



COMMAND AND CONTROL ELEMENT

(C2E)

ILS CONCEPT PLAN

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U 3994
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Accession Number: 3994

Publication Date: May 01, 1992

Title: Command and Control Element, (C2E), ILS Concept Plan

Corporate Author Or Publisher: DoD, SDIO, Washington, DC 20301-7100

Descriptors, Keywords: Command Control Element C2E ILS Concept Plan Hierarchy GPALS Deployment Logistics Integrated Support

Pages: 00100

Cataloged Date: Dec 04, 1992

Document Type: HC

Number of Copies In Library: 000001

Record ID: 25433



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STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

SDB

29 May 1992

MEMORANDUM FOR DISTRIBUTION

SUBJECT: C2E ILS Concept Plan

This memorandum forwards a copy of the Command and Control Element (C2E) Integrated Logistics Support (ILS) Concept Plan for review and requests comments on 30 June 1992.

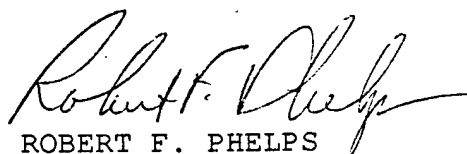
The plan is an initial step in the development of a formal C2E ILS Plan. It was prepared in the recognition that at this early phase of the program there are more questions confronting the logistics community than answers. Many of these questions are due to: continuing trade-offs at the GPALS system level; on-going system to element functional and performance allocations, and; evolving deployment strategies. Today, the SDIO community is getting formally organized for system development, acquisition and deployment. This document is intended to help the C2E ILS community get organized in advance of preparing a formal ILS Plan.

The C2E ILS Concept Plan is in two parts. The first consists of chapters one through nine and attempts to set an integrated framework of objectives, system hierarchy and lexicon, ILS requirements, and key logistics performance factors. The second is the appendix, which addresses the traditional ILS functions and begins the process of setting requirements and identifying the issues which a formal ILS Plan must address.

We request that you review this Concept Plan with the objective of providing comments for incorporation in the C2E ILS Plan, which is now in the early stages of preparation. We urge that you regard this Concept Plan as the opening round of what promises to be a sustained campaign to identify C2E logistics requirements and provide support capabilities for the long haul. Establishing a sound foundation now is essential to both meeting accelerated deployments and to developing enduring support capabilities. The Concept Plan's issues are formidable and require substantive solutions.

To aid the review, we intend to brief this Concept Plan at a meeting of the Support Concepts Panel of the SDS ILS Working Group in Huntington Beach, California, on 17 June 1992.

If you have any specific comments requiring near term discussion, please contact Dan Townsend, at (703) 693-1824.



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Attachment

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ACRONYMS

EXECUTIVE SUMMARY

The first motivation of this C2E ILS Concept Plan is to frame a debate that can place the planning for a C2E in-service infrastructure on a sound foundation. It proposes objectives, strategies, requirements, key performance factors, a system hierarchy/lexicon and imponderables that should be discussed across a broad-based, inter-disciplinary, inter-service community before committing to a formal ILS plan.

C2E is the least autonomous of all the GPALS system elements. It interfaces with the other GPALS BMD elements, with non-BMD systems and equipments, and with certain facilities and equipments housed in common operational spaces. Embedded in such a multi-level environment, individual C2E ILS functions take on different meanings than with more autonomous systems. Functions such as training and maintenance can no longer be conducted without routinely engaging other elements and systems.

In addition, GPALS operational requirements have placed heavy demands on its support structure especially in terms of endurance, availability, reconfigurability and growth potential. Moreover, C2E will probably become ever more tri-service in nature, following recent trends for unified commands. Standard equipments, joint communications and common computer programs will surely emerge. Finally, GPALS is under pressure to field capability by 1997. A continuous incremental deployment strategy has resulted with a concurrent "Block" development strategy for C2E.

These trends put pressures on C2E in-service planning which should not be addressed with quick fixes such as "use contractor support" or "the services will do it." Instead, this concept document proposes:

(1) An overall strategy to establish program coherency by:

- Establishing focal points of responsibility,
- Growing experienced teams,
- Creating dedicated assets,
- Linking operations and support functions to the evolutionary acquisition process, and
- Facilitating communications across program boundaries and organizations.

- (2) Two overriding in-service objectives to (a) sustain operational readiness of deployed C2E and (b) provide for the shared introduction of new capabilities.
- (3) A common system hierarchy and lexicon that crosses all sub-elements, services, and contractors, and can be used to flow-down planning. A distinction has been made between this hierarchy and C2E deployed entities housed on operational bases and stations.
- (4) Five key logistics performance factors that cut across ILS functional areas and force necessary team building:
 - Operational availability
 - Endurance
 - Restoration Time
 - Logistics Synchronization
 - Readiness
- (5) An initial centralized management team that can evolve with our learning into a more delineated structure.
- (6) Many imponderables and pertinent questions that should be debated and resolved within unique ILS functional communities and across all ILS functions as GPALS proceeds to Full Operational Capability.
- (7) The investment early-on in two government support entities: (a) an in-service engineer and (b) military training units collocated with development.

Much work still needs to be done. An attempt to demonstrate both the range and depth of this work has been documented within in two parts. The first is the base document which addresses overall infrastructure needs and strategies. The second is the appendix which focuses upon the individual ILS functions and areas. Each section attempts to bound the job as the program progresses incrementally from initial NMD to full GPALS and beyond.

CHAPTER 1 INTRODUCTION

1.1 Purpose

This concept plan is an interim document. It is preliminary to the formal Command and Control Element (C2E) ILS Plan which will be issued later this year. The purpose of this draft is to structure the discussion and debate that can lead to a well-thought-out ILS Plan. As such it is intended to:

- Enunciate the known requirements that will drive the performance of the support infrastructure.
- Raise critical questions and pose imponderables that must be addressed during the C2E development program to ensure a support infrastructure is in place as the GPALS System evolves from initial NMD to Full Operational Capability.
- Scope some of the structures, organizing principles, strategies, policies, documents and practices that the ILS community must develop to tackle those questions and imponderables over the next 8-10 years.

Many of the topics addressed within will be carried forward into the ILS Plan. As discussed here, however, these topics are not necessarily complete nor is their treatment universally accepted. Your constructive participation in expanding upon them is invited.

1.2 Scope

The scope of this plan and the ILS Plan to follow encompasses these dimensions:

- (1) Physical - The C2E element and its interface with other GPALS elements and non-BMD military systems.
- (2) Temporal - The C2E program for development, production, deployment and operation through GPALS FOC and beyond.

(3) Organizational - The following audiences, each critical to the success of C2E:

- A. Functional communities and establishments - experts and specialists in fields such as training, maintenance, supply, engineering, computer programming and finance.
- B. Military Services and DoD Agencies
- C. Laboratories
- D. Contractors
- E. Operational Commands and Forces

1.3 Objectives and Strategy

Ballistic Missile Defense (BMD) is a relatively old, yet somewhat immature, military mission area. While full BMD system deployments were achieved over 20 years ago, today, our BMD operational support infrastructure is largely unproven and, in some cases, nonexistent. That is one of the reasons the Strategic Defense Initiative was created - to put that infrastructure in place.

For C2E, this in-service support infrastructure will be characterized by continuous system operations and the block introduction of new system equipment and capabilities. Therefore, there are two overriding C2E objectives:

- (1) sustain the operational readiness of deployed C2E equipment, people and computer programs, and
- (2) provide for the phased introduction of new C2E capabilities that are compatible with deployed capabilities and support a smooth cutover to the upgraded element.

The strategy for achieving these objectives is to *establish program coherency*. This will be done by:

- Establishing focal points of responsibility for centralizing critical operational and support functions.

- Growing experienced teams (e.g., engineers, operators and logisticians).
- Creating the dedicated assets needed for life-cycle support.
- Providing the leadership and continuity necessary to link operations and support (O&S) functions to the evolutionary acquisition program in terms of people, parts, paper and computer programs.
- Doing whatever is necessary to facilitate communications across program structures and organizations.

We expect that some new infrastructure - teams, processes, facilities, and documentation - will result from this strategy. Nevertheless, we intend to take all steps to reduce the disruption this may cause to existing infrastructure already put in place by other more mature mission areas - such as strategic offense or tactical ballistic missile defense. In short, we intend to:

- Retain the Proven - we will use existing facilities, organizations and processes to the extent they can meet the need.
- Adopt the Promising - where current infrastructures are already recognized as deficient by others, we will support those measures being proposed to redress the deficiencies.
- Create where Non-existent.

1.4 Approach

The job is to "prime the pump" so that an in-service infrastructure can provide adequate C2E systems, equipments, and people for years to come.

Historically, the in-service support structure - especially its communities such as training, maintenance, and engineering - has been organized orthogonal to the way systems must be fought. For example, in the past, large training, maintenance, supply and comptroller establishments have been organized which stand

somewhat alone from each other. Fighting forces, on the other hand, do not organize along these functional lines but along the mission areas in which they fight. Through the years, numerous observers have noted this compartmentation in in-service support structures. The principal challenge for C2E then, is to "integrate" logistics and create teams that can support our forces. C2E will address this challenge as part of the development program, Figure 1.

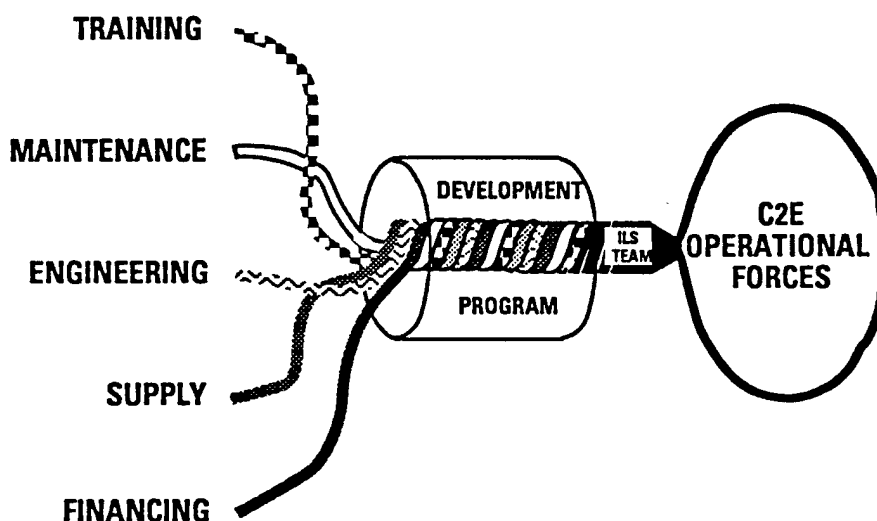


Figure 1

The approach, is to:

- A. Scope the "superset" logistics support requirements that will be needed at FOC. Today and for some years to come, this will be a moving target. Numerous "imponderables" still exist.
- B. Audit the existing support infrastructure put in place by prior military systems and identify shortfalls.
- C. Use the GPALS C2E "building block" and incremental development program - especially its facilities, test programs, and agents - to try out support schemes, forge

functional coalitions and create logistics teams. The development philosophy is "build a little, test a little, field a little" and to use these successive "building blocks" to prove-out permanent infrastructure incrementally.

- D. Concurrent with efforts to evolve operational support infrastructure, logistics support will be provided to the development program itself. In most cases, these two efforts will be identical.
- E. Adapt and learn with experience.

CHAPTER 2 C2E DESCRIPTION

2.1 GPALS System Context and Hierarchy

The Command and Control Element (C2E) is part of the GPALS Ballistic Missile Defense System. The GPALS system has been segmented for incremental deployment of ground and space based national defense, space based global protection, and transportable theater defense. The GPALS system is being developed in six MDAPs: five weapon system MDAPs and the GPALS System/BMC3 MDAP. The GPALS/BMC3 MDAP includes C2E development. This GPALS context appears in Figure 2.

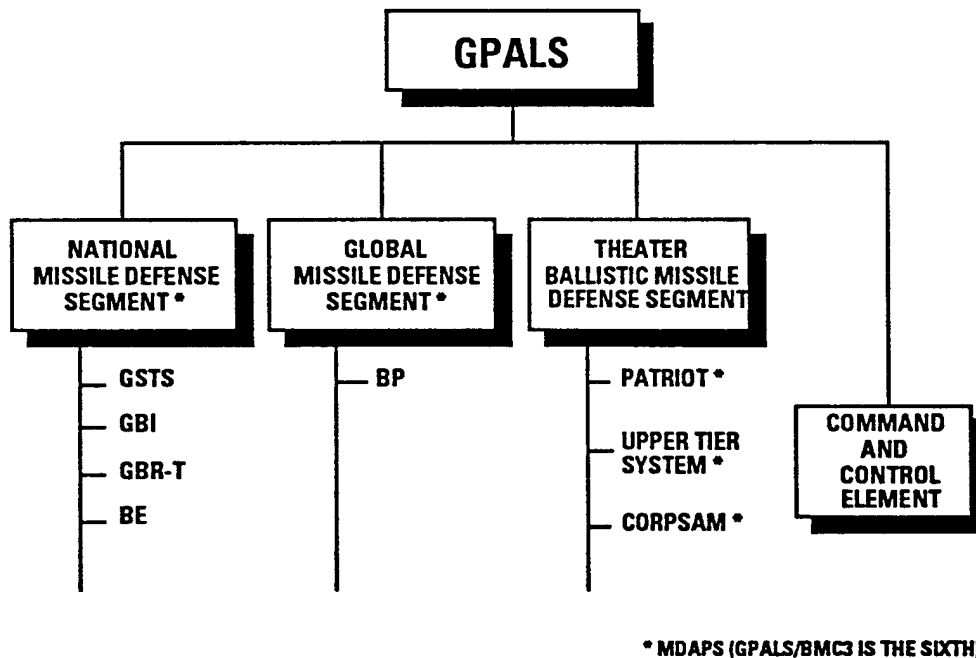


Figure 2

C2E provides the hierarchical command, control, communications and battle management functions analogous to the military chain of command. C2E provides these functions across the strategic segments and programs. Its role in the theater segment and programs is less defined at this time but will certainly be more limited. Thus the focus of this document is on the C2E role within the National and Global Missile Defense segments.

2.2 C2E Breakdown

C2E is composed of three major sub-elements:

- Command and Control Sub-element - includes the functions, equipments, people and computer programs needed to provide the decision support processes and issue the system control directives that the human-in-control requires to operate and maintain positive control over the GPALS System.
- Battle Management Sub-element - includes the functions, equipments, people and computer programs needed to respond to the C2E system control directives, combine or fuse data from different sensors, perform the automated processes that result in tasking the sensors and the weapons, and provide real-time summaries to assess performance (Engagement Planning) The sensor and weapon elements select and schedule the individual asset(s) to execute the Engagement Planning tasking (Battle Execution). The sensors provide the data needed to detect and track the threat; the weapons engage and negate the threat.
- Communications Sub-element - includes the functions, equipment, people and computer programs needed to provide the communications resources and the management necessary to send and receive information/data among the GPALS System elements.

2.3 System/C2E Hierarchy

For purposes of this report and all subsequent C2E ILS and ILS related publications, the following nomenclature is being used to refer to the levels of GPALS and C2E:

Tier 1	System
Tier 2	Segment
Tier 3	Element
Tier 4	Sub-Element
Tier 5	Prime Mission Group
Tier 6	Prime Item
Tier 7	Component
Tier 8	Part
Tier 9	Piece Part

A further breakdown of C2E to Tier 6 of GPALS appears in Figure 3:

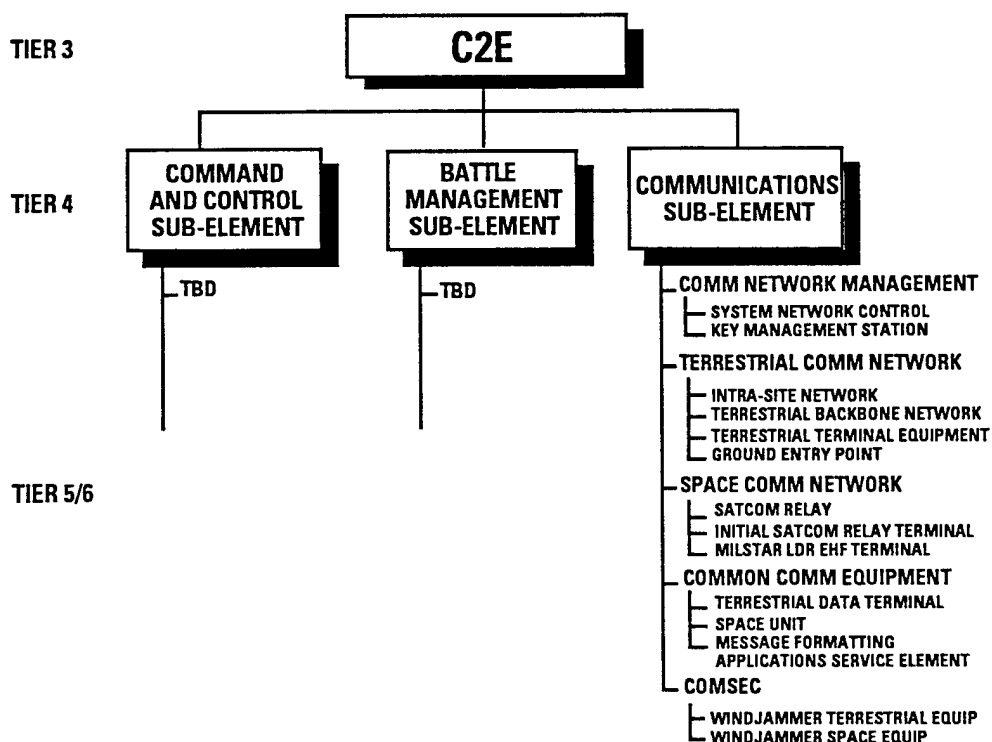


Figure 3

2.4 Deployment Perspective

Not only will C2E cross the segments, elements and programs associated with GPALS, it will also cross those deployed units and forces needed to carry out the GPALS ballistic missile defense mission. In all three segments - national, global, and theater - those forces will consist primarily of permanent bases, fixed stations, mobile units, and space-deployed communications, sensors and weapons.

A typical Base can include command centers, operations centers, readiness stations, communication nodes, radar installations, launch pads or some subset of these. They may also include training centers, supply facilities, housing, messing and facilities dedicated to non-BMD military missions. Cheyenne Mountain and Grand Forks are examples of potential BMD Bases.

A typical Station will probably have no command or operations center facilities but could be connected to such centers through communication nodes. An example would be an isolated radar station with communications facilities. A station may be manned or unmanned.

C2E forces will consist primarily of rooms or spaces within bases or stations and equipment, people and computer programs from each of the sub-elements resident in those rooms or spaces. As currently being organized, the generic facilities in which C2E rooms or spaces will reside include:

- A. Command Centers - basically one type of command center is envisioned. There may be centers with duplicate equipment for USSPACECOM component services (e.g., an Army CCC and Air Force CCC). C2E will have a dedicated space or BMD Cell in the center(s). The Commander-in-Chief, US Space Command, will use his Command Center to command and control the GPALS System, e.g., communicate with national command authority, obtain intelligence and information, direct BMD forces and coordinate BMD with other mission forces.
- B. Operations Centers - three types of operations centers are envisioned:
 - BMD Operations Center (BMDOC) to provide information to support command decisions made in the BMD Cell. The BMDOC equipment will be duplicated in the Army and Air Force Component Command Centers and Operations Centers. These may be collocated within or adjacent to a command center.
 - Regional Operations Centers (ROC) to control ground forces.
 - Element Operations Centers (EOC) to control space forces.

The role of these operations centers will be to produce information needed to assess the situation, change the System readiness condition, select and command a system response, assess system performance and adjust the response if required. C2E will "own" dedicated space in all these centers.

- C. Readiness Stations - on-line test, monitoring, and repair facilities, manned and organized to keep military units up and ready. C2E probably will be one of several tenants in these facilities.
- D. Communications Nodes or Stations - between the terrestrial communications network, satellites and missiles. C2E will "own" these.
- E. Communications Networks - these will almost completely be part of C2E.

2.5 External System Interfaces

As the element that provides most of the battle management, command, control and communications functions for GPALS, C2E also must deal in a larger arena than GPALS and ballistic missile defense. C2E is the principal means by which USCINCSpace (or his designated agent) will obtain information for making BMD decisions and will coordinate planned actions with (1) the National Command Authority, (2) other Unified Commands and Specified Commands, (3) other USSPACECOM/NORAD mission areas (e.g., Air Defense, Early Warning . .).

2.6 Interoperability

As has been discussed previously, C2E and its sub-elements, equipments, facilities and people must be interoperable across the GPALS system as illustrated in Figure 4.

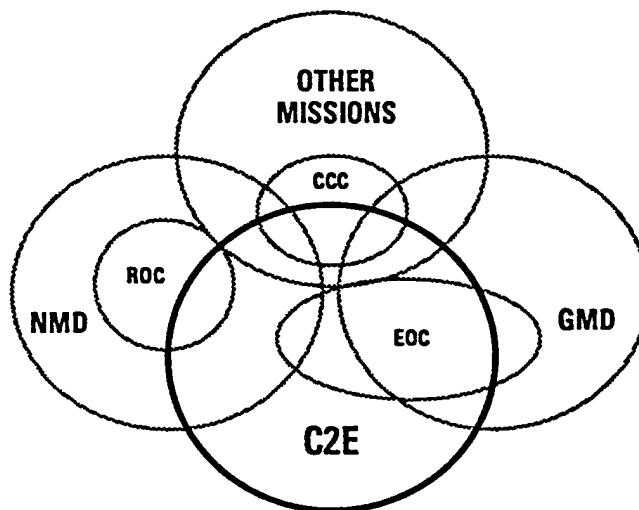


Figure 4

CHAPTER 3 REQUIREMENTS

3.1 ILS Related Operational Requirements

The "US CINCSpace Operational Requirements Document for GPALS System/Battle Management Command, Control and Communications (BMC3) of 14 May 1992 (Reference A) sets a number of top-level requirements that drive the Strategic Defense C2E ILS Planning. Some key operational requirements (ORs) are tabulated below and cross-referenced to Reference A. For a full description of each requirement and others, see Reference A:

OR#

- 1.E Provide fail-safe test, training and exercise capabilities that simulate system operation across the full range of credible operational scenarios. Simulation fidelity and resolution must be sufficient to refine or upgrade tactics and predict system response considering:
 - nuclear effects
 - system degradation
- 1.F Provide for mission growth based on future operational requirements.
- 1.G The GPALS System must operate 24 hours a day, 365 days a year with a system operational availability of at least 0.995 (threshold).
- 1.N Provide the logistics support capabilities which are consistent with the high availability and maintainability requirements for this system.
- 1.S The simulation capability described in paragraph 1E above must not be developed to require specialized talents not normally available in military services. Scenario

definition and incorporation of changing threat characteristic parameters, etc must be performed by military personnel.

- 3.G Exercise and operational testing will be substantially restricted by limits on live fire test realism, requiring alternative means of maintaining proficiency and system confidence.
- 4.A Provide assured human control of the system including the capability for near-real-time battle redirection.
- 4.K Provide a BMC3 capability that is immune to single point failure or decapitation and provides for graceful degradation.
- 4.L Detect, report and display internal GPALS system status changes within 5 seconds of occurrence.
- 4.M Provide a means of demonstrating correct system response to control directions during exercises and operational tests.

In addition, the Operational Requirements Document provides general and specific guidance for Integrated Logistics Support. Among the requirements called out are to:

- meet GPALS effectiveness while minimizing life cycle costs,
- make maximum use of standard DoD logistics infrastructure,
- minimize demands on military force structures, personnel and the environment.

Other specific guidance from this document has been embedded, where applicable, in Appendix A.

3.2 Derived Logistics Support Requirements

A Logistics Support Analysis (LSA) will be the principal method for deriving specific C2E ILS requirements from GPALS operational and functional requirements.

CHAPTER 4

KEY LOGISTICS PERFORMANCE FACTORS

There are many performance factors and parameters that will influence the creation of the C2E support structure. Some are known and others will evolve. Historically, quantitative performance factors have received limited attention as drivers of infrastructure. In fact, the most universally used factor (of any type) is probably money, which is not a performance factor. The performance factor most often used by other systems has been "availability" - either inherent or operational.

To meet the operational requirements discussed in Chapter 3, five key performance factors are proposed to drive the development of an ILS infrastructure that is always ready to meet the requirement. These factors are to serve as the basis for compromises to meet cost and schedule constraints. Other performance factors should be traded off to preserve these. They are:

1. Operational Availability - a measure of the degree to which a C2E unit can operate at its designed performance over a defined amount of time. It is measured in percent (%) over a time interval.
2. Endurance - a measure of a C2E unit's capability to perform its mission without being resupplied or reinforced. It is measured in days.
3. Restoration Time - a measure of the time between a call for help to correct a critical problem and the restoration of C2E capability. The solution can involve response time, travel time, diagnosis and change implementation. It is measured in days for off-site response and minutes for on-site response. It may not include a complete correction of the problem - which in some cases may take years.
4. Logistics Synchronization - a measure of the time delta between the completion of a change to a configuration item and the completion of all logistics functional

activities impacted by that change. Examples of activities include documentation changes, course updates, and restocking of spares. It is measured in days.

5. Readiness - a measure of the capability to retain unit performance when replacement people, equipment or computer programs are substituted. It is measured in percent effectiveness over a one month period.

These five factors are proposed because they:

- have operational significance and directly relate to numerous operational requirements
- address the principal challenge to integrate logistics and create teams - since each factor can only be satisfied by a balanced application of multiple logistics support disciplines, and
- are quantifiable, allowing progress to be measured on route to FOC.

Not surprisingly, time is a big part of all of these factors. Some questions attach to these factors which need to be addressed through DEMVAL. Examples are:

1. What quantitative values should be used? These should be set by the end of DEMVAL.
2. What conditions or scenarios should we use to test them?
3. Who should impose tests?
4. Who will monitor performance factors?
5. What happens if a factor falls below an acceptable standard?
6. Who analyzes the "out of tolerance" factor to determine where corrective action needs to be applied?

CHAPTER 5 OTHER PLANNING CONSTRAINTS

5.1 Planning Data

Quantities. For purposes of planning, the following force levels should be used.

BMD Cell	1
BMDOC	1
C2E Portion ARCCC	1
C2E Portion AFCCC	1
ROC	2
EOC	1
NMD Sites	4
Forward GEP	2
Alaska/Hawaii Sites	2

In addition the following facilities should be considered in the ILS planning process.

Readiness Station (C2E)	TBD
Development Test Center	1
Operational Training Center	1

Precise equipments, people, computer programs, and parts to be located at these sites are still being defined.

Schedule. C2E will support a rapid incremental deployment schedule for GPALS. Key logistics support dates are:

Initial NMD	1997
Full Operational Capability (FOC)	TBR

The C2E development schedule is summarized in Figure 5. It represents evolutionary C2E capabilities. Initial core capability (Increment 1) with three C2E Blocks followed by two increments will be sequentially evolved:

- Initial Core Capability
 - Block 0 - the aggregation of off-the-shelf equipment to refine operator oriented requirements;
 - Block 1 - a functional implementation of the C2E to provide proof of concept;
 - Block 2 - initial deployment to support Initial NMD mission;
- Increment 2 - the C2E deployment augmenting Block 2 capabilities with Brilliant Eyes to support the NMD mission, and
- Increment 3 - the C2E deployment including Brilliant Pebbles supporting the full GPALS mission (FOC).

Figure 6 expands upon the capability to be available in each Block.

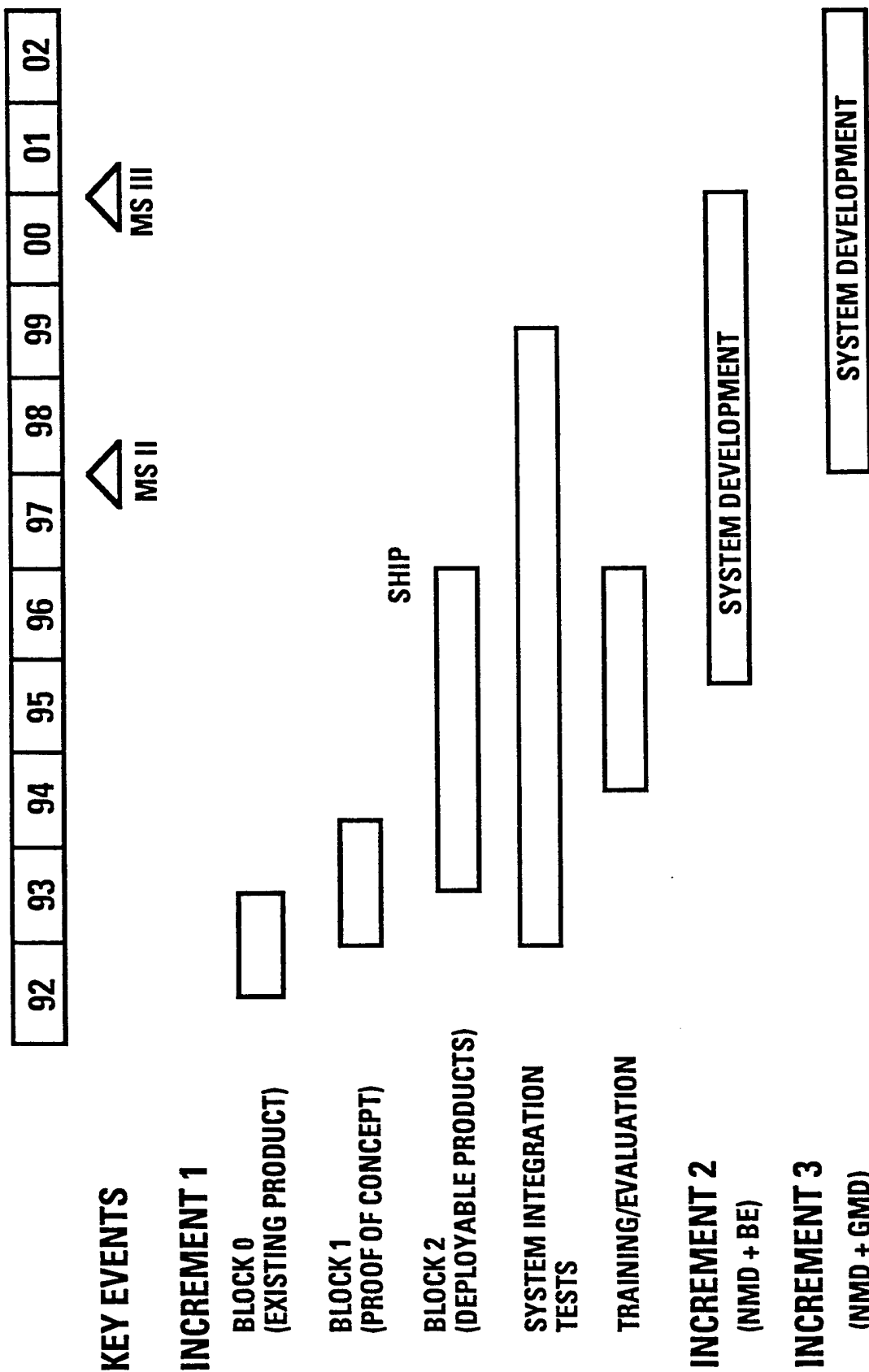


FIGURE 5 - C2E EVOLUTIONARY DEVELOPMENT SCHEDULE

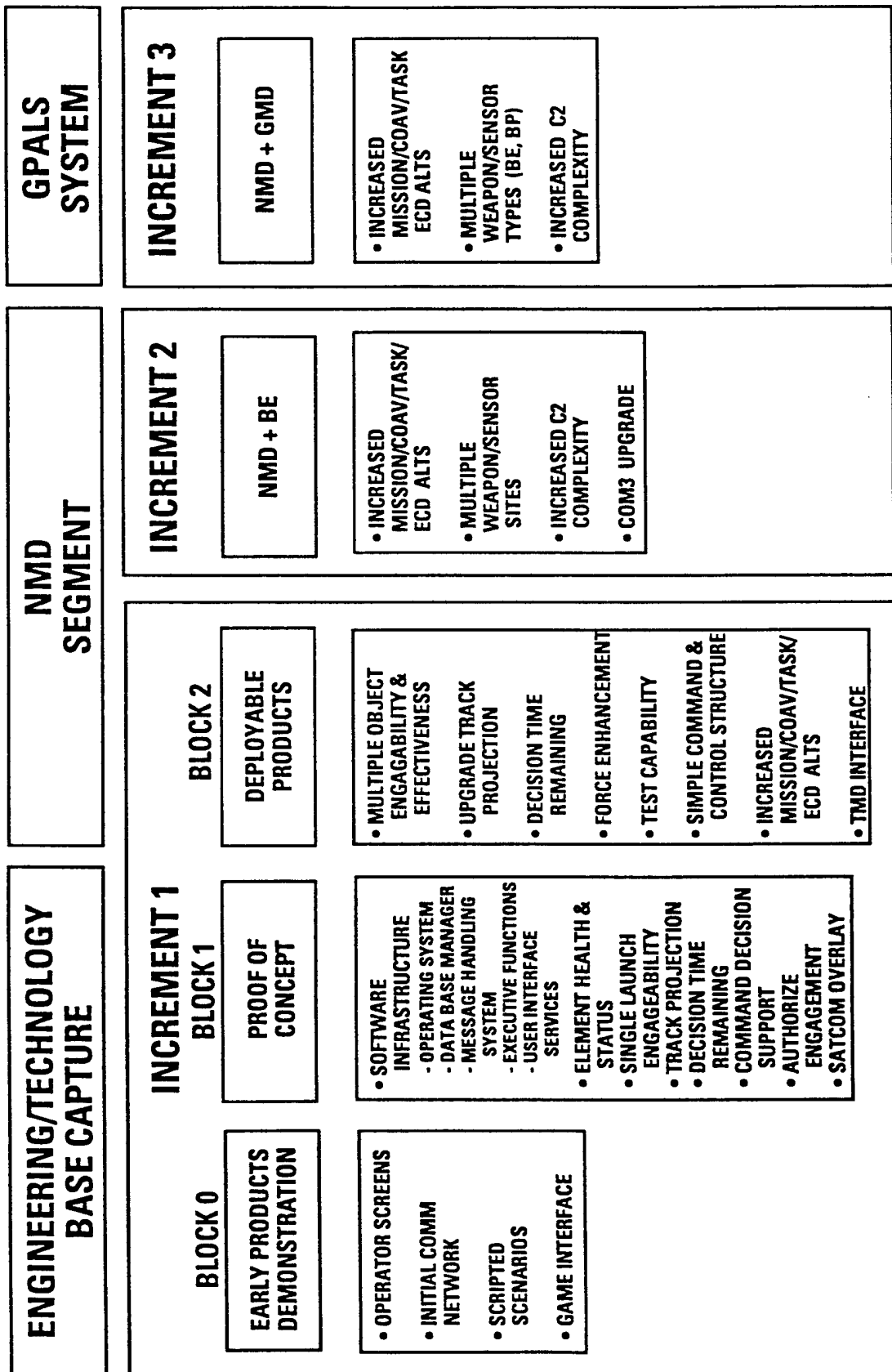


FIGURE 6 - C2E BLOCK FUNCTIONAL EVOLUTION

5.2 Other Planning Factors

- (1) C2E will incorporate
 - Extensive support features into both the prime mission equipment and computer programs,
 - Significant common equipment and computer programs,
 - Open system interface architectures as well as more conventional architectures.
- (2) The BMC3 force structure will be both highly centralized (i.e., located on a common base) and highly decentralized (i.e., spread onto non-contiguous, isolated stations).
- (3) C2E development will be somewhat decentralized. Individual sub-element and equipment groups will probably be delegated to more than one service and more than one contractor or laboratory.
- (4) Adaptive response options will be built-into C2E operations.
- (5) C2E will employ multi-mode configurations.
- (6) GPALS Operational Readiness will fall into one of three established conditions:
 - Peacetime
 - Crisis
 - Wartime

Within these conditions, readiness postures will specify minimum equipments to be on line while others are to be available within some specified time period. C2E warfighting functions will be available 100% of the time (See USCINCSpace Concept of Operations, Reference B, for the details of the readiness conditions and the postures within the conditions).

(7) C2E equipment will be

- both commercial and militarized
- both off-the-shelf and developmental

(8) C2E computer programs will be both large and sophisticated. These computer programs will be run on both militarized and non-militarized computers. Not all C2E computer programs will be at one C2E location, but they will be highly common, compatible and consistent across all locations.

(9) Standardization across all development, production and operational activities will be the preferred means of implementation when end items have similar functional or physical requirements.

CHAPTER 6

TOP PLANNING DOCUMENTS

Two broad categories of top level documents are to be used to guide C2E ILS planning - non-C2E documents and documents that disseminate C2E ILS plans. Additional ILS peculiar documents are also identified in Appendix A.

In defining these documents, the need to control the proliferation of planning documents has been stressed. Plans should serve to improve program communications, but too many of them can become a hindrance. In addition, determining which ones are controlling and eliminating contradictions becomes more complicated with the proliferation of plans. Consistent with this approach, this concept plan itself will be superseded by the ILS Plan and discarded.

The C2E Program will use a hierarchy of ILS planning documents to overrule confusion and establish protocol, currency, and direction. C2E ILS top level planning documents have been categorized by use of a document tree, based on the same C2E hierarchy presented and discussed in Chapter 2. (Note that, in every case, "planning" for ILS functions areas will proceed to the C2E Piece Part Level, Tier 9, even though the formal plan itself may stop at a higher level, for instance, the Element Level, Tier 3, or the Prime Mission Equipment Group Level, Tier 5.)

6.1 Non-C2E ILS Documents and Plans Used

The top planning non-ILS documents on which this C2E ILS Concept Plan is based are as follows:

- USCINCSpace Operational Requirements (ORD) for Strategic Ballistics Missile Defense (U) of 31 March 1992 (SECRET).
- Draft USCINCSpace Concept of Operations (CONOPS) (U) of 5 March 1992 (SECRET).
- Draft C2E CARD Initial NMD/GPALS (U) of 30 April 1992 (SECRET).

- SDS ILS Plan of September 1991.
- Draft Command and Control Element (C2E) Program Plan of 25 March 1992.

6.2 C2E Plans Crossing ILS Functions

There are four key plans which cut across the ten ILS functional areas: Integrated Logistics Support Plan, Human System Integration Plan, Logistics Support Analysis Strategy, and Logistics Support Analysis Plan. The first two are defined in DoD 5000.2 while MIL-STD-1388-1B defines Logistics Support Analysis. The ILS Plan is prepared as early as in the Concept Phase and updated thereafter. All should be drafted before the end of DEMVAL. The table below proposes the tier at which these plans should be written. System and Segment level plans of the same type are also included where known.

TIER	ILSP	HUMAN SYSTEM INT PLAN	LSA STRATEGY	LSA PLAN
GPALS	Yes	No	Yes	Yes
NMD	Yes	?	No	No
GMD	Yes	?	No	No
TMD	Yes	?	No	No
C2E	Yes	Yes	Yes	Yes
COMMS	Included	Included	?	Note 1
C2	Included	Included	?	Note 1
BM	Included	Included	?	Note 1
PME GROUP	Included	No	No	Note 1
PRIME ITEM	No	No	No	Note 1
COMPONENT	No	No	No	No
PART	No	No	No	No
PIECE PART	No	No	No	No

Note 1: At the Contract Level

6.3 ILS Functional Plans Crossing GPALS Elements

There are eight plans that cross the GPALS elements: Maintenance Plan, Material Support Plan, Technical Manual Development Plan, Manpower Estimate Report, Training Development Plan, Facility five Year Plan, Support Equipment Selection Plan, and Computer Resources Life Cycle Management Plan. These plans are shown in two tables below, Part I and Part II, cross-referenced to the ILS functional area number in Appendix A. The tables also break out the tier at which they should be written.

PART I

APPENDIX A SECTION:	1 MAINT PLAN	2 MAT'L SUPP PLAN	3 TECH MAN DEV PLAN	4 MAN EST REPORT
TIER				
GPALS	*	No	No	Yes
NMD	?	?	?	?
GMD	?	?	?	?
TMD	?	?	?	?
C2E	Yes	Yes	Yes	In GPALS MER
COMMS	Included	Included	Included	Included
C2	Included	Included	Included	Included
BM	Included	Included	Included	Included
PME GROUP	No	No	No	No
PRIME ITEM	No	No	No	No
COMPONENT	No	No	No	No
PART	No	No	No	No
PIECE PART	No	No	No	No

* Address System Concept Only

PART II

APPENDIX A SECTION:	5 TRAIN DEV PLAN	6 FACILITY 5YR PLAN	7 SUPP EQUIP SEL PLAN	9 CRLCMP
TIER				
GPALS	No	Yes	No	Yes
NMD	?	?	?	?
GMD	?	?	?	?
TMD	?	?	?	?
C2E	Yes	Yes	Yes	Yes
COMMS	Included	Included	Included	Included
C2	Included	Included	Included	Included
BM	Included	Included	Included	Included
PME GROUP	No	No	No	No
PRIME ITEM	No	No	No	No
COMPONENT	No	No	No	No
PART	No	No	No	No
PIECE PART	No	No	No	No

6.4 ILS Plans Crossing Deployed Assets (Bases, Stations, and Services).

There may also be plans written at the level of sites or agents where planning must be done across sensors, weapons, other mission areas, and services. In such plans, the C2E requirements will be treated among equals or the C2E Program will contribute inputs pertaining to C2E equipment, computer programs, people, or parts. Such plans include: Maintenance Plan, Material Support Plan, Technical Data Management Plan, and Support Equipment Selection Plan.

LEVEL	1 MAINT PLAN	2 MAT'L SUPP PLAN	3 TECH DATA MGMT PLAN	7 SUPP EQUIP SEL PLAN
BASES	?	?	?	?
STATIONS	?	?	?	?
SERVICES	?	?	?	?

CHAPTER 7 ORGANIZATION AND RESPONSIBILITIES

7.1 C2E Organization and Responsibilities

The organizational relationship of the Command and Control Element within the Strategic Defense Initiative Organization is shown in Figure 7.

The C2E Program is managed by the SDIO BMC3 directorate and supported by the U.S. Army Strategic Defense Command, the U. S. Air Force Electronics System Division and Space System Division, the U. S. Navy and the Department of Energy. The BMC3 directorate is responsible for design, development, test, validation and logistics support of C2E. Within C2E, the three sub-elements will be led as indicated:

- Command and Control - U.S. Air Force
- Communications - U. S. Army
- Battle Management - SDIO

Prime Mission Equipment Groups will be developed by both the Army and Air Force within each sub-element.

7.2 C2E ILS Organization and Responsibilities

As a focal point of responsibility, the BMC3 ILS manager will function within the BMC3 directorate. He will be initially supported by a centralized BMC3 ILS Executive Board and by lower tier ILS Management Teams as illustrated in Figure 8. These teams will be supplemented by specific organizations and agents as the development program evolves. The responsibilities of the centralized BMC3 ILS Team members are as follows:

SDIO/SDB ILS Manager

The ILS Manager provides overall leadership and direction in planning and executing the BMC3 ILS Program. The Manager is responsible for assuring GPALS system and NMD and GMD segment

ILS requirements related to the C2E are identified, allocated to the sub-elements and that their implementation is verified during the development process. The Manager sets overall C2E ILS policy and guidance, prepares and issues the ILS Plan, sets priorities and approves resource allocations and reports progress to the C2E Manager.

BMC3 ILS Executive Board

The ILS Executive Board assists the SDIO/SDB ILS Manager in executing his responsibilities. The Board representation includes the principal user organizations, the GPALS System Engineer, and the sub-element executing agents. The Board identifies and/or advises on C2E ILS issues, coordinates sub-element planning, reviews sub-element execution and communicates status between organizations.

ILS Management Teams

Six, multi-disciplinary ILS Management Teams (ILSMTs) have been organized to start executing the C2E ILS Program. Team representation includes ILS functional experts responsible for overseeing analyses and work products within their area of expertise.

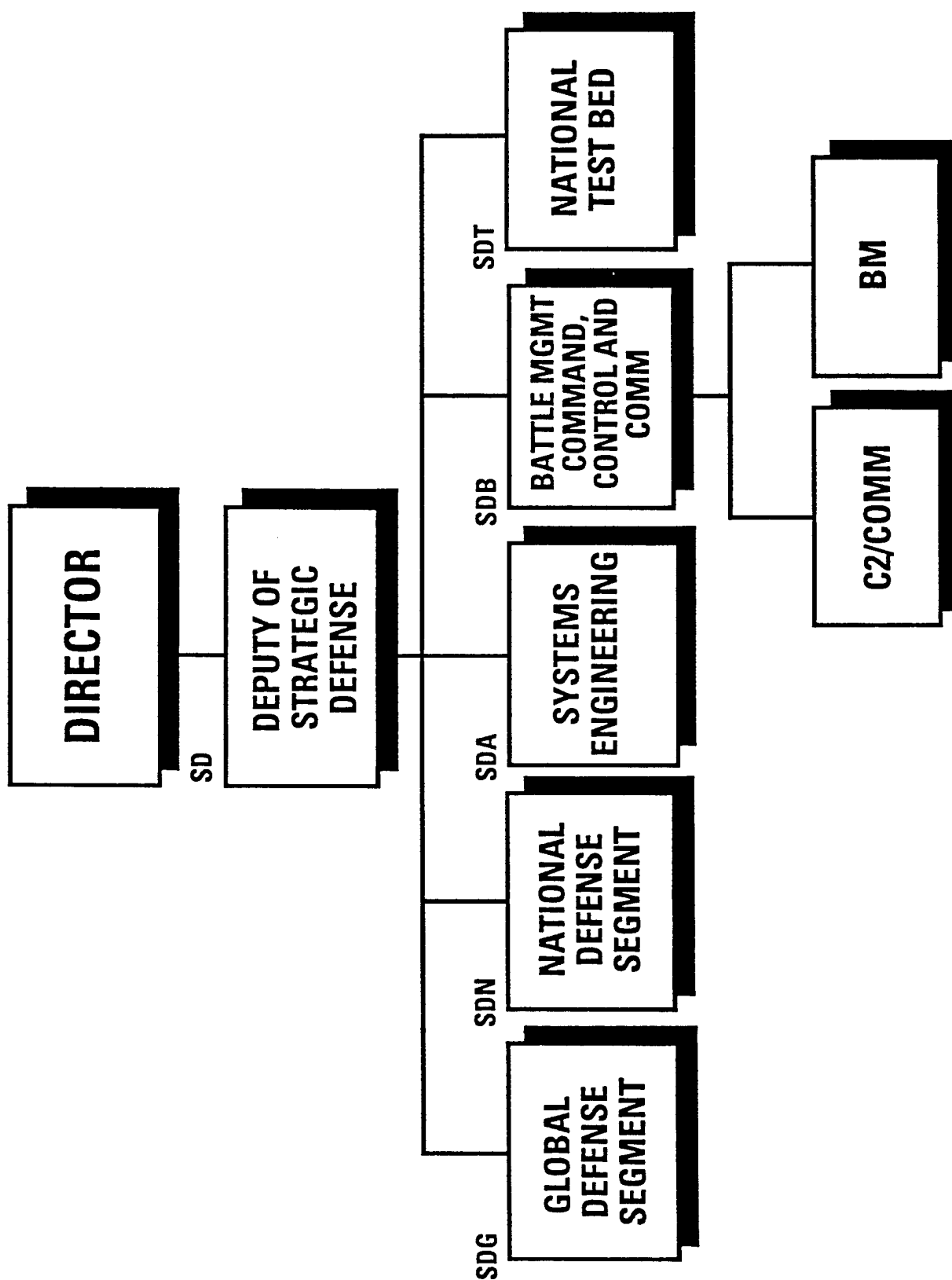


FIGURE 7 - STRATEGIC DEFENSE INITIATIVE ORGANIZATION

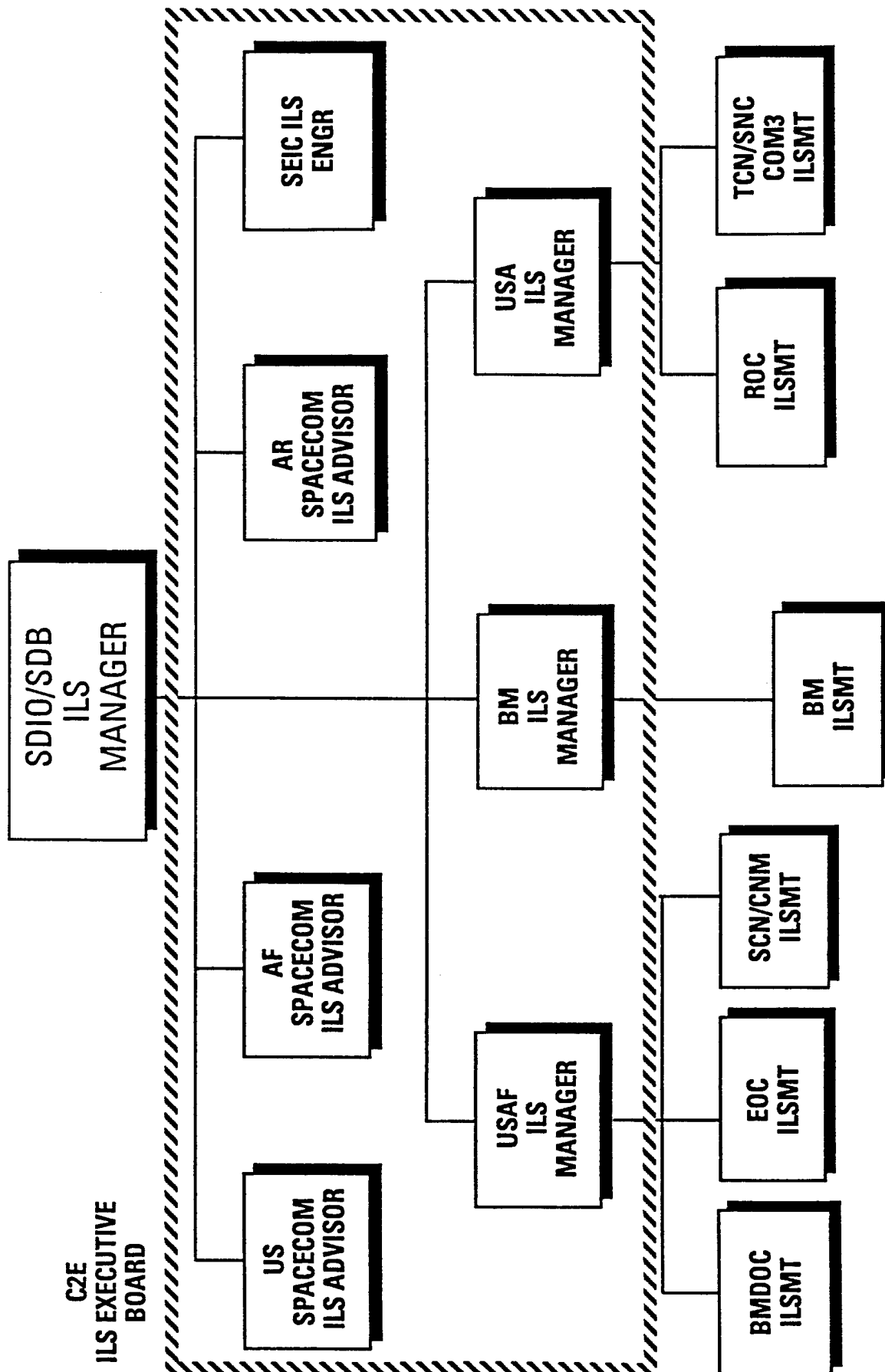


FIGURE 8 - C2E ILS TEAM

CHAPTER 8

SUMMARY STATUS AND RECOMMENDATIONS

8.1 Status

C2E is currently in early DEMVAL. A C2E Logistics Support Analysis has not been done nor have the major support concepts been completely defined. However, an early deployment is planned five years hence (1997) and cascading deployments thereafter.

The element development is complicated by its GPALS System role in that capabilities such as system on-line training and system readiness status monitoring converge at C2E. In addition, there are extensive interfaces internal and external to GPALS. The concurrent development and deployment of other GPALS elements and the vagaries of non-BMD managed programs will promote an environment of constant change. Combined, these factors will put unique pressures on our ability to achieve program coherency and provide the required operational support.

Appendix A attempts to summarize the current planning knowledge base by the ten logistics functional areas. It identifies known functional area requirements and objectives, logistics risks, jobs to be done in DEMVAL, guidance that can be given today and "imponderables" that should be solved as soon as possible but no later than FOC.

Imponderables are questions that have no quick, immediate answer and require further study, testing, and careful decision-making to reach resolution. They must be resolved before the C2E "superset" logistics approach (Chapter 1.4) is implementable. In more deliberately paced programs, imponderables may actually exist for years before they can be resolved. Moreover, these imponderables usually represent higher order questions whose answers, for the most part, drive the overall organization of the in-service infrastructure. The imponderables from Appendix A which have the most immediate impact on our ability to (1) establish focal points of responsibility, (2) grow experienced teams, (3) create dedicated assets, (4) link O&S functions to the development program and (5) facilitate communications across organizations are:

1. Will we have an element level in-service engineer? or Sub-element level engineer? Both? How will these relate to our Software Support activities? Will they be the same? When will we bring in-service engineers on board?
2. If the same C2E Prime Mission Equipment Group (or lower tiers) is at Bases and/or Stations of different services, will we use different, or the same, maintenance concept for the equipment and computer programs at such sites? How will we organize to provide maintenance services when equipment or computer programs are common across services and locations?
3. Should there be a single command or agent charged with determining sites' allowances and overall C2E material requirements, monitoring C2E supply support, and initiating actions to maintain sites' allowances and the supply systems' responses at satisfactory levels of performance?
 - will this be the same as the GPALS agent or agents?
 - operated by SDIO, DLA, by one or more Services, or jointly?
4. Since military manning at any C2E location may be "purple",
 - How will C2E military manning be planned and allocated between services and between other countries? Who will do this?
 - Who will determine which operation and support billets are deemed "critical"? What is the definition of a critical billet?
5. How will we provide C2E element and sub-element level operator and maintenance training? How will this fit with initial NMD and GPALS system training? Will we use a lead service? Will we split it among the services?
6. Will Military Training Units be used? Will they conduct classroom training at operational sites? Will they conduct team training at operational sites? Will they evaluate operational site readiness? Will they certify operational crews or teams? Will USSPACECOM have a

- Military Training Unit? Or will each service have one?
Who will train the training units? How will we use them during development?
7. What Planned Maintenance System (PMS) will C2E use?
Army PMS? Air Force PMS? GPALS PMS? Other type PMS?
 - Will the C2E PMS be dedicated and stand alone or will it have to be incorporated into a common PMS at bases and stations?
 8. Will there be one C2E technical data repository or more than one?
 - How will it (they) fit into GPALS technical data repositories?
 - Will repository(s) be operated by SDIO? by a C2E In-service Engineering Agent? by one or more services? or jointly?
 - If there will be more than one C2E technical data repository, what cognizance will each exercise over C2E technical data?
 9. What spaces, rooms, characteristics, and engineering requirements will C2E equipment, programs, people and support require at initial NMD? in Cheyenne Mountain? ARSPACECOM? AFSPACECOM? Grand Forks? NTF?
 10. Will there be one automated health and status monitoring system?
 - more than one?
 - centralized?
 - decentralized?
 - on-line?
 - part of a GPALS automated health and status monitoring system?
 11. Will there be a C2E Computer Program Generation and Test Center for life cycle support?

- Will there be more than one (Army, Air Force, Other)?
- If so, how will we generate common computer programs (across CC, OC, Bases and Stations), regardless of operating service?

Quick-fixes such as "use contractor support" or the "Services will do it" may only be partial answers to these imponderables. In fact, some level of organic, government and tri-service support at initial NMD may be mandatory if we are to establish program coherency and program credibility and use the next five years of development productively.

8.2 Recommendations

Experience from other programs and systems using similar phased deployments over ten year periods such as are contemplated for C2E has shown that two fundamental functions must be organized first if we are to be successful - engineering (and through engineering, maintenance) and training. This is because:

- A. engineering is the creative function that produces equipment and computer programs,
- B. training is the creative function that produces people, and
- C. for large systems in a climate of change, the need for these creative functions never goes away.

The way we plan to achieve program coherency for these two functions is a necessary (not sufficient) condition for success. All the other support functions depend on how we organize for these two. For these reasons, it is recommended that,

- (1) A government C2E in-service engineer be brought aboard within the next year. The C2E In-Service Engineering Activity provides engineering and technical support for in-service C2E equipment and, when assigned as the Software Support Activity, for the computer programs during the production and operational phases of GPALS. This includes

overall top-down and bottom-up engineering, test, maintenance and logistics requirements incident to specific operational C2E equipment and computer programs. This Activity's involvement may only entail a small cadre of people at first and he may be supplemented by other engineering activities, national laboratories and contractors.

- (2) Military Training Units (MTUs) be created and small contingents be assigned at each of the development activities, both military and contractor, over the next two years. These Military Training Units will work side-by-side with the C2E development engineers to provide operational experience while learning the development engineers approach to Command and Control Element design. As the equipment moves to Test, Integration and Training Sites, the MTUs move with it. Based on their experience the MTUs will create curricula, write course materials, training the trainers and provide a pool for C2E manning of the initial NMD system.

REFERENCES

Listed below are the reference documents used in preparing this plan:

- A. US CINCSPACE Operation Requirements Document for GPALS System/Battle Management, Command, Control and communications (BMC3) (U), 14 May 1992 (SECRET)
- B. USS CINCSPACE Draft Concept of Operations (CONOPS) (U), 5 March 1992 (SECRET)
- C. MIL-STD 1365, Weight and Dimension Limitations for Transportability
- D. MIL-STD 1366, PHST Program Requirements for Systems and Equipment
- E. MIL-STD 882B, System Safety Program Requirements

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(NOT REFERENCED)**

1. USCINCSpace Operational Requirements(ORD) for Phase I, Strategic Ballistic Missile Defense (U), 3 October 1990 (SECRET)
2. GPALS C2E Segment Specification (U) Effectivity #1 INMD, 15 November 1991 (SECRET)
3. Draft Command and Control Element (C2E) Program Plan. 25 March 1992 (SECRET)
4. SDI GPALS SYSTEM/BMC3 Cost Analysis Requirements Document (CARD), 26 February 1992
5. Draft C2E CARD Initial NMD/GPALS (U), 4 May 1992 (SECRET)
6. SDS ILS PLAN, September 1991
7. Draft NMDS ILS Plan, 17 April 1992
8. Draft US Army Capstone ILS Plan for Army Elements of the NMD System, 8 November 1991
9. Draft US Air Force ILS Plan for Air Force Elements of the Strategic Defense System (SDS), September 1991
10. Draft US Army SDC Ground Based Interceptor element ILSP for INMD Deployment, 28 January 1992
11. Draft US Army Ground Based Radar - Terminal ILSP for the NMD System, 8 November 1991
12. Draft USS Army Ground Based Surveillance and Tracking system (GSTS) ILSP for NMD System, 8 November 1991.
13. SDIO Brilliant Pebbles ILSP, 18 January 1992
14. Draft US Army Theatre Missile Defense GBR ILSP, 8 July 1991
15. Draft Theatre High Altitude Area Defense (THAAD) ILSP
16. SDIO Computer Resources Life Cycle Management Plan (CRLCMP)
17. MIL-STD 1388-1/2A

APPENDIX A

PLANNING BY LOGISTICS FUNCTIONAL AREAS

The following sections give the status of planning for each logistics functional area. Each section follows this outline:

- Functional Area Support Requirements and Objectives as known today.
- Key Logistics Functional Risks as opposed to system risks. Currently "risk" is defined as impacting C2E schedule or cost. No C2E system or logistics risks are considered to exist at the present time.
- Imponderables which have no quick, immediate answer and require further study, testing, and careful decision making to reach resolution. Imponderables may actually exist for years before resolution. In this report the term "imponderables" is used to designate higher order questions whose answers drive the overall organization of the BMD support infrastructure. All imponderables should be resolved by the time C2E reaches Full Operating Capability (FOC).
- Other Pertinent Questions
- Jobs To Be Done In DEMVAL In general, there are three types of jobs:
 - (1) Demonstrate the capability to develop and put in place critical support capabilities,
 - (2) Accomplish logistics functional tasks in preparation for the Engineering Manufacturing Development phase, and
 - (3) Develop and put in place the capability to support the DEMVAL version of C2E that will be deployed at initial NMD.
- Planning Documents To Be Prepared for the particular logistics function.
- Guidance to logistics planners on how and when they shall develop the C2E support capability related to their logistics function. It may also provide specific ground rules.

1.0 MAINTENANCE PLANNING

Maintenance Planning is the process conducted to evolve and establish maintenance concepts and requirements for the lifetime of C2E.

1.1 C2E Maintenance Support Requirements and Objectives

- Implement a two level maintenance concept:
 - Organizational Maintenance Level (O-Level), i.e., maintenance performed on-site (at Base or Station) by assigned, on-site maintainers. Several echelons can be involved.
 - Depot Maintenance Level (D-Level), i.e., maintenance performed off-site or on-site by off-site personnel.
- Structure all O-Level planned maintenance tasks to be performed at enlisted personnel skill levels. At the D-Level and, as required for corrective maintenance at the O-Level, maintenance tasks may specify people at officer grade skill levels.
- Military personnel shall perform on-site, O-Level, 1st Echelon planned and corrective maintenance of C2E equipment. Contractors may provide 2nd Echelon maintenance assistance. Before FOC, contractor personnel may provide all O-Level and D-Level maintenance assistance.
- When incorporating Non-Development Item (NDI) equipment for use in C2E, adopt the equipment's established maintenance concept as much as practical while still achieving C2E Key Logistics Performance Factors (See Chapter 4.0).
- Bases and Stations with C2E equipment must operate under specified "Lock-Up" or other periods of sustained operations. Provide autonomous maintenance capability throughout such periods for C2E at such locations.

- Design all maintenance tasks so an equipment in a "Maintenance Mode" is always capable of returning to "Operational Readiness" Mode within the required time periods.
- Maintenance tasks shall include the testing to ensure that repaired or serviced equipment are ready for their normal "Readiness" Mode. Mean Time To Repair (MTTR) limitations shall include the time to perform such testing.
- Planned or Corrective maintenance and associated tests to C2E equipment shall not interfere with operations of other C2E equipment or computer programs that are in the operational readiness, planning, training or test modes.
- C2E Planned or Corrective Maintenance and associated tests shall not interfere with Mission Operations (including Non-BMD Missions) at Command Centers (CC), Operations Centers (OC), Bases, or Stations.
- Develop procedures for scheduling "Maintenance and Test Mode" and/or off-line maintenance and tests with USSPACECOM's schedule for operational readiness and alert status and/or "Planning, Training, Test and Readiness" modes.
- There will be one C2E planned maintenance system. This system should be able to structure, segregate and administer data and tasks separately at the C2E Sub-Element level.
- Include the capability for routine and recurring down-classification of equipment and computer programs so as to permit support personnel with, at most, a Secret clearance to have greater unescorted access to C2E spaces, equipment and computer programs.
- Deployed mobile units shall not include dedicated repair technicians. Instead, maintenance teams will be sent to such units, as needed, to perform corrective maintenance.
- Adopt and implement the Operator-Maintainer concept for mobile units, except for those situations

where analysis of operator versus maintainer workloads show that the maintenance workload exceeds 40% of the operator-maintainer's available working hours.

- In all maintenance task instructions include directions to report configuration management data/information when applicable.

1.2 Key Maintenance Support Risks

None known at this time.

1.3 Imponderables

- (1) Will we do on-line maintenance? To what degree? Will there be situations when the C2E is simultaneously in Operational and Maintenance mode? Sub-element? Prime mission equipment? Prime equipment? Lower tiers?
- (2) Will there be any mission critical maintenance tasks that must be performed on-site while the system is operating and on-line? If so, then how do we accomplish such maintenance in prescribed time periods?
- (3) Will there be GPALS system tests to checkout satisfactory accomplishment of maintenance actions?
- (4) Will the Operator-Maintainer concept be employed at fixed Bases and Stations? If so, to what degree?
- (5) What cross-training, if any, will C2E maintainers receive? As Operators? As Maintainers of equipment in other GPALS Elements? As Maintainers of other mission categories of equipment?
- (6) If the same C2E Prime Mission Equipment Group (or lower tiers) is at predominantly Army, or Air Force, Base and/or Station, will we use different, or the same, maintenance concept for the equipment and computer programs at such sites? How will we organize to provide maintenance services when equipment is common across services and

locations? Examples include communications equipment, displays, consoles, computers, peripherals, etc.

- (7) Will we have an element level in-service engineer? Sub-element level engineer? Both? How will these relate to our Software Support activities? Will they be the same? When will we bring in-service engineers on board?
- (8) In as much as telecommunications companies will probably provide and maintain key portions of C2E communications networks, how will we fit maintenance of such links into the overall C2E maintenance concept? If C2E Communications Network maintenance capability resides in the communications companies that provide network lines,
 - Shall we count on obtaining maintenance services from these contractors during combat conditions? During adverse weather conditions?
 - If No, then what maintenance support concept shall we adopt for maintenance at such times? To what extent should the resulting capability influence the maintenance concept for non-combat and/or fair weather conditions?
- (9) What Planned (aka, Preventive) Maintenance System (aka, Schedule) (PMS) will C2E use? Army PMS? Air Force PMS? GPALS PMS? Other type PMS?
 - Will the C2E PMS be automated?
 - Will the PMS at bases and stations be automated?
 - Will the C2E PMS be dedicated and stand alone or will it have to be incorporated into a common PMS at bases and stations?

1.4 Other Pertinent Questions

- (1) For each C2E equipment:
 - What maintenance tasks may be done when C2E equipment is on-line in "Operational Readiness" Mode?

- What maintenance tasks may be done when each C2E equipment is in "Maintenance" Mode?
- What maintenance tasks must be done only when the C2E equipment is in an "Off-Line" or non-operational status?
- What maintenance tasks must be done only when the C2E equipment is at the Depot?
- For each mode or status of the C2E equipment, what maintenance tasks can be performed by assigned on-site and on watch Operators or Maintainers?
- For each mode or status of the C2E equipment, what maintenance tasks can be performed by assigned on-site and on watch Operators or Maintainers with the assistance of 2nd Echelon maintenance level personnel?

Mode/Status Maintenance Level	Readiness Mode	Maintenance Mode	Off-Line Status
On Site 1st Echelon			
On Site 2nd Echelon			
Depot			

- (2) What will be the maintenance workload for each C2E equipment? What will be the required time and technician skills levels?
- Per shift?
 - Daily?
 - Weekly?
 - Monthly?
- (3) What criteria will be used to decide whether to employ civilian or military personnel to perform maintenance services for C2E equipment?
- (4) What criteria will be used to decide whether to adopt contractor or organic maintenance services for C2E equipment?

(5) What is the acceptable scope of contractor maintenance services for C2E equipment?

- at the 2nd Echelon Level?
- at the Depot Maintenance Level?
- at the Software Support Activity?

(6) Assume the following groupings of C2E equipment:

Commercial: Designed and manufactured for sale to commercial users.

Military: Manufactured to military specifications; design under military control.

Common: Multiple applications within DoD.

Unique: (1) Used only in the Command and Control Element.
(2) Used in GPALS

How can we provide assured maintenance services to each category at all locations, under all operational conditions?

(7) What are the C2E Maintenance Planning impacts resulting from the C2E System Security Program's requirements, constraints and limitations? Levels of security clearances for maintenance personnel? Personnel Reliability Program? Escort requirements? Two-man rule to perform maintenance tasks? Other?

(8) When an already deployed equipment or computer program that is a candidate for inclusion in C2E is being supported by a maintenance concept different from that of C2E, what concept should we implement for it? Examples include power equipment, switchboards, computers, peripherals, computer operating systems.

1.5 Jobs to be done in DEMVAL

- Demonstrate that maintenance tasks authorized to be performed when C2E equipment is on-line (i.e., "Operational Readiness" Mode) can, in fact, be performed without interruption or degradation of the equipment's "Operational Readiness" status.
- For all C2E equipment, demonstrate that critical equipments at each CC, OC, Base and Station can be shifted within specified time periods from "Maintenance Mode" to normal "Operational Readiness" Mode during the performance of all maintenance tasks authorized and/or specified to be performed on the equipment or computer programs during "Maintenance Mode" status.
- Complete DEMVAL LSA tasks and use results as inputs to Test and Evaluation Plans and logistics support documents.
- Develop requirements for maintenance planning for each planned Engineering Manufacturing Development (EMD) contract.
- Develop C2E Maintenance Planning inputs to the C2E and GPALS System Test and Evaluation Master Plan (TEMP).

1.6 Planning Documents To Be Prepared

The top planning documents for maintenance planning are:

- C2E Maintenance Plan
 - Command and Control Sub-element Annex
 - Communications Sub-element Annex
 - Battle Management Sub-element Annex
- C2E Planned Maintenance Systems (PMS) Plan
 - Command Center Planned Maintenance System
 - Operation Center Planned Maintenance System
 - Communications Station Planned Maintenance System
 - Common Communications Components (COM3) Planned Maintenance System

- Maintenance Planning inputs to the C2E and GPALS System Test and Evaluation Master Plans (TEMP)
- C2E Maintenance Planning requirements for use in C2E EMD Phase contracts
- Maintenance Planning inputs for use in each facility's (CCs, OCs, Bases and Stations) Maintenance Plan.

The Lower tier documents planned at this time are: (TBD)

1.7 Guidance

- Reduce the number of planning documents so that confusion will not rise over (a) currency and (b) protocol due to the over-proliferation of planning documents. For example, prepare C2E maintenance plans with attachments for sub-elements.
- Implement a maintenance concept that tailors its requirements, policies, and procedures to match the needs of the activity that will man, operate, and maintain the C2E equipment at specific sites (e.g., Army, Air Force, and Unified Command). That concept should disrupt current practices as little as possible to meet the requirement.
- While a C2E Maintenance Plan is required, initial C2E maintenance plans can be at the Sub-Element level, rather than the C2E level.
- Provide Maintenance Plan(s) in those forms, formats, and media that match the users' usual procedures.
- Specify and include maintenance of Command and Control Communications Networks in lease agreements.
- All critical maintenance planned to be performed by military shall be demonstrated by appropriate skill level and trained military personnel before initial NMD.

- To support initial NMD, contractor maintenance may be used to supplement military maintenance capability at all levels to the extent necessary, including completely replacing military personnel.
- Support equipment will provide health and status and diagnostic capabilities that are needed to plan and complete maintenance tasks. Ensure coordination of such support equipment capabilities match MTTR and skill levels
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

2.0 SUPPLY SUPPORT

All management actions, procedures, and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue, and dispose of secondary items. This includes provisioning for both initial support and replenishment supply support for all C2E equipment including support and test equipment.

2.1 Supply Support Requirements and Objectives

- Bases and Stations with C2E equipment must operate under specified "Lock-Up" or other periods of sustained operations. Autonomous C2E Supply Support capability must be provided at these locations throughout such periods. This means stowage locations for critical replacement support items must be established so maintainers have immediate and unencumbered access to such items during combat, lock-up, and/or times of sustained operations.
- Employ a single, readiness-based sparing model optimized to meet the key performance factors and to calculate C2E support items' material requirements.
 - Calculate overall supply system material requirements for C2E support items, regardless of stocking agency. Allocate these requirements to specific agencies (e.g., DLA, Services' Supply Systems), specific support contractors, or bases for execution.
 - Calculate each site's C2E material allowance without regard to support requirements for other equipment at the site, regardless whether such equipment is identical or uses the same support items as does C2E equipment.
 - Calculate material allowances, for common or shared equipment (e.g., power generation and distribution equipment) at bases and stations that provide direct support to C2E. Provide such calculated allowances annually to base and station commanders and their sponsors. Plan with them to place on site the specified range and quantity of such support items.

- One planned inventory accounting and reporting system for C2E support items will be used at all C2E sites. Structure this system to segregate and administer separately the data on C2E support items. At the site level, ensure that the system interfaces with the C2E health and status monitoring and Maintenance Planning System (PMS) (See sections 1 and 7 of this Appendix).
- The C2E development program will provide the initial outfitting allowance of support items for each C2E site. These items will be provided by direct purchase from the prime contractor or, when initial support provisioning is complete, by funding the requisitioning of the support items from DLA and/or individual Services' Supply Systems.
- For an introductory period, until DLA and/or the Services are prepared to provide replenishment C2E material support, the C2E development program will fund and oversee a Contractor Interim Supply Support program that will furnish C2E-peculiar replacement support items.
- Include the capability for routine and recurring down-classification of stowage spaces and areas to permit support personnel with, at most, a Secret clearance to have greater access to C2E spaces where replacement items are stowed.
- Provide deployed mobile units with only enough kits or stocks of C2E support items in the range and quantity of consumables and servicing items required to meet the duration of their specific mission assignment.

2.2 Key Supply Support Risks

None known at this time.

2.3 Imponderables

- (1) How should C2E supply support planning merge with overall GPALS supply support planning?

- (2) If the same C2E Prime Mission Equipment Group (or lower tiers) is at a predominantly Army or Air Force Base and/or Station, will we use different, or the same, allowances of support items at such sites? How will we organize to provide support items that are common across services and locations? (Examples include communications equipment, displays, consoles, computers, peripherals, and power generation equipment.)
- (3) Should we charter a C2E supply support management activity to exercise full cognizance over C2E material requirements and supply support, regardless of source?
- (4) Should there be a single command or agent charged with determining sites' allowances and overall C2E material requirements, monitoring C2E supply support, and initiating actions to maintain sites' allowances and the supply systems' responses at satisfactory levels of performance?
- Will this be the same as the GPALS system agent or agents?
 - Manned by military, civilian or contractor personnel?
 - Operated by SDIO, DLA, by one or more Services, or jointly?
- (5) How will we program funding for such a C2E supply support management activity?
- (6) What material inventory accounting system will C2E use? an Army system? An Air Force system? DLA? Other type system?
- Will the C2E inventory accounting system be dedicated and stand alone or will it have to be incorporated into a common inventory at bases and stations? Across GPALS?
 - Will the inventory accounting system at bases and stations be automated?
- (7) What is supply support's role in and strategy to meet reconstitution requirements?

- (8) What material support strategy should we adopt for post-production support of: C2E equipment? C2E peculiar equipment? Military equipment? Non-Developmental Items? Common equipment?

2.4 Other Pertinent Questions

- (1) What are the impacts on C2E Supply Support from the C2E System Security Program's requirements, constraints and limitations? levels of security clearances for supply support? secure storage spaces? escort requirements? Other?
- (2) An already deployed equipment that is a candidate for inclusion in the C2E may have a support concept for its Line Replaceable Unit (LRU) and other support items that differ from what is required for the C2E (e.g., different Source, Maintenance and Recoverability (SM&R) coding). What support concept can we implement for such items when we incorporate them into the C2E? (Examples include power equipment, switchboards, computers, peripherals, and LRUs.)
- (3) What range and quantity of mission critical support items will have to be made available to C2E sites during periods of "Lock-up" or sustained operations?
- (4) What criteria will be used to decide whether to employ civilian or military personnel to perform supply support services at C2E sites?
- (5) What criteria will be used to decide whether to adopt contractor or organic supply support services for C2E support items?
- (6) What is the acceptable scope of C2E contractor supply support services? at the O-Level? at the D-Level?

2.5 Jobs To Be Done In DEMVAL

- Develop requirements for Supply Support for each planned Engineering Manufacturing Development (EMD) contract.
- Develop C2E Supply Support inputs to the C2E and GPALS System Test and Evaluation Master Plan (TEMP).
- Evaluate available readiness-based sparing models and select an approach for C2E.

2.6 Planning Documents To Be Prepared

The top planning documents for this logistics function are:

- C2E Material Support Plan for initial NMD.
- C2E Supply Support Management Activity Charter.
- C2E Supply Support Management Plan.
- C2E Supply Support requirements for use in C2E EMD Phase contracts.

Lower tier documents planned at this time are:

- C2E sites' allowance lists of C2E support items.

2.7 Guidance

- Since the Defense Logistics Agency (DLA) and the Services' Supply Systems will ultimately buy and manage wholesale stocks of C2E support items, coordinate with them our estimates of the material requirements to outfit and replenish individual sites' allowances of C2E support items. Recalculation of such estimates should be annual or whenever significant changes occur (including those pertaining to the introduction of changes or major maintenance actions).
- As practical while still meeting the need, implement a Supply Support concept that tailors its requirements, policies, and procedures to match the practices of the

activity that will man, operate, and support the C2E equipment at specific sites (e.g., Army, Air Force, and Unified Command).

- All critical supply support planned to be performed by military shall be demonstrated by appropriately graded and trained military personnel before initial NMD.
- To support initial NMD, Contractor Interim Supply Support may be used to supplement military material support capability at all levels to the extent necessary, including completely replacing military material support.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

3.0 TECHNICAL DATA

Scientific or technical information recorded in any form or medium, such as manuals and drawings. Computer programs and related software are not technical data; documentation of computer programs and related software are. FINANCIAL data and other information related to contract administration are also excluded.

3.1 Requirements and Objectives:

- Acquire a comprehensive technical data package for all C2E equipment including peculiar support equipment. Data calls shall be used to assured complete functional representation in identifying data requirements.
- All C2E technical data acquired during development shall be authenticated using the actual equipment prior to deployment.
- Structure C2E Technical documentation to follow the multi-tiered C2E hierarchy, (e.g. element, sub-element, prime mission equipment).
- Ensure Government access via remote computers and/or peripherals to C2E data in contractors' digital technical data bases. As necessary and appropriate, document such access in controlling contractual documents, including statements or certificates that spell out Government property rights.
- Require C2E technical manuals to be written to the reading and skill levels of the proposed military manning (See section 4 of this Appendix).

3.2 Key Technical Data Risks

None known at this time.

3.3 Imponderables

- (1) How much C2E technical data will be on site?
 - in paper media?
 - in electronic storage media?-on-line in electronic media?
 - transmitted to sites, as required, via electronics circuits?
- (2) Will there be one C2E technical data repository or more than one?
 - How will it (they) fit into GPALS technical data repositories?
 - Will the repository(s) be manned by military or civilian personnel?
 - Will repository(s) be operated by SDIO? by a C2E In-service Engineering Agent? by one or more services? or jointly?
 - How will we charter the Repository to control and manage C2E technical data from all sources?
 - How will we program funding for the C2E technical data repository(s)?
 - If there will be more than one C2E Technical Data Repository, what cognizance will each exercise over C2E technical data?
- (3) How will we maintain technical data for NDI/COTS items?
- (4) What will be the breadth and depth of our Computer Aided Logistics System (CALS)?

3.4 Other Pertinent Questions

3.5 Jobs to be done in DEMVAL

- Develop C2E EMD Phase contractual requirements for technical data.
- Select the initial Technical Data Repository(s).
- Establish list of C2E base line documents and maintain currency.

3.6 Planning Documents To Be Prepared

The top planning documents for this logistics element are:

- C2E Technical Manual Plan.
- C2E Technical Data Repository charter.

Lower tier documents planned at this time are: (TBD)

3.7 Guidance

- Ensure that C2E technical data packages are sufficiently comprehensive to enable manufacture or competitive reprourement of the documented items without additional engineering effort. Obtain such technical data packages for all C2E Equipment and Computer Programs regardless of whether or not plans at the time of procurement call for the equipment's deployment.
- Acquire in computer compatible, digital form the required C2E technical data that a contractor develops in digital form.
- SDIO and its Executing Agents may grant contractors computer access to C2E data in Government data bases and Government-owned C2E data in other contractors' digital technical data bases. Document such grants of access in controlling contractual documentation.
- Require that C2E contractors and subcontractors:
 - prepare and update their technical data packages as an integral part of their design, development, and production efforts,
 - participate in the validation and verification of the technical manuals for their C2E equipment or software.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

4.0 MANPOWER AND PERSONNEL

The identification and acquisition of military and civilian personnel with skills and grades required to operate and support C2E over its lifetime at peacetime and wartime rates.

4.1 C2E Manpower and Personnel Requirements and Objectives:

- The C2E will be manned and operated 24 hours per day 365 days per year.
- All C2E operators will be military.
- C2E operators /maintainers at any C2E location may be from any of the armed services.
- C2E operators/maintainers may be military personnel from other countries.
- C2E maintenance may be performed by U.S. military or civilian, other country military or civilian or U. S. or foreign contractors.
- Due to the need to conduct wartime operations and reconstitute equipments during battle, all critical operation and support billets will be assigned to military personnel.
- Steps will be taken to reduce manning at C2E command and operations centers, bases and stations by:
 - combining operator and maintenance functions;
 - increasing the use of automation for maintenance, test, operations and training;
 - combining maintenance functions within and across sub-elements, and elements
 - combining operating functions within and across sub-elements.

- For C2E manning at all fixed locations, the following factors should be used for both peace and war:
 - 3 shifts a day
 - 8 hours a shift
 - 5 crews to sustain shift operations
- Planning for military manning should be based on an All Volunteer Force. Assume All Volunteer Force demographics.
- Replacement manning will not be an option during sustained full Battle Readiness Conditions for endurances specified in the Operational Requirements Document (ORD).
- New specialty codes (MOS, AFSC, NEC) should be created only where absolutely necessary.

4.2 Key Manpower and Personnel Risks

None known at this time

4.3 Imponderables

- (1) Since military manning at any C2E location may be "purple",
 - How will C2E military manning be planned and allocated between services and between other countries? Who will do this?
 - Who will determine whether operational positions will be manned by officers or enlisted?
 - Who will determine extent of C2E cross-training? When? The extent of cross-training is a key for determining manpower requirements?.
 - Who will determine which operation and support billets are deemed "critical"? What is the definition of a critical billet?
- (2) Who will make C2E manning decisions between military, civilian and contractor for element equipment at initial NMD?

- (3) Will we consider people who control/manage leased communication lines/equipments as "C2E operators"? Will we consider leased line maintainers as "C2E maintainers"? If so, does this change the requirements for military/civilian manning?

4.4 Pertinent Questions:

- (1) Will a "two man" rule for maintenance of C2E hardware and software be imposed?

4.5 Jobs to be done in DEMVAL

- Identify and demonstrate the critical skills needed to operate maintain, and support the Command and Control Element.
- Implement the military and civilian manpower requirements for initial NMD. Determine the manpower requirements for the next incremental deployment. Initiate personnel planning and actions to fill such requirements.
- Develop Human Factors design criteria for use in EMD phase contractual requirements.
- Develop contractual requirements for Manpower and personnel functions and tasks during Engineering and Manufacturing Development.

4.6 Planning Documents To Be Prepared

The top planning documents for manpower and personnel are:

- C2E Manpower Estimate Report.
 - Includes sub-element manning.
 - Includes manpower estimate for all services and unified commands.
 - Includes civilian, contractor and other nations.
- C2E Human Systems Integration Plan.
 - Includes sub-elements.

The lower tier documents planned at this time are:

- Preliminary base, and station C2E Manning documents that reflect number of Officers and enlisted pay grades service origin and specialty codes. Documents should be written for each Base and Station; Command Center; Operations Center: (ROC, FOC); GEPs; Communications Stations and Readiness Stations. (These may be part of more encompassing GPALS documents).
- Phased Manning Plan for initial NMD.
- Others TBD.

4.7 Guidance

- For manpower planning follow USCINCSpace Operational Readiness Conditions Guidelines (See Reference B).
- Permanent military billets on a selective basis should be planned for C2E Test and Training Sites. These billets should be used to form the cadre of Operational Training Units (if they are formed) and should also be used for some form of closed loop detailing of experienced C2E people.
- Enlisted manpower usage should be maximized. Requirements for advanced or technical degrees should be minimized.
- Comply with the services' Personnel Reliability Programs for C2E Operational and Maintenance Personnel.
- Develop Preliminary equipment allowance lists for each C2E location to permit LSA task analysis to provide manpower and personnel requirements for initial NMD.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

5.0 TRAINING AND TRAINING SUPPORT

The processes, procedures, techniques, training devices, and equipments used to train civilian and active duty and reserve military to operate and support the system. This includes individual and crew training; new equipment training; initial, formal, and on-the-job training; proficiency training and logistics support planning for training equipment and training devices.

5.1 C2E Training and Training Support Requirements and Objectives

- C2E Operator and Maintenance Training will be provided at the element-level and will encompass training that impacts:
 - more than one C2E sub-element.
 - more than one GPALS element.
 - C2E and other warfare mission areas.
- Services will provide advanced skill level individual operator and maintenance training (basic specialty code training).
- Training for C2E common equipment will be conducted in such a way as to reduce costs and to increase standardization and interoperability among services and elements.
- Individual operator and maintenance cross-service training (for U. S. Armed Services, foreign military, and U. S. and other country civilian and contractors) will be provided.
- Unit Qualification Training and continuation or proficiency training for the USSPACECOM crews will be the responsibility of USCINCSpace.
- On-line exercise scenarios will be used at all C2E operational locations (Bases, Stations . . .) to conduct crew, team and proficiency training and certification.

- C2E operators and maintainers will be cross-trained on C2E equipment based on needed skill levels.
- A personnel qualification and certification program for officers, enlisted and civilians will be implemented for critical warfighting positions.
- The initial cadre of operators that will man C2E Operational Sites at initial NMD will be trained and certified through a progressive internship composed of participation in engineering, prototype manufacturing and test phases of DEMVAL.
- An Operational Training Center (OTC) will be established with dedicated training equipment and instructors. There will be at least one set of all C2E operational equipment available for training. This OTC should be selected prior to initial NMD but may not be fully established by then.
- System, element and sub-element training can be co-located with system, element and sub-element engineering and test sites during DEMVAL.
- The NTF will be used to support development of training, exercise, standardization and evaluation scenarios.
- On-line C2E training capabilities will be implemented and acquired with the initial sub-elements.
- Planning for C2E training will include flexibility for expansion to meet increased throughput for the phased deployment of GPALS.

5.2 Key Training/Training Support Risks

None known at this time.

5.3 Imponderables

- (1) How will we provide C2E element and sub-element level operator and maintenance training (i.e., MOS/AFSC/NEC)? How will this fit with initial NMD and GPALS system training? Will we use a lead service? Will we split it among the services?
- (2) How will we train for C2E Common Equipment? Should it be done the same way as the answer to the above question?
- (3) Will Military Training Units be used? Will they conduct classroom training at operational sites? Team training at operational sites? Will they evaluate operational site readiness? Will they certify operational teams? Will USSPACECOM have an Operational Training Unit? Or will each service have one? Who will train the training units? How will we use them during development?

5.4 Other Pertinent Questions

- (1) How should we cross-train operators and maintainers? Will operators be cross-trained as maintainers and maintainers as operators? Will operators be trained at different operator positions and maintainers only on different equipments?
- (2) How much on-line training in C2E equipment will we do for initial NMD?
- (3) Where will the permanent OTC be located? At Falcon AFB? At more than one location?
- (4) Will engineering development and test sites not located at the National Test Facility (i.e., National Test Bed) be interconnected by communication links to conduct system training? Will this be ready for training by initial NMD?

- (5) What C2E training will be done at operational sites? Will this be on-line training conducted by an organic training team? Will it be off-line? Will there be training facilities at bases? If a base training facility is in place will it have C2E operational equipment installed for training?
- (6) Will a dedicated agent be established with the responsibility to generate C2E exercises at the system, element, sub-element level?

5.5 Jobs to be done in DEMVAL

- Define, identify and create curricula, course and course material for initial NMD.
- Determine extent of cross-training to be accomplished for each operator and maintenance position.
- Prepare, as part of LSA, a preliminary task analysis plan which will provide skill levels required to operate and maintain C2E equipment at initial NMD.
- Prepare a preliminary training plan for the establishment of element and sub-element operator and maintainer schools as determined by the task analysis for initial NMD.
- Resolve C2E training locations for initial NMD.
- Determine the need and plan for operational training units for initial NMD.
- Create an exercise evaluation process, structure and organization for initial NMD.

5.6 Planning Documents To Be Prepared

The top planning documents for training and training support are:

- C2E Training Development Plan
 - includes all sub-elements
 - includes all services

- C2E Interim Training Support Plan
 - for initial NMD including all services plans.

The lower tier documents planned at this time are:

- Preliminary C2E Task Analysis for initial NMD.
- Others TBD.

5.7 Guidance

- Initial NMD operator and maintenance personnel will be trained as much as practical on development equipment wherever the equipment is located. That training will be considered an integral part of the development process. The development program will be planned and contracted for to accommodate training. Where training-only equipment is needed to supplement development gear, planning must take cognizance of budgeting, procurement and production lead times.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

6.0 FACILITIES

The permanent, semi-permanent, or temporary real property assets required to support the system, including conducting studies to define facilities or facility improvements, locations, space needs, utilities, environmental requirements, real estate requirements, and equipment. Facilities required may be either operational or support; government or contractor provided. They can include operational facilities as well as training centers, repair and supply depots and support engineering facilities.

6.1 C2E Facilities Requirements and Objectives

- To the extent practicable, C2E facilities will be co-located or contiguous to the facilities for other GPALS elements.
- Use of existing bases, buildings and other facilities will always be considered. If none of the existing facilities meet C2E criteria, a waiver must be granted by SDIO before new facilities can be planned.
- C2E mission rooms and spaces are to have a great deal of built in standardization (i.e., common contract design) for each of the following facilities:
 - Command Centers
 - BMDOC Operations Centers
 - Regional Operations Centers
 - Element Operations Centers
- Administrative, messing, housing and medical facilities are to be provided by the host bases where personnel are permanently assigned.
- All facilities containing C2E rooms and spaces will be engineered and supported to meet GPALS system endurance requirements. Medical, housing, sanitary, messing, provisioning facilities, etc., requirements during lockup must be addressed.
- Temporary or permanent facilities (operational, supply, training and support) with sufficient power, heating, cooling and ventilation services and a means to attain a

secure perimeter will be required for C2E equipments at more than one location by initial NMD. These can be contractor provided.

- There will be permanent Government C2E development facilities and at least an interim training facility at the NTF to support initial NMD. These may share common equipments and their equipments may change over time after initial NMD.

6.2 Key Facilities Risks

None known at this time.

6.3 Imponderables

- (1) What spaces, rooms, characteristics, and engineering requirements will C2E equipment, programs, people and support require at initial NMD? In Cheyenne Mountain? ARSPACECOM? AFSPACECOM? GRAND FORKS? NTF?
- (2) How will C2E facility planning be interfaced with GPALS facility planning? How will it interface with facility planning for host bases or stations? Who will prepare and update an overall C2E five year facility plans? SDIO? Army? Air Force? Other?

6.4 Pertinent Questions

- (1) What physical security criteria will be imposed on C2E buildings and rooms?
- (2) What survivability criteria will be imposed on the C2E operational, maintenance, training, supply, and personnel support buildings and rooms against:
 - Nuclear effects - blast, radiation, contamination?
 - Natural disasters - tornado, earthquake, flood?
 - Other?
- (3) What schedule will be available to install C2E equipment at CMAFB?

- (4) Can/will C2E hardware and/or software maintenance facilities be consolidated with other GPALS maintenance facilities? At the organization level? At the depot level?
- (5) Will new or expanded depot maintenance facilities be required to support C2E hardware or can existing facilities currently supporting similar equipment be used?

6.5 Jobs to be done in DEMVAL

- For initial NMD perform the Task Analysis LSA Report 012 (Facility Requirements Report). Facility requirements will be needed for:
 - Command Centers
 - Operations Centers
 - Other base facilities (support and mission)
 - Other stations (support and mission)
 - NTF/NTB
 - Training facilities
- Program and budget for facility requirements generated by the LSA Facility Requirements Report.
- Obtain preliminary design approval for the C2E parts of the BMD Cell, BMDOC, ARCCC, AFCCC, ROC, EOC, GEP, and communication spaces.

6.6 Planning Documents To Be Prepared

The top planning documents for Facilities are:

- C2E Five Year Facilities Plan.
 - All facilities requirements across all services and agencies, whether government or contractor provide should be included. Such facilities may be part of larger GPALS facilities and may be required for operations, maintenance, supply, training, and personnel support.
- The Facility Requirements Report (LSA Report 012).

Lower tier planning documents at this time are:

- Military Construction Project Data Form 1391 for individual facility projects.
- Others TBD.

6.7 Guidance

- C2E sub-element managers will provide all operations and support room/space requirements (footprints, power, HVAC) and schedules to the C2E element manager who will coordinate this information with all the activities responsible for facility programming and planning. These activities can include OSD, SDIO, the Services, individual bases and stations, other agencies or contractors. Initial NMD requirements should be identified early.
- C2E sub-element managers will provide C2E manpower and personnel requirements to the C2E element manager who will coordinate this information with the activities responsible for the administrative, medical, housing, messing and other support facilities required to support the specified manning.
- The communication sub-element manager will determine intra-base terrestrial communications facility requirements and provide this information to the C2E element manager.
- C2E sub-element managers will provide the C2E element manager with their requirements for test and training facilities at the NTF in time to meet initial NMD.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

7.0 SUPPORT EQUIPMENT

All equipment (mobile or fixed) required to support the operation and maintenance of the system. This includes associated or multi-use items, ground handling and maintenance equipment, tools, metrology and calibration equipment, test equipment, and automatic test equipment.

7.1 C2E Support Equipment Requirements and Objectives:

- Support Equipment should be acquired to provide for continual diagnostic inquiries, responses, analyses and reports of the C2E.
- Health and readiness reports should be tailored:
 - to cognizant commanders' needs,
 - at established frequency periods, and
 - so operators and maintainers can act.
- Link status monitoring equipment designs and reports to trouble shooting methods, identifying the failed items and listing maintenance actions to be performed. Such information should include:
 - identification of the malfunctioning or failed module,
 - description of required maintenance actions,
 - skills/grade of needed technician(s),
 - applicable technical data, support equipment, tools, test requirements and test program sets,
 - identification and location of replacement items.
- Designate and provide at each C2E site (including operational and support sites) the range and quantity of support and test equipment, ancillary equipment, and related Test Program Sets (TPS) needed to isolate failures to an LRU and accomplish repair within the specified MTTR period.
- Test Program Sets (TPS) for an LRU shall test fully all applications of the LRU within the C2E.

7.2 Key Support Equipment Risks:

None known at this time.

7.3 Imponderables

- (1) Will there be one automated health and status monitoring system?
 - more than one?
 - centralized?
 - decentralized?
 - on-line?
 - part of a GPALS automated health and status monitoring system?
- (2) How will the allowances of TPS and related support equipment at C2E sites be supplemented for the site's commercial equipment?
 - During normal operations?
 - During periods of "Lock-Up and/or Sustained Operations?

7.4 Other Pertinent Questions:

- (1) What are the criteria that should govern the stocking versus buy-when-needed of commercial support and test equipment?
- (2) What Software Support Activity(s) (SSAs) will have cognizance over TPS for C2E equipment?
 - Will it be manned by military or civilian personnel?
 - Will it be operated by SDIO, one or more services, or jointly?
- (3) If there will be more than one C2E SSA, what scope or cognizance over C2E TPS will each such SSA exercise?
- (4) Will the TPS SSA fall under the cognizance of the C2E SSA? (See section 9 of this Appendix).

7.5 Jobs To Be Done In DEMVAL

- Demonstrate that a C2E health and status monitoring system:
 - is fully capable of monitoring C2E,
 - does not interfere with C2E equipment and/or programs and degrade their performance,
 - provides operational commanders with timely, adequate and tailored readiness reports,
 - detects and reports promptly all failures in equipment, connecting hardware, and interfaces, regardless of system or equipment status mode.
- Demonstrate that critical test equipment and related TPS at each operational site are fully capable of performing all critical tests that technicians need to conduct O-Level maintenance actions.

7.6 Planning Documents To Be Prepared

The top planning documents for this logistics element are:

- C2E Support Equipment Selection Plan (Demonstration and Validation Phase version).
- C2E Support Equipment Selection Plan (Engineering Manufacturing Development Phase version).

Lower tier documents planned at this time are:

- C2E Test Program Set Software Support Activity Charter.
- Others TBD.

7.7 Guidance

- When designing on-line test equipment and computer programs accept and use as planning factors the Mean Times To Repair (MTTR) that has been set for each authorized maintenance action. Ensure that such MTTRs include the time for post-repair tests to verify the repaired equipment's operational readiness to perform.
- The range, quantity, and capability of critical support equipment, ancillary equipment, and TPS should not be based on sharing such equipment with other systems, elements or equipment at the site. This rule should hold even if such support equipment is not directly related just to the ballistic missile defense mission.
- Ensure the availability of standards and procedures to verify calibration parameters (ranges and accuracies) by measurements traceable to national or DoD calibration standards.
- For Test, Measurement, and Diagnostic Equipment (TMDE), conduct trade-off studies for standardization at bases, readiness stations, and depots, including studies for Automatic Test Equipment (ATE) standardization. In such studies give C2E requirements first priority.
- Maintain consistent test parameters and specifications across all test environments, including production, test, and operating sites.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

8.0 PACKAGING, HANDLING, STORAGE AND TRANSPORTATION (PHST)

The resources, processes, procedures, design considerations, and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly, including environmental considerations, equipment preservation requirements for short and long term storage, and transportability.

8.1 C2E PHST Requirements and Objectives:

- C2E Logistics Flow Charts will be kept that define, describe, and document the planned Handling, Storage, and Transportation of C2E Equipment during both peacetime and wartime operations.
- C2E PHST Support Equipment shall be repairable under the cognizance of its host activity and will follow the host's maintenance concepts.
- C2E Packaging Requirements:
 - TBD (based on a review of MIL-STD-1365, Weight and Dimension Limitations for Transportability (Reference C) and MIL-STD-1366, PHST Program Requirements for Systems and Equipment (Reference D).

8.2 Key PHST Risks

None known at this time.

8.3 Imponderables

- (1) What transportation modes, if any, will we employ during reconstitution operations to relocate C2E equipment?

8.4 Other Pertinent Questions

- (1) When will C2E Transportability requirements for initial NMD be known?

- (2) What general strategy applies to moving C2E items?
 - C2E Developmental C2E equipment?
 - Production Type C2E equipment to Operational sites for installation?
 - Equipment to/from sites during combat condition?
- (3) Will open shelf, access and climate controlled storage be available for C2E on-site repair parts and support items?
- (4) When will the shipping breakdown of C2E end items become available? from whom?
 - Requirements from the C2E LSA?
 - Transportability capabilities?

8.5 Jobs to be done in DEMVAL

- Define the Allocated Baseline of PHST equipment required for C2E major components.
- Designate an In-Service Engineering Agent(s) for C2E PHST requirements.
- Develop PHST Contractual requirements for C2E EMD Phase contracts.

8.6 Planning Documents To Be Prepared

The top planning documents for this logistics function are:

- Packaging Management Plan and Transportability Report
 - DEMVAL Version
 - EMD Version
 - PRODUCTION DEPLOYMENT Version
- Logistics Flow Charts:
 - DEMVAL Versions
 - EMD Versions
 - PRODUCTION DEPLOYMENT Versions

The Lower tier documents planned at this time are TBD

8.7 Guidance

- Develop and maintain current a series of C2E Logistics Flow Charts to define and describe the Handling, Storage, and Transportation of C2E Equipment and computer program storage media during movement from:
 - Developing Activity to NTF, Falcon AFB, CO.
 - NTF Falcon AFB to C2E sites.
 - Manufacturers to C2E integration sites and thence to installation sites.
 - Operational sites to depots.
 - Depots to operational sites.
 - Manufacturer to storage site or stock point and thence to operational site(s) for installation or storage.
 - Storage sites to operational site for installation.
 - Initial Outfitting Material from staging site to operational sites.
 - C2E repairables from manufacturer and/or depot to operational sites.
- During the C2E's DEMVAL, EMD, and Production Deployment Phase, the PHST Logistics Element Manager at each cognizant Executing Agent shall develop and maintain Logistics Flow Charts for the C2E equipment being developed. During the Operational and Support Phase, the C2E In-Service Engineer shall keep the charts current.
- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

9.0 COMPUTER RESOURCES SUPPORT

The facilities, hardware, system software, software development and support tools, documentation, and people needed to operate and support embedded computer systems.

9.1 C2E Computer Resources Support Requirements and Objectives

- C2E computer programs will be run on both militarized and non-militarized computers.
- There will be one post deployment C2E Software Support Activity (SSA). This activity will have cognizance over, but not necessarily perform, all tasks involved in the development, modification, revision, configuration management, scheduling, and updates of all C2E system software.
- Plan for C2E operational computer programs update annually, except for changes required to assure:
 - mission performance
 - safety
- Include the capability for routine and recurring down-classification of hardware and software so as to permit support personnel with, at most, a secret security clearance to have unescorted access to C2E spaces, equipment and computer programs.
- See Maintenance Planning (See section 1 of this Appendix) for additional requirements and guidance that apply to Computer Resources (CR) Support.
- In all maintenance task instructions include directions to report configuration management data/information when applicable.

9.2 Key Computer Resources Support Risks

None known at this time.

9.3 Imponderables

- (1) Will the C2E Software Support Activity be:
 - A Government or contractor activity?
 - Operated by SDIO, by one or more Services, or jointly?
 - A single activity or if not will one activity be in charge?
- (2) How will the SSA be chartered to exercise full cognizance over C2E system software?
- (3) Will there be a C2E Computer Program Generation and Test Center for life cycle support?
 - Will there be more than one (Army, Air Force, Other)?
 - If so, how will we generate common computer programs (across CC, OC, Bases and Stations), regardless of operating Service?
 - What should be the target date for establishing such Center(s)?
 - How will we program funds for such Center(s)?
- (4) Will there be one system for computer program problem reporting or:
 - Will there be a separate one for each military service?
 - Will there be a single C2E system with inputs in various forms, formats, and media from every C2E hardware/software site?
- (5) Will we do computer program maintenance (e.g., trouble shooting and revision) on-site at C2E locations?
 - If so, then to what degree?
- (6) How will we support DEMVAL versions of C2E System Computer Programs after initial NMD? What will be the C2E SSA's role at that time?

- (7) Commercial computers and peripherals usually have a life span from five to ten years. How will we ensure support capability for C2E COTS computers, software, and peripherals when their manufacturer shifts to new models or goes out of business?
- (8) How will we plan to maintain state-of-the-art computer processing equipment at our bases and stations?

9.4 Other Pertinent Questions

- (1) Where will we deliver versions of C2E System Software for system-wide integration and testing? Prior to PDSS? Post PDSS? Who will do system integration and test?
- (2) What methods of software transfer will we use for C2E System Software? Portable electromagnetic media? CD-ROM? Electronic or fiber networks? Other?
- (3) What is the planned flow down of computer program changes and how are they related to changes in other GPALS System Elements?
 - major updates only?
 - series of small changes?
 - scheduled updates only?
- (4) With selected C2E computer equipments and computer programs in the "Planning" Mode, users may be able to change automated mission strategies (e.g., CONUS defense verses regional defense). What is the plan for:
 - Validate and authorize such changes?
 - Programming such changes?
 - Testing such changes?
 - Configuration management of such changes?
 - Disseminating such changes?
 - Maintaining the resulting computer programs?
- (5) What is the planned strategy for developing new or changed automated tactics and doctrine (e.g., courses of action) for use in C2E's computer programs during in-service operations?

- Will users (i.e., SPACECOM(S)) be able to change these with C2E equipment that they place in the "Planning" Mode?
 - Will ROC/EOCs be able to change these with C2E equipment that they place in the "Planning" Mode?
 - Will only the C2E SSA change these and, after test, validation, and review by Operational Commander, provide them as C2E Computer Program updates?
 - How will such activity be coordinated?
- (6) If SPACECOM, ROC(s) and EOC(s) can change automated tactics and doctrines, how will they :
- Program these?
 - Test and validate prior to actual use?
 - Perform configuration management?
 - Disseminate?
- (7) How will updates to C2E computer programs be married to C2E training curricula changes? Simulation changes?
- (8) How will we support operating system software for commercial-off-the-shelf (COTS/OTS) computers and peripherals in the C2E?
- When will such support start?
 - What is the planned strategy for such support?
 - What do we do if the vendor goes away during the service life of the C2E equipment?
- (9) How will we manage and control updates to operating systems for commercial computers and peripherals? for US Government OTS software? for DoD OTS software? for Allied Government OTS?
- Will all such changes and/or updates be routed via the C2E SSA?
- (10) Will there be a system for categorizing (i.e., Class 1, Class 4) computer program problem reports by severity?

9.5 Jobs to be done in DEMVAL

- Produce the C2E Computer Resources Life Cycle Management Plan (CRLCMP)
- Select and designate the C2E Software Support Activity (SSA).
 - Provide the C2E SSA with an approved charter.
 - Incorporate the C2E SSA's representatives into the C2E Computer Resources Working Group (CRWG).
 - Develop a plan for the C2E SSA's post-development support of C2E software after initial initial NMD, after other incremental deployments.
- Demonstrate the adequacy of the management system and procedures for C2E system computer programs, including the SSA'S computer assets, with an emphasis on the tasks to be done during C2E Engineering Manufacturing Development. What will be the role of the developer and the SSA?
- Develop a C2E Software system safety program:
 - Identify the Category I and II types of hazards (as per MIL-STD 882B) that C2E software failure(s) or malfunction(s) can create during system test, deployment, operations, and maintenance,
 - For C2E computer programs, expand the scope of inquiry to include all sensors, weapons, computer programs, support facilities and equipment that it controls and commands and all interfacing communications systems and weapon systems of other mission areas,
 - Ensure that the inquiry examines all mission disabling faults and "Fail Safe" fault features,
 - Scope the requirements for safety resources,
 - perform a Preliminary Hazard Analysis and Sub-system Hazard Analysis, considering all C2E modes,
 - relate identified hazards to C2E Computer Software Configuration Items (CSCI) under development,

- develop the software safety requirements for inclusion in contracts for C2E Engineering Manufacturing Development
- Computer Resources Security Program
 - Define computer resources security requirements.
 - Develop and specify Computer Resources Support security requirements that impose features or requirements on other logistics elements (e.g., "two-man rule" maintenance teams, special material receipt inspections, expanded personnel security clearances, etc.).
 - Include CR Support specific security features in C2E contracts for Engineering Manufacturing Development
- Develop CR Support requirements for inclusion in C2E engineering manufacturing development contracts
- Develop C2E Computer Resources inputs to the C2E and GPALS System Test and Evaluation Master Plan (TEMP).

9.6 Planning Documents To Be Prepared

The top planning documents for this logistics element are:

- C2E Computer Resources Life Cycle Maintenance Plan (CRLCMP).
- C2E Software Support Activity Charter.
- CR Support inputs to the C2E and GPALS System Test and Evaluation Master Plans (TEMP).
- CR Support requirements for use in C2E EMD Phase contracts.

Lower tier documents planned at this time are: (TBD).

9.7 Guidance

- Provide pertinent support element inputs to transition plans for C2E Blocks and/or Increments. As necessary and after coordination with C2E ILS Manager, prepare separate plans to transition function from contractors to organic support.

10.0 DESIGN INTERFACE

The relationship of logistics related design parameters to readiness and support resources requirements. These logistics related design parameters are expressed in operational terms rather than as inherent values and specifically relate to system readiness objectives and support costs of the system.

10.1 C2E Design Interface Requirements and Objectives

- Provide a forum for ILS inputs and discussion at all C2E element and sub-element design reviews (PDRs, CDRs, SDRs, IPRs).
- Conduct on-going analysis and data gathering programs to consider the life cycle cost impacts of trade-offs such as these examples:
 - C2E operational availability versus amount of forward prepositioned spares versus depth stock of critical spares.
 - Operational mean time to repair versus manning skill levels and training investment versus support equipment investment.
 - Built-in automated technical data development versus hard copy storage versus manning skill levels.
- Provide for the following on-line logistics support capabilities in the C2E element design
 - automated training exercises
 - automated test scenarios
 - automated technical documentation
 - automated fault detection and isolation
 - automated fail-safe warning mechanisms (in all its forms)
 - organic provisioning capabilities

Trade-offs studies such as those suggested above should be conducted to ascertain the utility and the degree to which each of these should be implemented.

- conduct on-going reviews to fit C2E logistics related design interface into GPALS logistics related design interface. Retain C2E priority.

10.2 Key Logistics Element Risks

None Known at this time.

10.3 Imponderables

- TBD

10.4 Pertinent Questions

- TBD

10.5 Jobs to be done in DEMVAL

- TBD

10.6 Planning Documents To Be Prepared

- TBD

10.7 Guidance

- C2E engineers and ILS agents, managers, coordinators and working group members will on a continuing basis review and evaluate the BMD system, segment, element and sub-element engineering designs for their impact on logistics, life cycle cost and supportability. ILS related parameters and factors include:
 - Availability
 - Reliability
 - Maintainability
 - Supportability
 - Standardization

- Testability
- Interoperability
- Off-line and on-line training
- Security
- System Safety, health and environment
- Metrology
- Metrication
- System/Equipment health and status monitoring
- Human Factors
- CALS
- Open System Interface/Commercial Standards
- Non Development Items

ACRONYMS

AL	Alabama
AF	Air Force
AFB	Air Force Base
AFSC	Air Force Speciality Code
AFSPACECOM	Air Force Space Command
AR	Army
ARSPACECOM	Army Space Command
ATE	Automatic Test Equipment
BM/C3	Battle Management Command, Control and Communications
BMD	Ballistic Missile Defense
BMDOC	Ballistic Missile Defense Operations Center
CA	California
C2E	Command and Control Element
CINCSpace	Commander-in-chief, Space Command
CC	Command Center
CD-ROM	Compact Disk-Read Only Memory
CMAFB	Cheyenne Mountain Air Force Base
CNM	Communications Network Manager
CO	Colorado
COM3	Common Communications Components
COTS	Commercial Off The Shelf
CRLCMP	Computer Resources Life Cycle Management Plan
CRWG	Computer Resources Working Group
CSCI	Computer Software Configuration Item
DEO	Defense Employment Option
DEMVAL	Demonstration Validation
Det	Detachment
D-Level	Depot Level
DLA	Defense Logistics Agency
DoD	Department of Defense
EMD	Engineering Manufacturing Development
ENGR	Engineer
EOC	Element Operations Center
ESD	Electronics Systems Division
FOC	Full Operational Capability
GEP	Ground Entry Point
GPALS	Global Protection Against Limited Strikes
HVAC	Heating, Ventilation and Air Conditioning
HW	Hardware

ILS	Integrated Logistics Support
ILS MT	Integrated Logistics Support Management Team
IOC	Initial Operational Capability
IQT	Initial Qualification Training
LOC	Limited Operational Capability
LRU	Line Replaceable Unit
LSA	Logistics Support Analysis
MDAP	Major Defense Acquisition Program
MILCON	Military Construction
MIL-STD	Military Standard
MOS	Military Occupation Structure
MTTR	Mean Time To Repair
NEC	Navy Enlisted Code
NMCS	National Military Command System
NRL	Naval Research Laboratory
NTB	National Test Bed
NTB/JPO	National Test Bed/Joint Program Office
NTF	National Test Facility
OC	Operations Center
O-Level	Organizational Level
OR	Operational Requirement
OTS	Off The Shelf
PA	Pennsylvania
PDSS	Post-Development Software Support
PHST	Packaging, Handling, Storage and Transportation
PMS	Planned Maintenance System
PRO	Preplanned Response Option
ROC	Regional Operations Center
SDB	Staff symbol for Battle Management/Command, Control and Communications Directorate in SDIO's Strategic Defense Deputate
SDIO	Strategic Defense Initiative Organization
SCN	Space Communications Network
SEIC	Systems Engineer and Integration Contractor
SM-ALC	Sacramento Air Logistics Center
SM&R	Source, Maintenance and Recoverability
SNL	Sandia National Laboratory
SPACECOM	Space Command
SSA	Software Support Activity
SSD	Space Systems Division
SW	Software
TBD	To Be Developed
TCN	Terristeral Communications Network

TDTC	Test, Development and Training Center
Tech	Technical
TEMP	Test and Evaluation Master Plan
TMDE	Test, Measurement, and Diagnostic Equipment
TPS	Test Program Set
US	United States
USA	United States Army
USAF	United States Air Force
USASDC	United States Army Strategic Defense Command
UQT	Unit Qualification Training
WASH DC	Washington, District of Columbia