance reports, contract funds status reports, schedules, milestones, networks, integrated support plans, etc.
- (for ships) Extended Ship Work Breakdown Structure (ESWBS), Contract Data Requirements (988) element

H.3.5.4 Support Data

The data items designed to document support planning in accordance with functional categories selected from DoD 5010.12-L.

Includes, for example:

- supply; general maintenance plans and reports; training data; transportation, handling, storage, and packaging information; facilities data; data to support the provisioning process and all other support data; and software supportability planning and software support transition planning documents.

H.3.5.5 Data Depository

The facility designated to act as custodian to maintain a master engineering specification and establish a drawing depository service for government approved documents that are the property of the U.S. Government. As custodian for the government, the depository, authorized by approved change orders, maintains these master documents at the latest approved revision level. This facility is a distinct entity.

Includes, for example:

- all drafting and clerical effort necessary to maintain documents

Excludes:

- all similar effort for facility's specification and drawing control system, in support of its engineering and production activities.

NOTE: When documentation is called for on a given item of data retained in the depository, the charges (if charged as direct) will be to the appropriate data element.

H.3.6 Peculiar Support Equipment

The design, development, and production of those deliverable items and associated software required to support and maintain the system or portions of the system while the system is not directly engaged in the performance of its mission, and which are not common support equipment (See H.3.7 below).

Includes:

- vehicles, equipment, tools, etc., used to fuel, service, transport, hoist, repair, overhaul, assemble, disassemble, test, inspect, or otherwise maintain mission equipment
- any production of duplicate or modified factory test or tooling equipment delivered to the government for use in maintaining the system. (Factory test and tooling equipment initially used by the contractor in the production process but subsequently delivered to the government will be included as cost of the item produced.)
- any additional equipment or software required to maintain or modify the software portions of the system

Excludes:

- overall planning, management and task analysis functions inherent in the work breakdown structure element, Systems Engineering/Program Management
- common support equipment, presently in the DoD inventory or commercially available, bought by the using command, not by the acquiring command

H.3.6.1 Test and Measurement Equipment

The peculiar or unique testing and measurement equipment which allows an operator or maintenance function to evaluate operational conditions of a system or equipment by performing specific diagnostics, screening or quality assurance effort at an organizational, intermediate, or depot level of equipment support.

Includes, for example:

- test measurement and diagnostic equipment, precision measuring equipment, automatic test equipment, manual test equipment, automatic test systems, test program sets, appropriate interconnect devices, automated load modules, taps, and related software, firmware and support hardware (power supply equipment, etc.) used at all levels of maintenance
- packages which enable line or shop replaceable units, printed circuit boards, or similar items to be diagnosed using automatic test equipment

H.3.6.2 Support and Handling Equipment

The deliverable tools and handling equipment used for support of the mission system.

Includes, for example:

- ground support equipment, vehicular support equipment, powered support equipment, nonpowered support equipment, munitions material handling equipment, materiel handling equipment, and software support equipment (hardware and software)

H.3.7 Common Support Equipment

The items required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and which are presently in the DoD inventory for support of other systems.

Includes:

- acquisition of additional quantities of this equipment needed to support the item
- all efforts required to assure the availability of this equipment to support the item

H.3.7.1 Test and Measurement Equipment

The common testing and measurement equipment which allows an operator or maintenance function to evaluate operational conditions of a system or equipment by performing specific diagnostics, screening or quality assurance effort at an organizational, intermediate, or depot level of equipment support.

Includes, for example:

- test measurement and diagnostic equipment, precision measuring equipment, automatic test equipment, manual test equipment, automatic test systems, test program sets, appropriate interconnect devices, automated load modules, taps, and related software, firmware and support hardware (power supply equipment, etc.) used at all levels of maintenance
- packages which enable line or shop replaceable units, printed circuit boards, or similar items to be diagnosed using automatic test equipment

H.3.7.2 Support and Handling Equipment

The deliverable tools and handling equipment used for support of the mission system.

Includes, for example:

- ground support equipment, vehicular support equipment, powered support equipment, nonpowered support equipment, munitions material handling equipment, materiel handling equipment, and software support equipment (hardware/software)

H.3.8 Operational/Site Activation

The real estate, construction, conversion, utilities, and equipment to provide all facilities required to house, service, and launch prime mission equipment at the organizational and intermediate level.

Includes:

- conversion of site, ship, or vehicle
- system assembly, checkout, and installation (of mission and support equipment) into site facility or ship to achieve operational status
- contractor support in relation to operational/site activation

H.3.8.1 System Assembly, Installation, and Checkout on Site

The materials and services involved in the assembly of mission equipment at the site.

Includes, for example:

- installation of mission and support equipment in the operations or support facilities and complete system checkout or shakedown to ensure operational status. **(**Where appropriate, specify by site, ship or vehicle.)

H.3.8.2 Contractor Technical Support

The materials and services provided by the contractor related to activation.

Includes, for example:

- repair of reparables, standby services, final turnover, etc.

H.3.8.3 Site Construction

Real estate, site planning and preparation, construction, and other special-purpose facilities necessary to achieve system operational status.

Includes, for example:

- construction of utilities, roads, and interconnecting cabling

H.3.8.4 Site/Ship/Vehicle Conversion

The materials and services required to convert existing sites, ships, or vehicles to accommodate the mission equipment and selected support equipment directly related to the specific system.

Includes, for example:

- operations, support, and other special purpose (e.g., launch) facilities conversion necessary to achieve system operational status. (Where appropriate, specify by site, ship or vehicle.)

H.3.9 Industrial Facilities

The construction, conversion, or expansion of industrial facilities for production, inventory, and contractor depot maintenance required when that service is for the specific system.

Includes:

- equipment acquisition or modernization, where applicable
- maintenance of these facilities or equipment
- industrial facilities for hazardous waste management to satisfy environmental standards

H.3.9.1 Construction/Conversion/Expansion

The real estate and preparation of system peculiar industrial facilities for production, inventory, depot maintenance, and other related activities.

H.3.9.2 Equipment Acquisition or Modernization

The production equipment acquisition, modernization, or transferal of equipment for the particular system. (Pertains to government owned and leased equipment under facilities contract.)

H.3.9.3 Maintenance (Industrial Facilities)

The maintenance, preservation, and repair of industrial facilities and equipment.

H.3.10 Initial Spares and Repair Parts

The deliverable spare components, assemblies and subassemblies used for initial replacement purposes in the materiel system equipment end item.

Includes:

- repairable spares and repair parts required as initial stockage to support and maintain newly fielded systems or subsystems during the initial phase of service, including pipeline and war reserve quantities, at all levels of maintenance and support

Excludes:

- development test spares and spares provided specifically for use during installation, assembly, and checkout on site. Lower level WBS breakouts should be by subsystem.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-HDBK-881	2. DOCUMENT DATE *(YYMMDD)* 98/01/02

3. DOCUMENT TITLE
WORK BREAKDOWN STRUCTURE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include ZIP Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME MR. WAYNE F. ABBA	b. TELEPHONE *(Include Area Code)* (1) Commercial: 703-695-5166 (2) AUTOVON: 225-5166
c. ADDRESS *(Include ZIP Code)* PDUSD(A&T), Acquisition Program Integration Deputy Director for Performance Management(QUSD(A&T)API/PM 3020 Defense Pentagon Rm 3E1025, Washington DC 20301-3020	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 681-9340 AUTOVON 761-9340