

2

DTIC FILE COPY



DTIC
ELECTE
DEC 21 1988
S JH D

AD-A201 589

MANAGEMENT AND SUPPORT OF COMMERCIAL
OFF-THE-SHELF (COTS) COMPUTER RESOURCES
USED IN WEAPON SYSTEM APPLICATIONS

THESIS

Gerald A. Schumacher
Captain, USAF

AFIT/GSM/LSY/88S-24

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

88 12 21 048

AFIT/GSM/LSY/88S-24

MANAGEMENT AND SUPPORT OF COMMERCIAL
OFF-THE-SHELF (COTS) COMPUTER RESOURCES
USED IN WEAPON SYSTEM APPLICATIONS

THESIS

Gerald A. Schumacher
Captain, USAF

AFIT/GSM/LSY/88S-24

DTIC
ELECTE
DEC 21 1988
S H D

Approved for public release; distribution unlimited

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information is contained therein. Furthermore, the views expressed in the document are those of the author and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.

AFIT/GSM/LSY/88S-24

MANAGEMENT AND SUPPORT OF COMMERCIAL OFF-THE-SHELF (COTS)
COMPUTER RESOURCES USED IN WEAPON SYSTEM APPLICATIONS

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Systems Management

Gerald A. Schumacher, B.S.

Captain, USAF

September 1988

Approved for public release; distribution unlimited

Preface

The purpose of this study was to develop an Air Force Logistics Command (AFLC) commercial off-the-shelf (COTS) computer resources acquisition and support policy which addresses the unique aspects of managing and supporting commercial items. In lieu of the traditional DOD development process, high level interests in reducing weapon system acquisition costs has generated an increased emphasis in using commercially available equipment and software. Although COTS initially has many potential upfront advantages, numerous supportability and maintainability disadvantages may not be getting enough attention during system acquisitions. Consequently, if support planning does not adequately address the unique requirements of maintaining commercial items, life cycle costs may actually increase rather than decrease.

I would like to thank Professor Daniel V. Ferens, my advisor, for his support, advice, and time. I would also like to thank Mr Daniel Kvenvold of HQ AFLC/MMTEC for his help in obtaining AFLC comments on the proposed policy. Lastly, I'd like to give special thanks to my wife, Lisa, who spent innumerable hours on my behalf and on many nights must have felt like a single parent.

Gerald A. Schumacher



Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Table of Contents

	Page
Preface	ii
List of Figures	v
List of Tables	vi
Abstract	vii
I. Overview	1
Introduction	1
Specific Problem	2
Investigative Questions	2
Scope	3
Literature Review	3
History of Regulatory Environment	5
Conclusion	10
II. Background	11
What is Commercial Off-the-Shelf (COTS)?	11
Definition of Commercial Off-the-Shelf	12
AFLC FSG-70 Management	15
Conclusion	16
III. Methodology	18
Methodology Outline	19
Conclusion	21
IV. Research Observations	22
Section I: Analyzing the Facets of COTS	23
Advantages	23
Disadvantages	26
Section II: Policy Evaluations	35
The Shortfall of AFLCR 800-21 FSG-70 Policy	35
Air Force, Army, and Navy Policies	37
Air Force MAJCOM Policy	43
AFLC ADPE (AFR 700-series) Policies	45
AFLC FSG-70 (AFR 800-series) Policies	46

	Page
Section III: Other Findings	48
Item (IM) or System Management (SM)	48
Commercial Software Rights	51
Maintenance Alternatives	54
ALC and Using Command Comments and Suggestions	56
Section IV: Recommended Support Approach	60
Section V: Proposed AFLC COTS Policy	65
V. Summary and Conclusions	79
Policy Review	80
Policy Assessment	88
Recommended Research	88
Appendix A: Definitions of Terms	90
Appendix B: Chapter 7, AFLCR 800-21, 21 January 1983	93
Appendix C: For Comment Draft AFLC COTS Policy, 28 January 1983	100
Bibliography	112
Vita	119

List of Figures

Figure	Page
1. The Commercial Spectrum	14

List of Tables

Table	Page
I. DOD ADP Budget and % Growth	4
II. FSG-70 Supply Classes	17
III. The Commercial Spectrum	64

Abstract

The purpose of this thesis was to improve the AFLC commercial off-the-shelf (COTS) mission critical computer resources (MCCR) acquisition and support strategy. A review of current service and command regulations pertaining to the management and support of mission critical, automated data processing (ADP), and nondevelopmental (NDI) commercial off-the-shelf (COTS) computer resources, plus recently-completed studies on this topic (e.g., AFLC studies and GAO reports) was used to identify the advantages and disadvantages of procuring and supporting COTS computer resources. A review of the AFLCR 800-21 commercial off-the-shelf (COTS) policy revealed the support approach for COTS computer resources was similar to the support strategy used for military specified (MIL-SPEC) equipment and did not address the unique supportability requirements associated with commercial and commercial-type computer resources.

Using the problems noted in the AFLCR 800-21 review, a list of critical supportability issues was developed, focusing mainly on the availability of commercial contractor logistics support. The review of the Air Force, Army, and Navy regulations revealed a number of innovative management and support policies which could be used to resolve the critical supportability issues.

Based on the results of the regulation analysis and recommended changes submitted by the AFLC Air Logistics Centers, the policy was revised to emphasize decentralization of COTS computer resources management and commercial contractor logistics support.

MANAGEMENT AND SUPPORT OF COMMERCIAL OFF-THE-SHELF (COTS)
COMPUTER RESOURCES USED IN WEAPON SYSTEM APPLICATIONS

I. Overview

Introduction

The Directorate of Reliability, Maintainability, and Technology Policy at Headquarters Air Force Logistics Command (HQ AFLC/MMT), Wright-Patterson AFB, Ohio, is responsible for developing AFLC management and support policy for general purpose commercial off-the-shelf (COTS) computer resources used in Air Force weapon systems. An increasing number of Air Force weapon systems are being fielded with computer resources consisting mostly of general purpose automatic data processing (ADP) equipment and software. Due to rapid changes in electronic technology (i.e., technology obsolescence), the computer equipment used in these systems will typically have a supportability life span ranging from five to seven years (6:10). Many of these computers will go out of production before or shortly after the weapon system is fielded. Since Air Force purchases account for only a relatively small portion of the commercial market, the Air Force does not have the purchasing leverage to keep these production lines open. Furthermore, many ADPE manufacturers claim proprietorship of the engineering data needed to organically support these computer systems (6:12). Therefore, when a product line is discontinued, the engineering data needed to develop a second source (i.e., for

reprocurement) is either unobtainable or only available at an exorbitant price.

Specific Problem

The DOD spends hundreds of millions of dollars annually on ADP equipment and software support (60:A-30). In many cases the policies and strategies for managing and maintaining identical equipment are considerably different between services, between commands, and even within commands. MMT is interested in reducing support costs by improving the current support concept. The focus of this research will be a comparative analysis of the current MMT support policy to the support policies of the other services and commands. This comparison will focus on weapon system commercial off-the-shelf computer resources supportability.

Investigative Questions

As a minimum, the following investigative questions will need to be answered:

1. What is MMT's current approach for managing commercial off-the-shelf computer resources?
2. What are the advantages and disadvantages of various ADP policies including item management, system management, leasing equipment, owning equipment, organic maintenance, and contractor maintenance for general purpose ADP?
3. What are the ADP support strategies of other services?
4. What are the ADP support strategies being used by other Air Force commands?
5. How does MMT's policy compare to the policies covering support for information systems ADPE (e.g., AFR 700 series regulations)?
6. What changes should be made to MMT's policy?

Scope

The focus of this study is directed at improving the support policy of general purpose commercial off-the-shelf computer systems used in weapon system applications. Since the 1970's the Air Force management and support responsibilities for ADP have been split. The general purpose computers used in weapon system applications, along with computers designed to military specifications, have been managed as embedded computer systems (i.e., integral to a weapon system) under the AFR 800 series regulations. All other ADP is managed according to the AFR 700 (previously 300) series regulations as information system resources. In order to draw a reasonable analogy between the general purpose embedded computers and information system ADP, this study will focus on large mainframe systems as opposed to microcomputers. The rationale is that a significant number of general purpose embedded computers could be categorized as large mainframe systems and few, if any, microcomputers would be managed as embedded computers.

Two points needs further clarification. First, it should be noted that, although many other commercial products may or may not have similar supportability problems, this study solely addresses computer resources support. Secondly, although not usually interchangeable, the terms COTS, FSG-70, ADPE, and NDI within the context of this thesis are used interchangeably and refer to commercial off-the-shelf computer resources.

Literature Review

Within the last decade, general purpose commercial computers have increasingly been incorporated into weapon systems. In the early 1970's the DOD mandated that general purpose commercial off-the-shelf computers

commercial computers have allowed versatility and cost effective performance not previously available from militarized versions designed for operational environments. They have also provided significant cost savings by using commercially available data rather than using expensive MIL-SPEC data, which can cost more than the computer system it is intended to support (6:1).

The requirements for ADP within the DOD continue to rise. In June 1984, the Joint Logistics Commanders published the following ADP budget data (Table I) in their Proceedings from the Workshop on Post Deployment Software Support [60:A26].

Table I

DOD ADP Budget and % Growth (\$ Billions) (60:A26)

FY	80	81	82	83	84	85	86	87	88	89	90
DOD ADP BUDGET	2.6	2.83	3.17	3.56	3.99	4.48	5.00	5.61	6.26	6.99	7.81
%GROWTH PER YR	12.6	8.8	12.0	12.3	12.1	12.3	11.6	12.2	11.6	11.7	11.7

In recent years the DOD has been criticized for cost overruns in defense system acquisitions. ADP acquisition and, to a lesser extent, support costs have become frequent targets of congressional and audit agency inquiries of fraud, waste, and abuse. One of the major recommendations made by the President's Blue Ribbon Commission on Defense Management was to expand the use of commercial products rather than develop items under military specifications.

. . . DOD should make greater use of components, systems, and services available "off the shelf." It should develop new or custom-made items only when it has been established that those readily available are clearly inadequate to meet military requirements [68:23].

The Commission further recommended that program managers be required to get a waiver before using a product made from military specifications, if a commercial counterpart was available (68:24).

Clearly the the push from outside the DOD, and the movement within the DOD, is to increase the use of commercial items. But this raises the question, "What steps are being taken to control the proliferation of ADP and to ensure its supportability?"

History of Regulatory Environment. ADP acquisition and support is tightly regulated at all levels of management. In 1965, the Brooks Bill, Public Law 89-306, established a government-wide program to ensure the efficient and economical acquisition and support of ADP resources. Under the Brooks Bill, the Office of Management and Budget (OMB) was given responsibility for fiscal and policy control for all ADP management (31:1). The bill also gave the General Services Administration (GSA) operational responsibility for coordinating a government-wide ADP management program as well as the authority to acquire ADP for other agencies (31:2). The bill also directed GSA to establish a government-wide computer inventory and fiscal data repository so that prior to an acquisition, alternative acquisition options could be assessed to ensure that the most economical acquisition was being made. Therefore, prior to acquiring ADP by purchase or lease, all agencies were required to first determine whether their needs could be met by sharing already installed ADP or using excess ADP.

Within the Air Force and prior to 1975, all management authority for ADP was assigned to the Director of Computer Resources under the direction of the Comptroller of the Air Force (HQ USAF/AC) (22:1). This authority was assigned by the Secretary of the Air Force and exercised under the AFR 300 series regulations. Under these policies, each command designated a Command ADP Program Single Manager to provide the Commander a representative for monitoring, controlling, and reporting on all ADP regardless of application (52:1).

With the release of AFR 800-14 in September 1975, considerable confusion arose over the acquisition and support of embedded computer systems. There was apparent conflict between AFR 800-14 and AFR 300-2 because ADP used in weapon systems was excluded from AFR 300-2 policy (77:1). The ADP single manager concept remained in effect under AFR 800-14, but confusion existed over the role of the ADP single manager with respect to AFR 800 series acquisitions. Since AFR 300-2 did not recognize the existence of Air Force computer resources to be managed under AFR 800-14, the problem arose as to the extent that AFR 300-2 applied to embedded ADP computers and the scope of the approval authority of the ADP single manager (77:1). Within AFLC, the Materiel Management (MM) managers of embedded ADP perceived the Comptroller (AC) ADP single manager as having the authority to prevent MM actions, without having the responsibility to accomplish the MM mission (77:1).

Problems with dual lines of acquisition and management authority, overlapping policies and procedures, two requirements processes, and two sets of procurement regulations for ADP were not unique to AFLC or the Air Force. Because of varied interpretations of DOD and service level guidance, the AFLC policy for acquiring and supporting ADP became very

confusing (77:1). The embedded computer system managers argued that the AFR 300 series acquisition process required three years for the entire approval cycle, where local procurements took only a few months for completion of the approval. Adding in the time for procurement and system development, the feeling was that a support system could be obsolete before it became operational (77:2). A second disadvantage cited was an inability of the MM embedded computer manager to be responsive to the needs of the operational user. Due to the slower AFR 300 series acquisition process, modifications and upgrades were delayed while waiting on acquisition approvals (77:2).

In 1979, the Joint Logistics Commanders (JLC) took action to ensure that ADP for embedded computer resources for defense systems were managed consistently and in accordance with the Brooks Act and Title 10 U.S. Code, which governs system acquisitions (77:9). To do this the JLC used the results of a study on the impact of PL 89-306 on defense system acquisitions to initiate changes to the DOD Directive 5000.29, Management of Computer Resources in Major Defense Systems. The study found that "within the context of the Brooks Bill and in conformance with GSA rules, redundant approval and acquisition channels could be eliminated" (77:10).

In the fall 1981, Senator Warner successfully sponsored an amendment to the FY 82 DOD Authorization Act (PL 97-86) which amended the Brooks Bill in order to streamline the procurement process for ADP associated with several critical national security missions (23:1). This amendment (i.e., 10 US Code 2315 Section 908) exempted ADP resources and services for intelligence systems, cryptological systems related to national security, command and control systems, ADP which was an integral part of a weapon system, and systems critical to the direct fulfillment of military

or intelligence missions from the provisions of the Brooks Bill. It also directed that DOD ADP acquisitions be in accordance with normal DOD acquisition procedures (78:1). The Senate Armed Services Committee report on the DOD FY 82 Authorization Act stated that the intention of Congress in enacting Section 908 was that critical defense missions identified in the amendment should be "wholly relieved of the barriers to efficient ADP procurement that had developed under the Brooks Bill" (79:1). The Committee further stated that ADP procurements for the exempted systems should be:

. . . pursued by the Department of Defense free from interference from non-DOD Federal agencies. Similarly, Congress intended that procurements made in support of such critical military missions, for example, specialized mission-related logistic support systems, be exempted in the same manner as are the activities they support [79:1].

The DOD-Wide Guidelines For Acquiring Computer Resources under the Warner amendment further directed that all other general purpose computer resources not specifically exempted by the amendment, but requiring a designation as "mission critical" would be submitted to a Defense Computer Resources Board for review and approval under the procedures established by that board (80:1).

Following the enactment of PL 97-86, on 1 October 1982 the Secretary of the Air Force reissued Secretary of the Air Force Order 560.1 to revise the policies, authorities, and responsibilities for managing the Information Systems Management Program (56:2). The revised order assigned the management responsibility and acquisition authority for both exempt and non-exempt systems (weapon systems excluded) to the Assistant Secretary of the Air Force (Financial Management). The implementation responsibility for the order was assigned to HQ USAF/AC so that systems

exempted under PL 97-86, except for those integral to a weapon system, were reinstated to a dual management and policy structure that was eliminated by the Warner Amendment and the Office of the Secretary of Defense (OSD) implementing guidance (56:2).

In June of 1983, the management of Communication-Electronics systems and Data Automation were merged into the single management category of information systems. HQ USAF/SI (Assistant Chief of Staff for Information) was formed; and the AFR 100- and 300-series regulations were replaced by a new AFR 700-series (31:2).

Recognizing the need to address the regulatory relationship of the dual management and policy structures, AFR 700-1, 2 March 1984, provided the following clarification between AFR 700 and AFR 800 series ADP acquisitions:

The AFR 700-series provides the policies and procedures for implementing these responsibilities except for the acquisition phase of those information systems and information systems resources acquired using the AFR 800-series. For these exceptions, a program management directive (PMD) will be prepared and issued according to AFR 800-2. When non-embedded information systems or information system resources that are subsystems of a larger system, are to be acquired under AFR 800-series, the following policies will be included as program guidance in the PMD: [21:Atch 1].

Inputs required in the program guidance include: requirements processing; source selection authority, program direction and management oversight, standards, and operation and management to be performed under either the AFR 700- or 800-series regulations (21:Atch 1).

Similarly, AFR 800-14, Lifecycle Management of Computer Resources in Systems, 29 September 1986, states that computer resources managed under the AFR 800 series regulations are subject to the policies of 700-series only to the extent of program direction and AFR 800-14 policy guidance (20:1).

Conclusion

The acquisition and support of ADP has been an issue for over 20 years. Although many policy changes have taken place, at all levels of command, the dual acquisition and management process remains. Within AFLC the checks and balances of this dual management process are still being clarified.

II. Background

What is Commercial Off-the-Shelf (COTS)?

In June of 1986, the President's Blue Ribbon Commission on Defense Management (i.e., Packard Commission) recommended that the DOD increase its use of commercial equipment for military requirements. The specific recommendation was that "rather than relying on excessively rigid military specifications, DOD should make greater use of components, systems and services available 'off-the-shelf.' It should develop new or custom-made items only when it has been established that those readily available are clearly inadequate to meet military requirements" (64:3). To implement this recommendation Congress amended Chapter 137 of Title 10, United States Code Section 2325 to direct the Secretary of Defense to ensure to the maximum extent practicable [81:184]:

- (1) requirements of the Department of Defense with respect to a procurement of supplies are stated in terms of -
 - (a) functions to be performed;
 - (b) performance required; or
 - (c) essential physical characteristics;
- (2) such requirements are defined so that nondevelopmental items may be procured to fulfill such requirements; and
- (3) such requirements are fulfilled through the procurement of nondevelopmental items.

Subsequently, the DOD cancelled and then reissued DoD Directive 5000.37 to implement the amended law and establish policies and responsibilities for the acquisition and support of nondevelopmental items (NDI) (12:1).

Definition of Commercial Off-the-Shelf

The term NDI is very broad and covers a range of equipment and materials that are available from a variety of sources with little or no development effort required by the government. A nondevelopmental item is defined as [81:184]:

(1) Any item of supply that is available in the commercial marketplace;

(2) Any previously-developed item of supply that is in use by a department or agency of the United States, a state or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(3) Any item of supply described in paragraph (1) or (2) that requires only minor modification in order to meet the requirements of the procuring agency;

(4) Any item of supply that is currently being produced that does not meet the requirements of paragraph (1), (2), or (3) solely because the item -

a. Is not yet in use; or

b. Is not yet available in the commercial marketplace.

Clearly the terms nondevelopmental item and commercial off-the-shelf item are not same. Commercial off-the-shelf items are a subset of NDI and one of several categories of commercial items (see Figure 1). A commercial item is one that is developed and used for other than government purposes; sold to the public in the course of normal business and used unchanged when acquired by the government. Although there are several categories of commercial items, by strict definition the terms commercial item and commercial off-the-shelf are synonymous. This has created a problem in that the label COTS is now erroneously being applied to any non-MIL-SPEC item. This includes many items not found in the public marketplace (72:4). One of the major problems in providing the support for commercial items is this generalization of the term COTS. The

failure to distinguish between commercial categories during acquisition ignores the the unique support requirements of each category.

Despite the strict definition of a commercial item as COTS; in reality, the commercial designation can be divided into four different classes. The first class is "best commercial practices". In this case, the government has a requirement for a peculiar item which allows for the use of a less rugged or non-MIL-SPEC design approach. The contractor uses parts and design practices which will withstand typical civilian use, but probably would not withstand battlefield conditions. Typically this method of development is less expensive than the classical MIL-SPEC approach. The second class of commercial items are "custom products." These products are militarized and semi-militarized items designed by industry at their own expense. By selecting these products, the government obtains MIL-SPEC hardware without having to sponsor or wait for its design. The government typically doesn't get design stability or control, but usually gets vendor cooperation since the military is essentially the only customer. The third class of commercial items is "commercial-type." These items originate as COTS, but either through initial modification or failure to incorporate vendor updates the commercial design no longer is compatible with the commercial marketplace. COTS designs, especially computers, when embedded in a weapon system frequently transfer over to this category. The fourth and final class of commercial items is COTS. COTS are vendor design-controlled items which must be purchased, used, and updated in military systems in exactly the same way as for commercial customers (72:6).

In summary, an awareness of the differences in commercial classes is essential during acquisition to ensure an item's support concept is

aligned with the government's ability to control that item's design. Procurement decisions should be made in light of the trade-off between long-term support risk and acquisition cost. As stated above, it is not uncommon for COTS computers to cross over to the commercial type designation. Frequently when the COTS computer's decision is based only on the initial cost savings, the savings recognized during the acquisition are nullified by increased support costs when an item crosses over to the "commercial-type" designation (72:4).

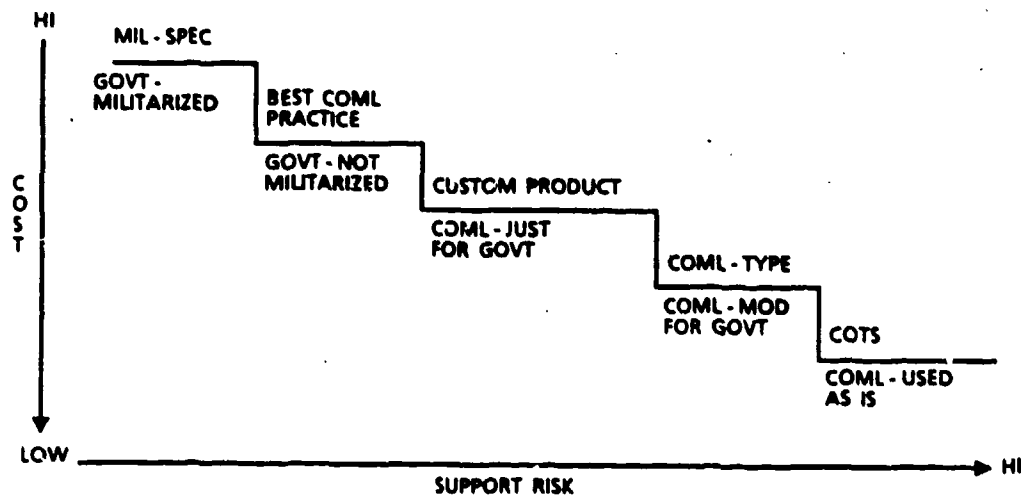


Figure 1. The Commercial Spectrum (4:5)

AFLC FSG-70 Management

Prior to 1973 all computers managed by AFLC were identified in Federal Supply Group (FSG) 74 (Office Machines) and all five AFLC Air Logistics Centers were involved in the management and support of computer resources (6:4). On 23 November 1973, a new Federal Supply Group, FSG-70, was created and Warner Robins ALC (WR-ALC) was given AFLC's first and still only technology grouping mission assignment. Historically, management responsibility within AFLC has been assigned on a system or item management level; but, at that time, AFLC Regulation 523-149 assigned Technology Grouping (Management) responsibilities for Federal Supply Group (FSG) 70 to WR-ALC (52:1). The regulation appointed WR-ALC as the single AFLC manager for FSG-70 and prohibited FSG-70 items from being management coded (i.e., Materiel Management Aggregation Coded) to other item and system managers. This assignment designated WR-ALC as the AFLC agency responsible for performing the central procurement, engineering support, and distribution for the 11 supply classes of FSG-70 general purpose computer resources. This group includes the supply classes listed in Table II.

Significant confusion ensued the new mission assignment due to the previous involvement of the other ALCs. In May 1974, HQ AFLC issued an exclusion which allowed the current ALC managers to retain management of previously cataloged FSG-74 and other management coded computers, but after that date all new FSG-70 items were to be managed at WR-ALC without management codes assigned.

Conclusion

The policy covering the management and support of commercial off-the-shelf FSG-70 has been revised several times since WR-ALC was assigned as the FSG-70 technology manager in 1973. Changes in computer technology and increasing support requirements have lead the command to seek a policy which can meet the increased demands for commercial computer support, as well as, the unique support requirements called for when supporting commercial items.

Appendix B is the AFLC COTS policy taken from Chapter 7 of AFLCR 800-21. It is included both as a baseline for identifying and analyzing the problems that initiated the requirement for this thesis and as a point of departure for developing a new AFLC policy.

Table II

FSG-70 Supply Classes (23:39)

Class Number	Class Name
(1) 7010	- ADPE System Configuration
(2) 7020	- ADP Central Processing Unit (CPU, Computer), Analog
(3) 7021	- ADP Central Processing Unit (CPU, Computer), Digital
(4) 7022	- ADP Central Processing Unit (CPU, Computer), Hybrid
(5) 7025	- ADP Input/Output and Storage Devices
(6) 7030	- ADP Software
(7) 7035	- ADP Support Equipment
(8) 7040	- Punched Card Equipment
(9) 7042	- Mini and Micro Computer Control Devices
(10) 7045	- ADP Supplies
(11) 7050	- ADP Components

III. Methodology

In order to answer the investigative questions pertaining to this research problem, the author gathered the current service and command regulations pertaining to the management and support of mission critical, automated data processing (ADP), and nondevelopmental (NDI) commercial off-the-shelf (COTS) computer resources, plus recently-completed studies on this topic (e.g., AFLC studies and GAO reports). These reports and studies were then be used to identify and examine some of the advantages and disadvantages of procuring and supporting COTS. Next, the commercial off-the-shelf (COTS) policy in AFLCR 800-21 was reviewed to determine what problems this policy did not resolve for the AFLC managers and maintainers of COTS. The criteria for identifying an area as a "problem" was based on the advantages and disadvantages identified, past Air Logistics Center's comments concerning commercial off-the-shelf computer resources support, and the results of several studies investigating the acquisition and support methodologies for DOD commercial items.

After reviewing the problems with the AFLCR 800-21 policy, a modified MMT policy was sent to each of the AFLC Air Logistics Centers (ALC) with a request for recommended changes. The policy was sent to the ALC Mission Critical Computer Resources (MCCR) focal point at each ALC for staffing within that particular ALC.

Using the problems noted in the AFLCR 800-21 review, a list of critical issues was developed. These issues represented the minimum topics to be addressed in the new proposed policy. Next, the applicable service and command regulations were reviewed in search of innovative

management and support policies which could be used to resolve the critical issues.

After the policies were obtained, pertinent information was extracted from each and following a review of other studies and reports pertaining to COTS management, a list of advantageous management and support concepts was developed. An approach was determined to be advantageous based on the author's experience.

Using the results from the analysis of regulatory policy, COTS management and support reports and studies, and the comments for recommended changes generated by the ALCs, the MMT policy was revised and resubmitted to the ALCs for a final review and comments. The results of the second review were analyzed and suggested changes to the proposed policy were identified.

Methodology Outline

The outline used to accomplish the research is as follows:

1. Computer resources focal points in other commands and services were identified. The author relied on the focal points' experience and judgment to identify all the regulations pertaining to this study. If possible more than one representative per service and command was contacted in order to be able to compare their inputs. If the inputs were relatively the same, it was assumed that the necessary regulations were identified.

2. Management and support policies were gathered for: Air Force (AFR 800 & AFR 700-series), Army, Navy, AFLC (AFLCR 800 & 700-series), Air Force Communications Command (AFCC), Tactical Air Command (TAC), Strategic Air Command (SAC), and Air Force Space Command (AFSPACECOM). AFCC was

chosen because they are the parent command for the AFR 700-series regulations. TAC, SAC, and AFSPACECOM were chosen because of their significant use of large mainframe commercial computers in command and control and tactical warning systems (AFR 800-series applications) as well as numerous AFR 700-series systems.

3. The current MMT FSG-70 policy was sent to the ALC MCCR focal points and comments and recommended changes were requested.

4. Other related studies were gathered: GAO reports, Air Force Audit Reports, functional management reports, General Services Administration regulations, DOD Directives and Instructions, public laws, nondevelopmental item studies, briefings, letters, etc.

5. Using the related studies, a list of potential advantages and disadvantages of procuring and supporting COTS computer resources was developed.

6. Problems with the current policy identified from the review of recently completed reports and studies were summarized.

7. A list of critical COTS support issues was developed.

8. Pertinent policy information pertaining to the critical COTS support issues and other related COTS maintenance and management topics was extracted from service, command, and AFLC regulations.

9. COTS policy and support issues were extracted from past ALC's comments and related reports pertaining to the MMT FSG-70 policy.

10. The policies and procedures extracted from the regulations and the related reports and studies were used as the "recommended approach" for acquiring and supporting commercial off-the-shelf computer resources.

11. The "recommended approach" list and the comments received from the ALCs was used to develop a new MMT COTS policy.

12. The policy was revised and resubmitted to the ALCs for comments and recommendations.

13. The second set of comments were evaluated and outstanding issues were resolved.

14. AFLC/MMT plans to implement the new policy in AFLCR 800-21 and is proposing that the new policy be used for developing a joint AFLC/AFSC COTS computer resources regulation.

Conclusion

The most significant problem in this study was the problem of turnaround time involved in staffing the comments at the ALCs. A second, but less serious problem was ensuring that all the necessary regulations were found in order to make a valid comparison of the policies.

IV. Research Observations

This chapter is organized into five basic sections. Section one examines advantages and disadvantages to using commercial off-the-shelf computers. Section two presents a list of critical management and support issues and identifies existing service, command, and AFLC innovative policies and techniques for resolving these issues. Section three is a follow-on to the support strategies and findings of section two and presents information from recently completed reports, studies, and Air Logistics Center's comments. Section four lists the "recommended support approach." Finally, section five presents the proposed new FSG-70 policy.

Section I: Analyzing The Facets of COTS

Since 1979, annual budgeted procurement and support costs for embedded computers (i.e., typically MIL-SPEC) have been running at the multi-billion dollar level and increasing by approximately 80% per year (60:A-40). The DOD is constantly seeking to reduce these costs by using commercially available computers when it is in the government's best interest in terms of life-cycle cost, system capability, supportability, time, and risk.

Unlike many decisions, the decision to use of COTS in a weapon system application is not always clear. A number of factors need to be weighed when considering the use of commercial computers in lieu of the traditional DOD development process. The same considerations required for the traditional process are also applicable to COTS, but rather than setting the requirements and influencing the design, the government examines a fixed set of design considerations to determine what changes and resources are necessary to make the item suitable for weapon system applications. This section will identify and examine some of the potential advantages and disadvantages of using COTS computers in weapon system applications.

Advantages. It is probably not an unrealistic assumption to predict a rather rapid increase in the use COTS computers due to the increased Congressional emphasis to "go commercial." It is easy to understand the rationale for this increased emphasis by examining the four key areas of risk for any acquisition program manager: cost, schedule, performance, and supportability. When properly identified and planned for, COTS offers

several up-front advantages which can significantly reduce these risks (30:6):

- a. Current & Advancing Technology
- b. Market-Based Pricing
- c. Up-Front Product Identification & Pricing
- d. Proven Performance & Reliability
- e. Reduced Acquisition Time & Cost
- f. Existing Support Structure

Current & Advancing Technology. Military applications can take advantage of the latest technology innovations that the civilian marketplace can offer. Technology advances in the computer and micro-electronics markets are rapidly decreasing hardware costs and increasing computing performance.

Market-Based Pricing. Since the government is procuring items directly "off-the-shelf" it can be assured of a fair and reasonable price based on the normal competition of the open market.

Up-Front Product Identification & Pricing. Two of the major risk areas listed above are performance and cost. When buying COTS, both the performance and cost are known. There is no risk of cost overruns since the product either clearly meets performance requirements or it does not.

Proven Performance & Reliability. Open market economics is probably the main factor ensuring product performance and reliability. To survive and ensure continued acceptance in the computer marketplace, private industry first verifies technical and operational performance requirements. In many cases, industry offers warranties (often renewable)

of performance and also performs the same component level analyses as those used for traditional DOD developments (e.g., logistics support analysis, life-cycle cost, repair level analysis, reliability & maintainability analysis) (76:2).

Reduced Acquisition Time & Cost. An important advantage of procuring COTS for military applications is the shortened time to field the system. Procurement times are reduced, due in part, to fewer DOD testing requirements as a result of manufacturer's previously accomplished testing (75:6-1). Assuming COTS computers are used without modification and are operated in the same environment for which they were designed, acquisition costs may be reduced by relying on manufacturer-supplied test and item history data (75:6-1). Also, COTS reduces or eliminates research and development costs, engineering data development costs, and the need for technical manual preparation.

Existing Support Structure. In some cases, an entire logistics infrastructure exists for supporting COTS when the COTS computers are not modified during acquisition. Depending on the support concept chosen for the operational system, COTS equipment and software can be maintained through a flexible range of support options. Options range from total government support to total contractor support where the government contracts for both organizational and depot level maintenance. Total contractor support can eliminate or reduce (8:13):

1. The need for provisioning (no stock, store, & issue of spares). Contractor furnishes spares on a cost reimbursement basis;
2. The use of MIL-SPEC Technical Orders cost. Contractor acquires, and updates all technical data;
3. Manpower requirements and training costs; and

4. Depot activation costs.

When spares are needed historical usage data may significantly aid in the prediction of initial provisioning requirements and related support equipment (75:7-7). Other potential advantages include (7:22):

1. Assured maintenance of latest hardware and software configurations. Manufacturer subscription and licensing services are available to ensure that the users of COTS hardware and software are notified of vendor upgrades to their systems.
2. Decreased response time (support personnel can be on-site or on-call as often as 24 hours per day 7 days a week).
3. Contract can provide for operational system effectiveness level whereby the contractor is penalized for an equipment availability rate below a contracted threshold.
4. Third party maintenance is available for computer manufacturers that control a substantial share of the computer market (IBM, DEC, etc). This allows maintenance contracts to be competed, avoiding potential problems that may arise with a sole source contract to the original equipment manufacturer.
5. The Air Force may be able to realize some additional maintenance cost savings by taking advantage of COTS economies of scale. For instance, since WR-ALC/MMI is the item manager for weapon system FSG-70, rather than contract on a site-by-site basis for COTS maintenance support, a single multi-site maintenance contract covering a vendors (e.g., IBM) equipment and software might be possible.

COTS hardware and software acquisitions can reduce program costs, shorten the time to field an operational system, capture state-of-the-art technology, and reduce program risk (75:11). In terms of support, COTS can mean reduced cost when existing commercial maintenance facilities replace or supplement existing organic maintenance facilities. Furthermore, COTS can reduce personnel, training, and documentation costs (75:7-5). Basically, COTS acquisitions can provide an accelerated alternative to what is viewed as a lengthy and expensive MIL-SPEC development and support process.

Disadvantages. Decision makers need to clearly understand that the

major advantage of using COTS for weapon system applications is essentially its major disadvantage. "Because the government didn't fund and wait for the design effort, we can get an advanced product cheaper and faster than if we had. However, for that same reason we have no legal right to know how the contractor or vendor designed the item, nor can we control changes to that design" [72:7]. This is a key point. The majority of the advantages listed above for using COTS only pertain to the acquisition component of life-cycle cost; which typically comprises only 33 percent of a system's life-cycle cost (29:3).

Most of the logistics advantages listed above are based on the assumption that the COTS hardware and software are used unmodified, in the same environment as it was designed for, and maintained by contractor personnel. For weapon system applications these conditions are usually the exception, not the rule. Air Force operating commands have made it clear that, "on-site contractor support at deployed locations and a support policy based on the shipment of systems back to manufacturer support facilities will not satisfy wartime mission needs" (45:1).

Planning, establishing, and maintaining logistics support is often the most difficult aspect of using COTS for military applications. Historically the decision to acquire commercial hardware and software may have been made without completely understanding why certain data and control mechanisms obtained through traditional development processes are needed by the government to support the operational system. As stated above, the logistics support concept must address the system's operational environment, the organizational maintenance concept, and the type of hardware and software to be supported (i.e., COTS vs commercial-type).

Prior to making the decision to acquire COTS, program managers need to address its potential problems. Several potential disadvantages are identified and discussed below (6:11):

- a. Acquisition (obsolescence & proliferation).
- b. Configuration control (contractor vs government change control).
- c. Availability of data & data rights
- d. Availability of technical orders
- e. Provisioning
- f. Depot level maintenance

Acquisition. In order to remain competitive in the rapidly changing computer marketplace, computer manufacturer's are driven by market pressures to upgrade and introduce new product lines. By choosing to "go with COTS" the government accepts the risk of total vendor configuration control below the form, fit, and function level. This means the vendor may change any internal part or design as long as the form, fit, or function of the COTS remains the same (72:14).

Most COTS computers used in weapon system applications are acquired separately and embedded in the weapon system or configured with MIL-SPEC equipment and software and used as an integral part of a system. Because the government has design control over MIL-SPEC weapon systems, many have been maintained and upgraded from the original design. It is not uncommon for these systems to have service lives of 20 years or more (72:19). Although COTS may allow for lower initial costs, support problems are significantly increased when COTS computers, with a market life of 3 to 5 years, remain in the DOD inventory for 10 to 20 years (64:5). Support costs for COTS can skyrocket as computer vendors go out of business,

vendors discontinue product lines, manufacturers no longer produce parts, or system designs are altered.

As the weapon system ages contractor design changes have been known to no longer work in the system. If a contractor generated design change to a spare part results in a noninterchangeable item, the government has three alternatives (72:20):

- a. modify the computer system to incorporate the change;
- b. buy "life-of-type" spares of the old revision and program funds to replace the existing computer system; or
- c. freeze the old revision as a government "special" item and support the item as commercial-type hardware and software.

Over the past 10 years the cost of computer hardware has declined due to technological advances, while application software has continued to rise. When a COTS computer no longer meets mission needs, the government must decide between upgrading to a larger compatible system or converting to another manufacturer's system. If the government acquires a new system from the same manufacturer on a sole source basis, other manufacturers are denied the opportunity to compete. On the other hand, the government may face substantial effort, costs, and operational disruptions to convert the application software and change to a new system. Millions of dollars can be spent on a single weapon system by trying to convert to a new computer system (32:1).

Configuration Control. As already stated, "because the government didn't fund and wait for the design effort, we can get an advanced product cheaper and faster than if we had. However, for that same reason we have no legal right to know how the contractor or vendor

designed the item, nor can we control changes to that design" (72:7). Thus the configuration of COTS below the form, fit, and function level is dictated by the contractor. This leaves the government with the three options listed above. Either continually modify the weapon system to keep the COTS commercially compatible or freeze the computer system baseline. From a supporters perspective neither alternative is very desirable. Since the contractor controls the configuration of COTS, the government manager does not have visibility into the design stability of the current configuration or the budget lead time to program funds for unanticipated contractor generated engineering change orders. If the government decides to freeze the COTS baseline, the COTS becomes a "system peculiar" item (i.e., commercial-type), which jeopardizes the compatibility of future vendor upgrades and/or voids existing licenses and subscription services (8:12).

In an ideal situation, configuration control of a COTS computer would be vested in the weapon system's system manager. Air Force supported COTS computers typically have four agencies sharing responsibility for configuration management: the weapon system program manager, the FSG-70 item manager, the weapon system operating command configuration authority, and the COTS vendor. The Air Force receives notification of vendor changes by maintaining a service bulletin subscription. It should be noted that not all vendors offer this service or are responsive to mission needs (62:1; 82:1). The bulletins are sent directly to the system users who must review and determine if the revisions are applicable to their system. Site commanders are usually delegated the authority to initiate or reject implementation of revisions. Some sites may request

modification, others may feel it is not necessary. Since the operating command determines what system capability will meet mission requirements and the contractor controls the configuration of the COTS, it is extremely difficult for AFLC managers to maintain configuration control (6:23).

Data & Data Rights. Technical data for weapon system logistics support includes specifications, drawings, technical manuals, calibration procedures and other data required to procure, manufacture, test and inspect, perform preventive maintenance, and operate an item or its parts (75:7-8). Contractors are entitled to limited data rights on hardware items and restricted data rights on software developed at private expense. The military's need to acquire, maintain, and in some cases enhance state-of-the-art COTS computer technology developed with private funds are not always compatible with the private developer's need to protect its investment in its proprietary technology (63:11). Consequently, developer support may, in many cases, be the most cost effective, efficient means of maintaining the computer system, but frequently military mission needs require the military to retain an organic support capability. Additionally, the Competition in Contracting Act tends to limit developer support and increase the use of third party support contractors. However, developers are reluctant to license privately developed tools and documentation to third party support contractors without being able to negotiate license terms directly with such contractors.

For many systems, war planning and surge requirements necessitate a maintenance concept at least partially reliant on organic support. The impact of insufficient data is greatest when the decision is made to go organic or modify COTS. In either case, it is not business as usual.

Regulations require the identification of engineering data and specifications when processing a purchase request (6:24). Not having data also impairs competitive procurements because contractual procedures require it to be available.

Technical Orders. Air Force technical orders for COTS are usually contractor repair manuals which were written for a factory trained specialist who does not need detailed instructions for repairing an item. Depot level maintainers can probably do without MIL-SPEC technical orders and repair manuals, but blue-suit organizational level maintainers typically need more detail to provide maintenance and repair. Often, due to lack of configuration control and poor adequacy reviews during acquisition, technical data is not kept current with the vendor's latest improvements. Also, follow on buys of equipment frequently have design changes without new technical information or spares provisioning being considered (1:1).

Provisioning. The initial provisioning for logistics support for military systems normally takes place during the production phase of the weapon system acquisition life-cycle. Systems developed using the traditional DOD development process usually have enough time during the production phase to accommodate provisioning conferences, technical data reviews, and National Stock Number assignments (64:5). However, the schedule of a COTS acquisition may be so accelerated that the time required to complete the provisioning could very well delay the deployment of the system.

The later the decision to use COTS is made in the acquisition life-cycle, the less chance there is that logistics considerations can be

fully addressed. On the other hand, the earlier the COTS decision is made the greater the chance that production configurations will differ due to vendor design changes during the weapon system's production run. A COTS computer acquisition may shorten the schedule for one element of the weapon system, but given a commercial life-span of 3-5 years, the COTS computer can be expected to become obsolete about the end of the weapon system's production (6:22).

Another area of concern, which can lead to proliferation, is developer part number screening. Commercial developers assign discrete part numbers to each component in their equipment; in many cases, against a prime contractor's part number or a partial vendor number (6:23). This is their internal part number and the part number listed in their technical manuals. This makes the commercial developer a sole source when the government needs to provision spare parts for repair. The Defense Logistics Services Center performs item entry and control reviews to determine whether or not items already in the inventory are available to support new systems, but the success of these reviews is limited because the technical information needed to perform the reviews is not available in the quantity or quality needed to perform an effective search (64:21).

Depot Level Maintenance. The prime disadvantage of contract maintenance is the non-availability of the contractor in a wartime scenario (9:39). Even in peacetime, "contractors refuse to contract with the Air Force because of governmental red tape" [7:13]. Since the Air Force only represents 3-5 percent of the computer industries' total business, developers refuse Air Force data reporting requirements and often will not permit government quality or DCAS personnel in their plants

(6:25). General Services Administration (GSA) contracts are preferred by industry; however, these contracts are frequently inadequate because these contracts don't guarantee a response time for emergency depot repair requirements. Also, GSA contracts do not provide overseas coverage and frequently have a 30-75 day lapse of coverage at the end of each fiscal year (7:13).

In summary, the use of COTS hardware and software as an alternative to the traditional R&D development process can result in reduced program costs, state-of-the-art hardware and software technology, a shorter time to field operational equipment, and an overall lower program risk. The advantages of COTS tend to be up-front or acquisition oriented. If the COTS is modified or used in an environment different than that for which it was designed, the up-front advantages can quickly pale against skyrocketing support costs.

The effective employment of COTS requires support planners to rethink the traditional support approaches used for MIL-SPEC items. "With COTS we should expect to take what we get and do little to change or maintain it ourselves" (72:7). Given that 60-70 percent of a system's life-cycle costs are support cost, the decision to use COTS should only be made after a thorough analysis of the support trade-offs.

Section II: Policy Evaluations

The Shortfall of AFLCR 800-21 FSG-70 Policy. Inherent in the decision to "go with commercial off-the-shelf" is the decision to "not go with traditional support." In fact, the decision to develop an organic depot-level logistic and maintenance capability directly conflicts with the advantages of an existing commercially available maintenance and support infrastructure. An examination of the AFLCR 800-21 FSG-70 policy clearly shows the policy is written as a "business as usual" traditional support policy (Appendix B).

During the planning for support that takes place during a system acquisition, it is absolutely essential that commercial computer resources are correctly identified and arrangements are made to maintain the computer's configuration at the vendor's latest revision level throughout the system's life-cycle. As written, the AFLCR 800-21 policy does little to take advantage of commercial support opportunities and, in many cases, requires engineering support, testing, and documentation requirements which would not normally be possible or available from most vendors.

Section I of this chapter identified a number of hindrances involved with developing and maintaining support for commercial and commercial-type computer resources. Topics such as item manager and system manager configuration management problems, data availability and data rights, and the use of commercial manuals vis-a-vis MIL-SPEC technical orders are not addressed in AFLCR 800-21.

Recognition of these basic shortfalls is the first step in developing a new policy. Using the information presented in Section I, an initial

list of "critical issues" pertaining to commercial computer acquisition and support can now be made. These "critical issues" will serve as an initial list of items that must be addressed or clarified in a new AFLC COTS policy. A new policy will need to:

- a. Distinguish between commercial and commercial-type computer resources;
- b. Avoid the trap of trying to manage COTS as traditionally developed MIL-SPEC items and take advantage of the existing support infrastructure available for commercial items;
- c. Emphasize the importance of early planning during acquisition;
- d. Recommend strategies for provisioning for government ownership of spares, obtaining the necessary engineering and technical data, data rights, and maintenance manuals;
- e. Address configuration management difficulties between the government and vendors, and within the government between item managers, system managers, and ADPE managers (i.e., AFR 700 series regulations);
- f. Suggest techniques for managing and replacing obsolete computer resources;
- g. Handle the transfer of commercial off-the-shelf computer resources to commercial-type computer resources;
- h. Suggest testing guidelines for accepting a new acquisition and incorporating a vendor's field change orders or engineering change orders; and
- i. Clarify the options of contractor support and the policy for recompeting it.

Given that these issues represent the minimum set topics which need

to be resolved in the new policy, this list can now serve as a guide for reviewing existing policy documents. The remainder of this section will focus on and present the current policies and management approaches, from both inside and outside the DOD, for supporting commercial off-the-shelf computer resources. Although the thrust of this review is to identify innovative policies that will resolve the issues identified above, the policies presented obviously will not be limited to the issues already identified, since these are only a subset of all the commercial off-the-shelf issues to be addressed.

Air Force, Army, and Navy Policies.

Air Force Policy. The Air Force has two different series of regulations that potentially could be used to acquire and support the same commercial off-the-shelf computer resources. AFR 800-14 applies to the acquisition and support of computer resources integral to or in support of a weapon system and the AFR 700 series regulations pertain to the acquisition and support of information resources (20:1; 21:1).

AFR 800-14 addresses the following issues (20:1,10):

- a. Computer resources managed under this regulation are subject to the policies in 700-series publications only to the extent specified in program direction.
- b. The design configuration of the COTS computer hardware and software is controlled by commercial markets and independent contractor and vendor actions rather than by the Air Force.
- c. Include COTS deliverables in Logistics Support Analysis (LSA).
- d. Documentation must be sufficient for life-cycle operation and

support but need not be in accordance with military documentation standards.

e. Supported at the vendor's latest revision level, unless upgrades will adversely impact operational capability.

f. Competitive commercial practices will be used to the maximum extent possible when supporting COTS resources. For COTS resources in systems with a life-cycle greater than 5 years, recompetition of support contracts must be considered.

g. If contractor logistics support (CLS) is used, acquire the appropriate documentation and data rights (options to escrow or purchase proprietary information) which will allow the government to support the system in the event CLS becomes infeasible.

h. Maintain and acquire the appropriate licensing and subscription services throughout the life of the system.

i. COTS should not be altered so as to preclude CLS or void licensing and subscription services.

j. The supporting command will evaluate the system operations and logistics impacts of changes due to subscription upgrades.

The AFR 700-series regulations are notably different than the AFR 800-series regulations in their clear absence of an Integrated Logistics Support (ILS) planning process. This is understandable, since most of these systems are operated unmodified and in the same environment for which they were designed. Therefore, contract logistics support and maintenance are almost assured.

The AFR 700-series regulations address the following issues:

a. Nonembedded information systems and information systems resources

acquired under the AFR 800-series will normally be operated and managed as outlined in the AFR 700-series, unless the information system resources are an integral part of, or used to provide dedicated and direct support to a weapon system (21:4).

b. ADPE will not be acquired from commercial sources until it is determined that the requirement cannot be met through the ADPE reutilization program at a greater savings to the government. The program manager must use the automated ADPE reutilization management system to screen all ADPE requirements (17:16).

c. Identifies the requirements for obtaining a Mission Critical Computer Resources (MCCR) designation and states that an MCCR designation removes the requirement for a Delegation of Procurement (18:10).

d. Several other sources of supply for ADPE exist. Third-party vendors purchase new or used equipment for the purpose of entering into long-term lease arrangements with users. Original equipment manufacturer's usually amortize their equipment in 2 to 4 years of lease payments but third party vendors can amortize over a much longer period. Plug-in compatibles are another option. Some vendors manufacture and sell ADPE components that are compatible in all respects to high-demand components manufactured by other vendors. The manufacturers of these components then lease or sell their components at less cost than replacement components (18:8).

Army Policy. The Army acquires and plans logistics support for military commercial off-the-shelf computer resources under the policies and guidelines set-up for nondevelopmental items. Army policy states that all ADPE (embedded or stand-alone) planned for acquisition and issue to

combat, combat support, and combat service support units, and considered as wartime mission material will be subject to management and support through the standard military supply and maintenance system (wholesale and retail) (25:35).

Army integrated logistics support, computer resources, maintenance management, and material acquisition regulations were reviewed. The essence of the following policies and practices should be included in a new policy:

a. Planning for logistics support is given a very strong emphasis. Before the Milestone I decision the acquisition manager must perform a market survey which assesses the support potential for the manufacturer's design and technical support base including publication support, warranty provisions and constraints, world-wide parts network, user training support capabilities, and LSA and LSAR capabilities (24:22; 46:C-2; 48:1).

b. Three categories of NDI exist which are compatible with the definition of commercial. Category A is off-the-shelf items used in the same environment for which they were designed. Category B is modified off-the-shelf items modified to work in a different environment than that for which it was designed. Category C involves a dedicated R&D effort to integrate existing componentry (47:17.2).

c. To minimize testing, maximum use should be made of existing data sources (e.g., commercial testing, user data, and independent evaluation agencies).

d. The Market Investigation is a feasibility analysis used as a preliminary tool for determining whether an NDI is a viable option or not.

Issues that need to be considered in a Market Investigation are
(47:17-21):

1. Will off-the-shelf products need to be modified to satisfy operational requirements?
2. Are off-the-shelf products sufficiently transportable in their operational configuration in the theater of operation?
3. Are there suitable products available in sufficient quantities to meet requirements in both peacetime and wartime without unique or separate production runs?
4. Are there support systems, including parts and backup capabilities, that satisfy needs for the life of the system? If not, is a one-time buy of support a viable option?
5. What is the extent of competition?
6. Will commercial standards and warranties meet the system's operational, environmental, and maintenance requirements?
7. Are commercial training, operating, and maintenance manuals available and can they be made available for review?
8. Do vendors have a good product and support history? Does the vendor have a history of providing continued parts inventories or production for phased-out models?
9. What configuration management controls exist and are they adequate? What is the average time between model changes?
10. Are commercial distribution channels available and adequate to satisfy requirements in part or in whole?
11. Is the vendor employing reliability, availability, and maintainability design and test disciplines? To what degree do they

compare to design and test disciplines normally required for equipment used in the intended environment?

12. What is the status of the technical data package describing the vendor's product? To what extent do proprietary rights apply?

13. How long has the product been produced by the manufacturer?

14. Does vendor testing adequately address the intended military environment or is additional testing necessary to determine or verify maintenance skill requirements, training requirements, transportability issues, and the use of standard support and test equipment?

e. Maintenance and support concepts used in peacetime should be compatible with wartime approach (11:58).

f. Data rights are not always available or for sale. It is desirable to avoid the potential high-cost of life-cycle sole source suppliers. Where practicable, a reprourement data package should be contracted for as part of the acquisition effort.

Navy Policy. The Navy, like the Army, includes commercial off-the-shelf computer resources under the acquisition and support policies of NDI, but unlike the Air Force and Army, the Navy appears to have been more successful in curtailing off-the-shelf computer resources proliferation by establishing a standard embedded computer resources program. "By 1970, it was clear that the proliferation of various digital computers, peripherals, and displays in these systems would have to be controlled in the interest of efficiency in logistics, training, reliability and maintainability, configuration control, system interoperability, and software support" (41:ES-1). Recognizing the high cost of rewriting application software, the Navy has attempted to develop

standardized hardware that will be upwardly compatible and facilitate the introduction of state-of-the-art technology advances (26:2).

In addition to the Air Force and Army policies already listed, the Navy's handbook for acquiring and supporting NDI suggests the following:

a. If a commercial item has been altered or modified through a contract specification, or if the planned usage is different from its commercial usage, the warranty language may need to be altered (75:4-5).

b. The government should seek contract clauses to require the vendor to provide the data rights after a specified period or in the event of a significant configuration change (75:4-7).

c. Alternative supply methods (75:7-7):

1. Manufacturers provide storage and distribution of spares and repair parts.

2. Prime system contractors provide supply support.

3. Life-of-type procurement of all repair parts maintained and distributed outside of the military supply system.

Air Force MAJCOM Policy. The policies of four other Air Force commands were reviewed to assess whether their COTS support concepts would either introduce a new requirement for the AFLC depot-level maintenance approach or contain policy or procedures that should be included in the AFLC policy. The four commands were: Air Force Communications Command (AFCC), Air Force Space Command (AFSPACECOM), Strategic Air Command (SAC), and Tactical Air Command (TAC). SAC has supplemented several AFR 700-series regulations, but has not expanded on ADPE maintenance and support beyond that already covered in the parent Air Force regulations (42:1; 43:1; 44:1). None of the other commands had supplemented AFR

700-series regulations. Also, none of the commands had supplemented or developed a command regulation for AFR 800-series computer resources acquisitions or support.

TAC is working on a Tactical Air Forces (TAF) Wartime Mission Critical Computer Resources Support Concept. This concept states [45:2]:

Support policies which provide no organic support capabilities are not viable options. On-site contractor support at deployed locations or the shipment of systems back to the manufacturer support facilities will not satisfy wartime mission needs. Although spares may adequately support some wartime systems, limited airlift capability may negate this option for many wartime deployment scenarios. These systems are no longer nice to haves; they now equate to sortie rates, aircrew survival, and bombs on target.

The TAF support concept calls for a combination of spares and organic blue-suit support. Trained technicians, augmented by contractors, will be deployed with squadrons. "Maintenance on computers will be performed at two levels: organizational and depot. Organizational maintenance will be performed in-garrison by blue-suit computer support personnel, augmented by contractor personnel. While deployed, systems will be maintained entirely by blue-suit personnel" [45:4]. Minimum maintenance and logistics requirements for deployment include: storage area for bench stock, spares, and sub-assemblies; storage areas for administrative and technical documentation; standard handtools and electronic test equipment. The long range goal is to standardize TAF mission critical systems to provide better support, alleviate logistics problems, and decrease required training (45:C-2).

Clearly, a dichotomy exists between tactical military mission requirements and the use of commercial off-the-shelf computer resources. Mission requirements necessitate blue-suit support, on-site spares, bench stock, and standardization of tools, technical data, and test equipment.

On the other hand, commercial off-the-shelf computers tend to be most advantageous when used with contract logistics and maintenance support, no provisioning of spares, procurement of non-standard commercial manuals, and supported by vendor unique tools and test equipment.

AFLC ADPE (AFR 700-series) Policies. AFLC, unlike the other Air Force commands discussed above, has supplemented both the AFR 700-series regulations and AFR 800-series. The AFLCR 700-series supplements, like their parent Air Force regulations, emphasize acquisition planning and procedures over planning for support (35:1; 36:1). Although the AFR 700-series regulations don't restrict provisioning of spares or organic support, it appears almost all AFLC equipment managed under this series is not stocklisted and is either maintained by local or site contract logistics support. Similar to the AFR 800-series FSG-70 item manager concept, ADPE managed under the AFR 700-series regulations have ADP inventory, accountability, and reporting procedures and data systems (19:15). Therefore, there are two organizations within AFLC performing ADPE inventory management, but only one organization, WR-ALC/MMI, assigned item management responsibility for all military Federal Supply Class FSG-70 ADPE. The reason for this apparent overlap of responsibilities can be tied back to an agreement between the DOD and the General Services Administration (GSA) pertaining to supply management relationships under the National Supply System. The agreement sought to assign GSA those Federal Supply Classes (FSC) or commodities commonly used by federal agencies which were commercially available on the civilian market and not predominately of a military nature and assign the DOD those FSCs or commodities commonly used in military operations or weapon system support,

irrespective of their use by civil agencies (14:2). ADPE and related supplies were initially excluded because procurement was vested in GSA by law. Due to changes in the law and joint recognition that it was impractical to make exclusive FSC assignments, WR-ALC/MMI was appointed as the DOD FSG-70 item manager.

The responsibilities of the FSG-70 item manager with respect to AFR 700-series ADPE acquisitions and support are not clear. Normally an item manager will select, acquire, and maintain materiel, control inventory, and provide materiel support for the Air Force mission worldwide. Typically item management includes materiel requirements, budgeting, materiel repair scheduling, engineering, directing distribution and redistribution, initiating procurements, inventory planning, materiel utilization, disposition, and materiel improvements (37:10).

AFR 700-series ADPE is acquired under the guidelines of the DOD FAR Part 70 Subpart 70.3. ADPE components are considered to be end items and are procured under the guidelines of AFR 172-1 (15:30). Although all ADPE is FSG-70, unless an ADPE item is cataloged and stocklisted the FSG-70 item manager will never have procurement or management awareness (16:1). There is no requirement to stocklist ADPE procured under the AFR 700-series regulations. In fact, AFLC FAR Supplement 17.7402-91 requires written justification to validate the need to provision commercial end items (33:17.74-2).

AFLC FSG-70 (AFR 800-series) Policies. The AFLC/AFSC supplement to AFR 800-14 does not specifically provide any additional acquisition or support guidance on FSG-70 (40:1). The other remaining policy guidance is the existing AFLCR 800-21 and an interim FSG-70 policy (Appendix C)

developed solely to exploit some of the advantages of contract support and to generate constructive comments from the AFLC Air Logistics Centers (ALCs).

Additional command unique topics which should be addressed in a new policy include:

- a. Procedures for recompeting support.
- b. Procedures for processing field change orders and engineering change orders.
- c. Range of support options under contractor logistics support.
- d. Funding guidelines.
- e. Acquisition and support planning and management responsibilities by type of equipment.

Section III: Other Findings.

This section includes additional acquisition and support procedures extracted from a number of DOD and government sources. The information presented in this section is not intended to repeat ideas or concepts already covered, but to expand upon or introduce new topics not yet fully discussed.

Item (IM) or System Management (SM). How appropriate is item management for FSG-70 computer resources used in military applications? Weapon system managers for years have sought to have FSG-70 item management responsibility transferred to them so that computer equipment and software could be managed with the next higher assembly. The reason for this pursuit is quite clear. The system manager is the individual assigned management responsibility for the complete support (i.e., technical integrity of the system to include engineering, configuration control, safety, and security) of a system or program. In the case of commercial off-the-shelf computer resources neither the item manager nor the government control the configuration of the vendors product. Current FSG-70 policy calls for management responsibility to transfer from the FSG-70 IM to the next higher assembly system manager when the equipment or software no longer meet the definition of FSG-70. Since contract logistics support for weapon systems is typically provided for a system on a site-by-site basis, assuming the SM will not require additional skills or resources, no advantage is gained by allowing the IM to contract for support.

The assignment of item management responsibility is usually linked with the source of the item's depot level maintenance and repair

capabilities. Historically many MIL-SPEC items have been stocklisted for normal supply requisitions since the government controlled the item's configuration and depot level repair was performed organically at a military depot. Furthermore, it was in the governments best interest to item manage items which were common to more than one system. The FSG-70 item management assignment was a technology grouping assignment. These assignments are designed to manage an assemblage of homogeneous items, but unlike MIL-STD and MIL-SPEC items, the extent of homogeneity for COTS computer resources ends with the commercial off-the-shelf title (39:2). With FSG-70, the item manager supports multiple vendors whom maintain very little commonality and multiple hardware and software configurations per vendor. Typically the government does not have item configuration control below the form, fit, and function level and can only provide organic depot level support through expensive deals made with the vendors. Rather than manage an item or even a line of equipment, the FSG-70 item manager contracts on a system-by-system basis for support of all commercial off-the-shelf computer resources used in that system. In essence, rather than being an item manager in support of multiple system managers, the FSG-70 item manager due to the nature of item has become a coequal system manager (69:8). Once again, it appears the original policy makers attempted to manage commercial off-the-shelf computer resources in the same manner as traditionally developed items.

A number of common FSG-70 items exist, but contracting by product line won't necessarily work either. Frequently system are developed with multiple commercial off-the-shelf product lines installed. Past experience has shown that it can be very difficult to resolve

disagreements over responsibilities for maintenance when several different contractors are maintaining a system. In 1985, HQ AFLC/XR recognized this problem and assigned FSG-70 item management responsibility for Aircrew Training Devices to Ogden Air Logistics Center. The rationale is, "... separate contracting for computer support requires full communication and coordination to assure effective support of the user's aircrew training capability. A single contract will pinpoint responsibility to a single contractor" [55:1].

This is not to say FSG-70 item management is invalid. As long as common FSG-70 items exists in military systems there will be a need for an FSG-70 item manager. Although not specifically defined in any of the regulations reviewed, the management responsibilities of FSG-70 IM appear to be limited to provisioned AFR 700-series ADPE and unmodified AFR 800-series FSG-70 which has been designated as a Mission Critical Computer Resource (MCCR). With respect to FSG-70, MCCR can be divided into two categories: that equipment that is stand-alone and the system is the FSG-70 (e.g., WWMCS) and those computer resources that provide an integrating function for the system (5:2). Because of this distinction, the criteria for assigning FSG-70 item management responsibility to system managers needs to be expanded beyond the policies already listed in AFLCR 523-1 (39:2-3). In general, the FSG-70 item management assignment should address the system support concept and the extent of integration of the FSG-70 computer resources into the next higher assembly. Also, if the system contains a mix of FSG-70 equipment and software then all the equipment and software should be assigned at the level of the next higher assembly, unless the system manager agrees that specific equipment and

software should be managed by the FSG-70 item manager.

Basically, the system manager should be assigned FSG-70 item management responsibility whenever:

- a. They are willing to assume management responsibility, and
- b. Can do so without additional skills or manning, and
- c. Off-the-shelf computer resources are integral to or dedicated to, or essential in real time to the performance of the weapon system or the equipment or software have been modified to a commercial-type configuration.

This approach will increase the SM's visibility into FSG-70 changes and streamline the configuration management process. It also takes advantage of the AFR 700-series decentralized maintenance concept.

Commercial Software Rights. Military systems are increasingly reliant on state-of-the-art software to operate increasingly complex weapon systems. Private industry is developing many innovative software packages, but some of the best software is not available for government use because of software rights incompatibilities between the government and industry. Private developers need to commercialize their products in order to recoup their investments. The developers ability to commercially recoup their investment is significantly dependent on their capability to restrict access to that software. This includes limiting access to object code, source code, documentation, and development tools (63:10).

Military mission requirements frequently necessitate that an organic support capability be used to maintain and enhance the software or achieve competition so as to avoid being locked into a sole source situation with the original developer. This requires access to the code, documentation,

and tools which developers are least likely to disclose. To meet these requirements, as well as, provision against product discontinuance or unacceptable maintenance support by the developer, the government only allows restricted rights to apply to privately developed machine readable code. Since the government treats software documentation as technical data, rather than being subject to restricted rights, software documentation is subject to limited rights. Also, the government claims unlimited rights for manuals and instructional materials used for installing, operating, maintaining, or training purposes. Since nearly all software documentation falls within this clause, potentially all documentation is subject to unlimited rights claims (63:10).

Consequently, the DOD is losing access to valuable software because many vendors are not willing to license their documentation to the government due to the risk of having valuable proprietary documentation widely disseminated. When surveyed, contractors indicated that approximately 65% of the time they are unwilling to make privately developed software tools available, and that 49% of the time they are unwilling to make privately developed applications programs available due to the DOD's data rights policies (63:17).

Similar to the advantages associated with COTS hardware, a major advantage of acquiring commercial software is that the developer or a third party, rather than the government, can support the software. By using a commercial support approach, the DOD may not need to procure software documentation and only need assurance that the software can be adequately supported by the developer or a third party. To meet this need, the Software Rights in Data Workshop, proposed a "conditional

directed licensing clause which includes an escrow of support materials" [63:13]. This concept calls for all materials necessary to support the software, which were not delivered to the government, to be placed into an escrow at the time the object code is delivered. The developer will be required to update the escrowed documentation. When the developer is unwilling or unable to perform software support functions at a reasonable cost he may be directed to release the escrowed material. After notifying the developer, the government can transfer the support functions to a third party and a license will implicitly be granted to that party to perform support. The scope of the third parties rights are limited to those of the government under the original contract and the original developer retains the right to sue the third party directly under the license if the latter abuses it (63:13).

The advantages of this contracting approach apply equally well to commercial hardware. For both hardware and software, this concept can accommodate the DOD's need to establish an organic support capability or use a third party maintenance support strategy, as well as, take advantage of private industry's "leading edge" of software technology. Furthermore, this approach appears to be an innovative way of coping with hardware and software obsolescence. Given the extended service life of many of our military systems and the limited operational compatibility of many commercial systems, combined with the high cost of upgrading or converting over to a new computer system, contract clauses calling for support materials to be escrowed and maintained by the developer can significantly extend an items service life and ultimately reduce operational and support cost. Also, by extending the commercial items service life, proliferation

is reduced simply because fewer new items are entering the inventory.

Maintenance Alternatives. In recent years computer maintenance and support has become a very competitive and lucrative business. In addition to the manufacturers who service their own equipment and software, over 700 third party maintenance firms now exist (28:52). Third-party firms account for roughly 10% of the \$13.2 billion computer maintenance market (27:121).

Many major corporations are now switching over to third-party maintenance agreements to avoid the 7% to 8% annual increase in the original equipment manufacturer's maintenance costs. In addition to a reported cost saving between 20 and 40 percent and customized service agreements tailored to user's needs, a number of corporations are finding other advantages in turning over their computer maintenance support to third-party firms (27:121).

Historically, equipment manufacturers have balked at maintaining equipment other than their own. This forced a number of corporations with mixed equipment and software to depend on several vendors for support or develop an in house support capability. A big draw of third-party maintenance has been the advantage of having one party responsible for an entire system.

The Air Force spends hundreds of millions of dollars annually on ADP maintenance and support (2:1). From a system manager's perspective, the ideal maintenance arrangement is one firm maintaining all product lines for the given system. Still, for military systems using state-of-the-art large mainframe computers this support approach appears to be a long way off. Manufacturers are anxious to protect the technology of their

state-of-the-art equipment and typically refuse to provide full documentation that is needed to provide third-party support. Although third-party firms can buy the parts, the large scale integrated technology used in mainframe systems is so complex and expensive that the cost of spares and training require a huge investment (59:20). On the average, few third-party firms can match the manufacturer's support of large mainframe systems. Manufacturers have significantly more skilled technicians and third-party firms are not accustomed to providing the software support, consulting, planning, and installation services that large system user's tend to take for granted (27:124).

Even in a competitive market, as equipment ages, maintenance fees increase in an effort to sell new equipment (27:122). Although parts for established equipment are more widely available and far less expensive than state-of-the-art equipment, manufacturers tend to charge more for servicing older equipment and are less inclined to provide quality service for peripheral equipment (3:63). Third-party maintenance would seem to be the logical alternative for this type of equipment.

Since many of the commercial off-the-shelf, mission critical computers used in Air Force systems are large mainframe computers, these systems will generally benefit most from the following support strategy:

1. Newer mainframe systems tend to be highly reliable, limit maintenance service for the central processing unit to an on call maintenance concept with service provided by the original equipment manufacturer or a qualified third-party contractor.
2. Most computer maintenance problems are associated with computer peripheral equipment (e.g., printers, plotters, terminals) and many Air

Force organizations have wartime requirements for blue-suit organizational level support, maintenance services can either be provided by (9:45):

- a. Blue-suit support;
- b. Blue-suit augmented by third-party contractor support; or
- c. Third-party contract support.

3. Review maintenance contracts annually to see if operational needs can be met with less expensive maintenance alternatives. These reviews should include:

- a. A review and analysis of past maintenance data;
- b. Comparison of historical maintenance data, including turnaround time, to the stated mission need; and
- c. A review of current maintenance alternatives and costs from manufacturers and third-party maintainers.

ALC and Using Command Comments and Suggestions. The AFLC Air Logistics Centers (ALCs) have provided a number of comments pertaining to commercial off-the-shelf computer resources acquisition and support. Listed below is a summary of their comments. Comments that reiterate points already covered in this chapter have been screened.

1. All AFLC COTS acquisitions whether MCCR designated or not will be coordinated with ALC/SC (51:1).
2. It is essential for effective mission support that we have a single point of contact for maintenance of each system within our networks (57:1).
3. With commercial-type and true COTS we can rely on little or no design stability, if we intend to organically modify or maintain the item, we need to buy the design (49:1).

4. Follow-on compatibility testing should be conducted for all major revisions to an embedded COTS item. Testing should verify the form, fit, and function interface is not violated. Testing should be completed prior to government approval/acceptance of any major configuration change (49:1).

5. The term non-FSG-70 is misleading. The reference is to items that have been modified or have not been Materiel Management Aggregation Coded (MMAC) to the FSG-70 item manager. The fact that an item is managed by a PM or SPM does not change its class as an FSG-70 item (53:2).

6. The scope of the policy should specify ADPE, MCCR, or both ADPE and MCCR (73:1).

7. Identification of COTS equipment requirements should be addressed to the weapon system Computer Resources Working Group (CRWG) (73:2).

8. Effective immediately, all AFR 800 series commercial off-the-shelf (COTS) ADP acquisitions, including those modified for a specific purpose, will be coordinated with the local Communications-Computer System Officer (CSO). This acquisition policy applies regardless of type of funding or intended use (51:1).

9. The requirement to use and AFLC Form 75 for acquisition of all COTS software appears to be inconsistent with the funding policy listed. An AFLC Form 75 should not be required when a system (hardware and software) has been approved for acquisition (71:1).

10. Change reference AFR 172-1, Vol I, para 4-25b, to para 4-8a (50:1).

11. Unlimited and limited rights COTS software must have a CPIN assigned. CPINs for restricted rights COTS software is optional in

accordance with TO 00-5-16 (67:1).

12. Throughout the document there seems to be confusion about the definition of COTS. The term COTS applies only when an item is acquired and used exactly as it appears (and is updated) in commercial use. FSG-70 is limited to COTS computers and peripherals. If an item starts out as a variant, is modified, or exempted from contractor revisions and upgrades it leaves the COTS category and becomes commercial-type. It would seem non-FSG-70 is a contradiction of terms (58:1).

13. Include definitions of commercial and commercial-type (58:1).

14. A configuration may be altered or frozen in design for a military application and still conceivably have a commercial application. The standard should be whether the resulting configuration is still a viable member of the vendors commercial product line or whether it has become a "special" that needs unique support (58:2).

15. While competition is desirable and required by law, realistically we should recognize that the potential for competing COTS support is often limited. That is part of the downside of selecting COTS. While a preliminary market investigation might reveal that there is a wider support base for some COTS brands than for others. Most original equipment manufacturers will limit repair and support to themselves or a limited service network (58:2).

16. The nature of COTS and contract logistics support (CLS) may weigh against stocking government owned spares for use by a support contractor. It may sometimes be useful to stock unique recoverables, although soft configuration and problems with interchangeability may even make that inadvisable. The contractor may use shortage of Air Force owned parts as

justification for his own nonperformance. This could make CLS contracts unenforceable (58:2).

17. An integral part of COTS planning should be for its replacement when no longer viable. It is not unusual for that to take place within five years, and the eventuality should be integral to weapon system master planning so replacement funding can be advocated. Weapon system master plans must address COTS longevity and project funding (58:3).

18. An obsolescence review is a review to determine whether existing computer resources are economically or technically obsolete. Indications of economic and technical obsolescence include [13:70.2-3]:

- a. Maintenance service or parts or are becoming unavailable or are no longer being provided by the original equipment manufacturer (OEM);
- b. An operating system is or will no longer be supported by the OEM;
- c. Degradation in equipment reliability;
- d. Maintenance Costs are accounting for an increasingly greater portion of operating costs;
- e. Energy consumption, including necessary environmental control, is relatively high;
- f. System throughput and processing turnaround are too slow, and flexibility is limited for the mission requirement;
- g. The equipment is two or more production cycles behind the present product line.

Section IV: Recommended Support Approach

The comparison of the list of critical support issues to the AFLCR 800-21 FSG-70 policy pointed out several problems. Not only was most of the terminology outdated, but the policy attempted to manage commercial off-the-shelf computers in the traditional manner of MIL-STD and MIL-SPEC equipment. The first draft of the proposed revision to the policy (Appendix C) also had many shortcomings. Although this policy made a greater attempt to address the commercial availability of support, additional research pointed out fundamental management flaws with this approach. Additional emphasis needed to be given to the initial COTS acquisition decision and support planning. Logistic planners need to first understand the support distinction between the different classes of commercial (see Table III), and then be able to assess supportability in light of the weapon system's operating environment and proposed maintenance concept. Also, increased system management support of COTS, commercial maintenance alternatives, and long term supportability issues needed to be given greater emphasis.

Although COTS acquisition and support strategies must be tailored on a system by system basis, the following list is the author's "recommended approach for acquiring and supporting COTS computer resources." These concepts will serve as the point of departure for developing a new AFLC COTS policy:

1. System management of COTS computer resources should be increased within AFLC.

2. A COTS market investigation and supportability analysis should be performed prior to acquiring COTS.

3. Requests for proposals and contracts should clearly state what class of "commercial" will be used.

4. Procurement contracts should have firm-fixed priced, escrow clauses, for design data, support equipment, repair manuals, etc. to allow for organic or third party support in the event the vendor will no longer provide support.

5. Contracts should arrange for software licensing and vendor subscription services. AFLC managers should specify what information is expected to be reported with the vendor's subscription service.

6. If possible, an organic depot-level maintenance support concept should be avoided, COTS should be maintained commercially.

7. If a specialized depot is necessary and there is no design disclosure below the form, fit, or function level, detailed MIL-SPEC technical orders for depot level maintenance of COTS assemblies are not needed. Existing vendor's service manuals should be used unchanged and augmented by the vendor's service bulletin subscription service.

8. Maintenance contracts should be competitively awarded. Contracts should provide multiple year coverage, with one year options.

9. Limit maintenance service for large mainframe central processing units to an on call maintenance concept with service provided by the original equipment manufacturer or a qualified third-party contractor.

10. Since most computer maintenance problems are associated with computer peripheral equipment (e.g., printers, plotters, terminals) and many Air Force organizations have wartime requirements for blue-suit

organizational level support, maintenance services can either be provided by:

- a. Blue-suit support;
- b. Blue-suit augmented by third-party contractor support; or
- c. Third-party contract support.

When blue-suit organizational level support is used. MIL-SPEC system-level technical orders should guide system operation and troubleshooting to the assembly/module level for removal and replacement.

11. Spares should contractor furnished on cost reimbursement basis:

- a. Repairable spares 25% of acquisition cost.
- b. Unrepairable spares 100% of commercial market value.

12. If government ownership of spares is a requirement, stock spares on-site and don't provision. Maintenance contracts should include the requirement to maintain government spares at their latest revision level.

13. If provisioning is requirement, don't buy provisioning data that breaks the equipment down below the form, fit, and function level. Instead, at the form, fit, and function level, designs should be documented by Level 3 specification or source control drawings. Control drawings must be sufficiently complete to enable any competent source to produce interchangeable items.

14. Maintenance contracts should specify a system effectiveness level, below which the government collects maintenance credits.

15. Maintenance contractors should acquire, maintain, and update all technical data, tools and test equipment.

16. Maintenance contracts should specify that equipment be kept at the vendor's latest revision level.

17. Compatibility testing will be performed prior to approval and acceptance of any major configuration change. This testing should verify that the form, fit, and function interface has not been violated.

18. The equipment list in the contract should identify the equipment to be maintained and a site list should identify the maintenance locations.

19. Incidents reports should be submitted by the contractor for all malfunctions.

20. Review maintenance contracts annually to see if operational needs can be met with less expensive maintenance alternatives. These reviews should include:

- a. A review and analysis of past maintenance data;
- b. Comparison of historical maintenance data, including turnaround time, to the stated mission need; and
- c. A review of current maintenance alternatives and costs from manufacturers and third-party maintainers.

Table III

The Commercial Spectrum [72:5]

	MIL-SPEC	BEST COML PRACTICE	CUSTOM PRODUCT	COML-TYPE ("SPECIAL")	COTS
DESIGN FEATURES	GOV'T MILITARIZED	GOV'T NOT MILITARIZED	COML JUST FOR GOV'T	COTS MOD FOR GOV'T	FOR CIVIL MARKET
% SALES TO GOV'T	100%	100%	PROBABLY 100%	SMALL (OF BASIC ITEM	SMALL
DESIGN DISCL'SRE	FULL	FULL	MOSTLY F3 MAYBE FULL	PROBABLY F3 FULL NEEDED	F3*
CONFIG AUTH'Y	GOV'T	GOV'T	VENDOR	VENDOR	VENDOR
DESIGN STABIL RISK	LOW	LOW	MODERATE TO LOW	MODERATE TO HIGH	HIGH
LNG TERM SUPPORT RISK	LOW	LOW	MODERATE TO HIGH	HIGH	HIGH

* F3 - Form, fit, and function

Section V: Proposed AFLC COTS Policy

Mission Critical Computer Resources (MCCR)

ACQUISITION AND SUPPORT OF COMMERCIAL OFF-THE-SHELF (COTS) AND COMMERCIAL-TYPE COMPUTERS, PERIPHERALS AND SOFTWARE

1. Scope. This document describes the acquisition and support policies, and management responsibilities for MCCR COTS and commercial-type computers, peripherals, and software procured and managed under the AFR 800 series regulations.

2. Terms Explained:

a. Automatic Data Processing Equipment (ADPE). General purpose, automatic data processing components and the equipment systems created from them, regardless of use, size, capacity, or price, that are designed to be applied to the solution or processing of a variety of problems or applications and are not specifically designed to be applied to the solution or processing of a variety of problems or applications and are not specially designed (rather than configured) for any specific application (FAR 70.200).

b. COTS Equipment. Commercial ADPE developed for other than government purposes; sold or traded to the general public in the course of normal business operations and used unchanged ("off-the-shelf") when acquired by the government (FAR 11.001).

c. Commercial-Type Equipment. Commercial ADPE modified to meet some government peculiar physical requirement or addition or otherwise

identified differently from its normal commercial counterparts (FAR 11.001).

d. **Commercially Available Software.** Software developed at private expense and available in the commercial market through lease or purchase (including licensing arrangements) from a concern representing itself to have ownership and/or marketing rights in the software. Software which is furnished as part of the computer, but is separately priced from the computer, is included in this category (FAR 70.200).

e. **Commercial-Type Software.** Commercially available software that is modified to meet some government peculiar requirement or addition or otherwise identified differently from its normal commercial counterparts (FAR 11.001).

3. Relationship to Other Directives:

a. This document does not apply to information resources acquired and managed under the Air Force 700-series regulations.

b. COTS computer resources managed under this document are subject to the policies in Air Force 700-series regulations only to the extent specified in the Program Management Direction (PMD) and this document.

c. COTS computer resources acquired and managed under the Air Force 800-series regulations and used in systems as defined in AFR 700-4, Vol II, paragraph 1-5b, do not require a Delegation of Procurement Authority (DPA) if they have been designated as MCCR according to the procedures in AFR 700-4, Vol II, paragraph 3-4b.

d. An MCCR designation eliminates the need to obtain a DPA from the General Services Administration (GSA); however, it is a requirement that MCCR be competitively procured unless the provisions of the Federal

Acquisition Regulation (FAR) and the Competition in Contracting Act (CICA) are met.

e. All AFLC AFR 800 series commercial off-the-shelf (COTS) ADP acquisitions, including those modified for a specific purpose, will be coordinated with the local Communications-Computer System Officer (CSO). This acquisition policy applies regardless of type of funding or intended use. All AFLC COTS computer resources acquisitions whether MCCR designated or not will be coordinated with ALC/SC.

4. Planning for COTS Support:

a. The AFALC (DPML) and AFLC SPM/IMs will ensure that:

(1) A COTS computer resources market investigation and supportability analysis is performed prior to acquiring COTS. Attachment 1 is a sample listing of questions to be addressed in the supportability analysis.

(2) Requests for proposals and contracts clearly state what class of "commercial" will be used.

(3) When possible, an organic depot-level maintenance support concept is avoided. COTS computer resources should be maintained by contractor logistics support (CLS).

(4) Subscription service submittals are provided for by the System Program Office (SPO) for COTS equipment and software during the acquisition phase. AFLC managers should specify what information is expected to be reported with the vendor's subscription service.

(5) The SPO maintains configuration of COTS computer resources at vendor's latest approved revision levels through contractual subscription service and appropriate contractual logistics support to ensure the

revision level of the commercial manufacturer's or vendor's equipment is current at PMRT.

(6) If design requirements specify commercial-type equipment and software, ensure that design requirements are correctly classified and logistics support requirements are included in the contractual documents for the system being developed.

(7) COTS deliverables are included in the Logistics Support Analysis (LSA). LSA should not break COTS items down below the form, fit, and function level.

(8) Procurement contracts have firm-fixed priced, escrow clauses (i.e., to insure adequate data rights), for design data, support equipment, repair manuals, etc. to allow for organic or third-party contractor support in the event the vendor will no longer provide support.

(9) If a specialized organic depot is necessary and there is no design disclosure below the form, fit, or function level, detailed MIL-SPEC technical orders for depot level maintenance of COTS assemblies are not needed. Existing vendor's service manuals should be used unchanged and augmented by the vendor's service bulletin subscription service.

(10) When blue-suit organizational level support is planned, MIL-SPEC system-level technical orders will be procured. In general, organizational technical orders should guide system operation and troubleshooting to the assembly/module level for removal and replacement and should not go below the form, fit, and function level.

(11) The nature of COTS and contract logistics support (CLS)

weigh against stocking government owned spares for use by a support contractor, since contractors may use shortage of Air Force owned parts as justification for nonperformance. Preferably, spares will be contractor furnished on a cost reimbursement basis. If government ownership of spares is a requirement, preference should be given to stocking spares on-site, maintained by contract support, and not provisioned. If provisioning is a requirement, provisioning data that breaks the equipment down below the form, fit, and function level should not be bought. Instead, at the form, fit, and function level, designs should be documented by Level 3 specification or source control drawings. Control drawings must be sufficiently complete to enable any competent source to produce an interchangeable item.

(12) For systems with planned life cycles longer than five years, recompetition for follow on logistics support and modification contracts will be in accordance with by AFR 800-35, AF Competition Advocate Program. To provide the capability to recompute, the Air Force will purchase a CLS support package that includes data, documentation, and subscription services, for the appropriate version, to provide the information for any future recompetition. Items and materials readily available on the commercial market will not be included in the CLS support package. Instead they will be the contractor's responsibility under the CLS contract.

(13) AFLC representatives take part in COTS computer equipment and software testing as required.

(14) To minimize testing, maximum use is made of existing data sources (e.g., commercial testing, user data, and independent evaluation agencies).

(15) Appropriate warranty language is included. If an item has been altered or modified through a contract specification, or if the planned usage is different than its commercial usage the warranty language may need to be altered.

(16) Unlimited and limited rights COTS software has CPINs assigned.

(17) AFLC representatives take part in formal reviews, data calls, and audits as directed in AFR 800-14 and this regulation. Also, provide representatives and technical support to the CRWG, design and technical meetings, and assist in development and updating of CRLCMPs and PMDs.

(18) COTS computer resources support concepts will be reviewed at planning and Computer Resources Working Group (CRWG) meetings, and documented in the applicable CRLCMP.

5. Follow-on Support:

a. Competitive Contractor Logistics Support (CLS) practices will be used in maintaining COTS computer resources, unless the support concept as specified in the CRLCMP dictates organic depot support. If the support concept calls for full CLS (Organizational, Depot, and Supply), then commercial engineering and technical data and documentation will be acceptable for COTS equipment support. Maintenance contracts will:

(1) Be competitively awarded. Contracts should provide multiple year coverage, with one year options.

(2) Be written in coordination with users and specify user-defined operational effectiveness levels and penalties when effectiveness drops below contracted levels of support.

(3) Specify that equipment be kept at the vendor's latest revision level.

(4) Specify that vendor hardware and software be maintained at the current revision level.

(5) Specify that depot support contractors acquire, maintain, and update all technical data, tools and test equipment.

(6) Provide for maintenance of the established range and quantity of items in the CLS support package. This includes repair, replenishment, update, calibration as applicable and general maintenance. In this way, the items in the support package will be available in the latest configuration to transfer to a succeeding contractor if another contractor wins the support contract.

(7) Include an equipment list identifying the COTS equipment to be maintained and a site list identifying the maintenance locations.

(8) Require incident reports to be submitted by the contractor for all malfunctions.

b. Compatibility testing will be performed prior to approval and acceptance of any major configuration change. This testing should verify that the form, fit, and function interface has not been violated. Certification will be provided that all vendor prepared service bulletins, used as ECOs/FCOs, satisfy engineering requirements and that those changes causing or having interface impacts are approved or disapproved by the weapon system and user CCBs and SCCSBs. All vendor changes require system level testing and approval before installation. Specific procedures for accomplishing this test should be determined between the weapon system SPM/IM, the user, and WR-ALC/MMI; and included in the applicable CRLCMP.

c. An integral part of COTS planning should be for its replacement when no longer viable. It is not unusual for COTS computer resources to reach technical or economical obsolescence within five years. Planning for the eventual replacement of COTS should be integral to the weapon system master planning process so that funding can be advocated. Weapon System Master Plans must address COTS longevity and project funding.

d. An annual obsolescence review will be conducted on COTS computer equipment to determine whether existing computer resources are economically or technically obsolete. Indications of economic and technical obsolescence include:

- (1) Maintenance service or parts are becoming unavailable or are no longer being provided by the original equipment manufacturer (OEM);
- (2) An operating system is or will no longer be supported by the OEM;
- (3) Degradation in equipment reliability;
- (4) Maintenance Costs are accounting for an increasingly greater portion of operating costs;
- (5) Energy consumption, including necessary environmental control, is relatively high;
- (6) System throughput and processing turnaround are too slow, and flexibility is limited for the mission requirement;
- (7) The equipment is two or more production cycles behind the present product line.

e. When replacement of COTS equipment becomes necessary, the operating or application software may be affected. The CRLCMP will identify the management organization that will initiate and integrate the

change, and make the final determination as to what equipment is and is not acceptable as a replacement.

f. Maintenance contracts will be reviewed annually to see if operational needs can be met with less expensive maintenance alternatives. These reviews should include:

- (1) A review and analysis of past maintenance data;
- (2) Comparison of historical maintenance data, including turnaround time, to the stated mission need; and
- (3) A review of current maintenance alternatives and costs from manufacturers and third-party maintainers.

g. COTS computer equipment and software not currently supported by CLS will be phased into a method of CLS.

h. AFLC will determine COTS Depot Maintenance Sources of Repair (SOR) according to Decision Tree Analysis (DTA) procedures contained in AFR 66-7, and Depot Maintenance Interservicing (DMI) procedures contained in AFLCR 800-30. Technology Repair Center (TRC) assignments for items and equipment determined to be candidates for accomplishment will be made through the AFLC posture planning process.

6. Assignment of Management Responsibility:

a. In general, MCCR COTS can be divided into two categories:

- (1) Category I: COTS computer resources embedded in, dedicated to, or essential in real-time to the performance of the system; and
- (2) Category II: COTS computer resources that are stand-alone and the system is COTS.

b. The initial assignment of materiel management responsibility for COTS computer resources must address the system support concept and the

extent of integration of the COTS computer resources into the next higher assembly. In addition to the policies and procedures defined in AFLCR 523-1, Mission Assignment Policy, management responsibility for COTS computer resources should be assigned on the following basis:

(1) SPM/IMs should be assigned management responsibility for Category I COTS or COTS that has been modified to a commercial-type configuration; if no additional skills or manning are needed to assume responsibility.

(2) WR-ALC/MMI, as the FSG-70 IM, should be assigned management responsibility for Category II, common COTS computer resources that meet the definition of FSG-70 ADP.

c. If a system contains a mix of COTS and commercial-type equipment and software, then all the equipment and software should be managed at the next higher assembly level, unless the SPM/IM agrees that specific equipment and software should be managed by the FSG-70 IM.

d. All provisioned COTS computer resources will be cataloged as FSG-70 ADP. This includes COTS and commercial-type computer resources which have been Material Management Aggregation Coded (MMAC) to the next higher assembly SPM/IM.

e. COTS and commercial-type computer resources management assignments, and changes in application will be handled on a system-by-system basis and conducted in accordance with AFLCR 523-1. Normally, the next higher assembly SPM/IM will be assigned management responsibility for commercial-type computer resources.

7. COTS management organizations (WR-ALC/MMI and SPM/IMs) will:

a. Provide follow-on COTS support in accordance with the applicable

CRLCMP and paragraph 5 of this document.

b. Take part in formal reviews, data calls, and audits as directed in AFR 800-14 and this regulation. Provide representatives and technical support to the CRWG, design and technical meetings, and assist in development and updating of CRLCMP and PMD.

c. Program for and fund follow-on logistics and engineering support of assigned items.

d. Be members of the Configuration Control Board (CCB) and SCCSBs for systems which use their item.

e. In conjunction with users, develop contingency plans for supporting COTS computer resources in the event of contractor non-performance.

f. Maintain subscription services with COTS manufacturers or vendors throughout the life of the system.

g. When Class IV modification action is appropriate, identify requirements for item hardware, peripherals, software, and engineering and user documentation in the appropriate funding documents at the time of budget preparation. That is, prepare AFLC Form 775 (BP1100) or P Series Form (BP8300) and AFLC Form 48 to obtain CCB approval of COTS resources modifications in accordance with AFR 57-4 and AFLCR 57-21. Vendor prepared service bulletins used as Engineering Change Orders (ECOs) or Field Change Orders (FCOs) may be used as installation instructions for COTS modifications by assigning these a TCTO and data code number, issue and recession date and authority line.

h. When appropriate, budget for modification funding using procedures of AFLCR 57-21.

i. Notify other SPM/IMs of modifications and changes which may affect their system. The affected SPM/IM must provide recommendations within time frames specified in AFLCR 66-15 to the SPM/IM, and will address planning and programming requirements for accomplishing modification or change of the affected item.

j. Use an appropriate type of Time Compliance Technical Order (TCTO) to announce changes to COTS equipment and software configuration items. The TCTO must reference the vendor service requirement document and authorize work to be accomplished according to the vendor document, if applicable.

8. Funding:

a. The following applies when AFLC budgets and funds for licensing fees of COTS (see AFR 172-1, Vol I, paragraphs 4-8a):

(1) Fund with EEIC 592TB when acquiring software only.

(2) Fund with Other Procurement (57*3080) funds when acquiring a system that includes both hardware and software (AFR 172-1, Vol I, Para 10-65).

(3) Insure funding requirements are included in the annual POM, Budget Estimate Submission (BES), and the financial plan.

b. Licensing agreements will be maintained throughout the life of the system.

c. An AFLC Form 75, Computer Program Configuration Sub-Board Item Record, will be prepared and processed through the Software Configuration Control Sub-Board (SCCSB) for COTS software changes.

Attachment 1

Supportability Market Analysis

The Supportability Market Analysis is a feasibility analysis used as a preliminary tool for determining whether a COTS item is a viable option or not. Issues that need to be considered in the Market Analysis are:

1. Will off-the-shelf products need to be modified to satisfy operational requirement?
2. Are off-the-shelf products sufficiently transportable in their operational configuration in the theater of operation?
3. Are their suitable products available in sufficient quantities to meet requirements in both peacetime and wartime without unique or separate production runs?
4. Are there support systems, including spare parts and backup capabilities, that satisfy needs for the life of the system? If not, is a one-time buy of support a viable option?
5. What is the extent of competition?
6. Will commercial standards and warranties meet the system's operational, environmental, and maintenance requirements?
7. Are commercial training, operating, and maintenance manuals available and can they be made available for review?
8. Do vendors have a good product and support history? Does the vendor have a history of providing continued parts inventories or production for phased-out models?
9. What configuration management controls exist and are they adequate? What is the average time between model changes?

10. Are commercial distribution channels available and adequate to satisfy requirements in part or in whole?

11. Is the vendor employing reliability, availability, and maintainability design and test disciplines? To what degree do they compare to design and test disciplines normally required for equipment used in the intended environment?

12. What is the status of the technical data package describing the vendor's product? To what extent do proprietary rights apply?

13. How long has the product been produced by the manufacturer?

14. Does vendor testing adequately address the intended military environment or is additional testing necessary to to determine or verify maintenance skill requirements, training requirements, transportability issues, and the use of standard support and test equipment?

V. Summary and Conclusions

This thesis has attempted to present a new AFLC COTS policy which not only considers the unique logistics and maintenance support requirements of COTS, but also recognizes that a unique management approach is needed. The policy now emphasizes the need for a supportability market analysis, early identification of the commercial category, contractor logistics support, and decentralized assignment of item management responsibility.

Chapter II expanded upon the definition and management of COTS computer resources. This chapter defined the spectrum of commercial equipment and emphasized the distinction between true COTS and commercial-type equipment and software. Also as part of this background, a brief discussion of AFLC's COTS support concept along with the current AFLCR 80C-21 FSG-70 policy was presented.

Chapter IV was divided into five sections. Section I analyzed what were perceived to be the major advantages and disadvantages to procuring and supporting general purpose commercial off-the-shelf computer resources. Based on the analysis of Section I, Section II presented a list of critical support topics to be addressed in the new proposed policy. Section II also included COTS acquisition and support policy statements extracted from the service and MAJCOM regulations reviewed which provided solutions to the critical support topics. Section III expanded on COTS management assignments, commercial software data rights, and maintenance alternatives for supporting COTS computer resources. Section IV then consolidated these policies, strategies, comments, and suggestions into a COTS "recommended acquisition and support approach"

listing. This listing, served as the cornerstone for developing the proposed new AFLC COTS policy, presented in Section V.

The remainder of this chapter will focus on the comments received from the AFLC Air Logistics Centers from their review of the proposed new policy and recommendations for follow-on research to this topic.

Policy Review

One of the major problems of developing a policy that intentionally removes management responsibility from one organization and distributes this responsibility to several other is dealing with the political aspects of this decision. When viewed from the perspective of the AFLC FSG-70 item manager, a policy that potentially threatens the viability of this organization and may ultimately reduce or eliminate manning is a policy that should be very strongly opposed. Given these political implications, it was expected that WR-ALC would probably comment unfavorably against the policy and the other ALCs would probably comment in favor of the policy with some suggestions for change. This is exactly what happened. Even though WR-ALC contacted the other ALCs and solicited their support for nonconcurrence on the policy, the only ALC to nonconcur was WR-ALC.

The comments received from the review for the proposed policy by no means represents a corporate AFLC position. A corporate position would probably require several iterations of review, including several HQ AFLC organizations and possibly including comments from the major operating commands. The survey approach taken can be viewed as a modified Delphi technique, where the policy was sent to the ALC Mission Critical Computer Resources (MCCR) focal points who determined which organizations should review and provide comments for their respective ALC. Also, the policy

was reviewed by three headquarters AFLC logistics managers. One manager with extensive mission assignment policy expertise (HQ AFLC/XPXD), a second with over 20 years of experience with mission critical computer resources (HQ AFLC/MMTEC), and the third, with FSG-70 logistics support experience for communication-electronics and space systems (AFLC LOC/SDCS).

The comments and the author's evaluation of the comments follow:

a. OC-ALC concurred with the policy, but had several suggested wording changes (65:1-2):

1. In paragraph 1 change "document" to "chapter."

Evaluation: Concur with comment.

2. Change the title of paragraph 2b from "COTS Equipment" to "COTS Hardware."

Evaluation: Concur with intent. The intent of this comment was to make the title of this definition consistent with the wording used in the policy. Since the policy uses both hardware and equipment interchangeably, in each case, the term hardware should be replaced with the word equipment.

3. Insert in 3e, "ALC/SC" between "local" and "Communications."

Evaluation: Concur with comment. Comment clarifies organizational responsibilities.

4. Delete first sentence in 4a(3).

Evaluation: Nonconcur. Organic support is the least preferred method of supporting COTS computer resources. Sentence may need rewording to clarify intent.

5. In paragraph 4a(8) insert "possible follow-on" between "for" and "organic."

Evaluation: Concur with comment.

6. Delete second sentence of 4a(11).

Evaluation: Concur with intent. The sentence should be modified and be presented as an example.

7. Paragraphs 5a(3) and 5a(4) need to give the user and system manager the flexibility to not incorporate all changes.

Evaluation: Concur with intent. Paragraph 5a(4) should be deleted and the wording of 5a(3) should be modified.

8. Acronym SCCSB should be spelled out in paragraph 5b.

Evaluation: Concur with comment.

9. Clarify the wording and intent of the CRLCMP in paragraph 5e.

Evaluation: Concur with intent. The CRLCMP should identify and document the responsibilities of the organizations involved with COTS replacement.

10. In paragraph 5g delete the word "method."

Evaluation: Nonconcur. There is more than one form of contractor logistics support.

11. Delete paragraph 6a. This paragraph is redundant to paragraph 6b.

Evaluation: Nonconcur. Paragraph 6a is necessary to make a clear distinction between MCCR COTS. Clarification could be made by designating a category one and category two.

b. OO-ALC letter stated, "We feel the content of the rewrite makes sense and we concur with it" (66:1).

Evaluation: Since 1985, OO-ALC has been assigned management responsible for the FSG-70 used in aircrew training devices. This approach has proved very successful and was one of the primary catalyst for decentralizing FSG-70 management responsibility in the policy rewrite.

c. SA-ALC concurred with the policy but suggested four wording changes (70:1).

1. Add to paragraph 3e, "Final approval authority for MCCR acquisitions still remains with the SPM."

Evaluation: Concur with intent. Other ALCs submitted similar comments. The ALCs are concerned that the Information Resources Organizations (SO) are also making an attempt to manage and control weapon system MCCR and thus return to the lengthy procurement process under the provisions of the Brooks Bill. Clarification should be made.

2. In paragraph 5a, change last sentence to read, "Unless cost or time prohibitive as determined by the requiring office, maintenance contracts will:."

Evaluation: Concur with comment.

3. Add to 5a(3), "at the discretion of the user."

Evaluation: Concur with comment. Ultimately, the user has final approval authority on any change to the operational system. By not implementing all vendor's revisions the user also accepts the risk that future updates may not operate or operate correctly in the existing system configuration.

4. Insert in 7e after "users", "and ALC/PM."

Evaluation: Concur with comment. ALC/PM should be involved with the development of contingency plans for supporting COTS computer resources in the event of contractor non-performance.

d. SM-ALC concurred with the policy and recommended the following changes (74:1-2):

1. Break paragraph 2a into more than one sentence.

Evaluation: Concur with intent, but the paragraph is a direct quote from the DOD FAR and should probably be left unchanged.

2. Change the title of paragraph 2d from "Commercially Available Software" to "COTS Software." In the first sentence of the definition insert "Off-the-shelf" prior to "software". Also in the first sentence, insert "vendor or company." after "from a" and delete remainder of the sentence.

Evaluation: Concur in part. The title change and clarification of off-the-shelf is appropriate, but the remainder of the definition is a directly from the DOD FAR and should remain the same.

3. Change the title of paragraph 2e from "Commercial-type Software" to "Customized Software."

Evaluation: Concur with the comment.

4. In paragraph 3b insert "system's" between "in the" and "Program."

Evaluation: Concur with the comment.

5. Paragraph 3e impedes the MCCR acquisition process.

Evaluation: Concur with the comment. The policy detailing the extent of coordination with the SC Communications-Computer System Officer is currently being negotiated between MM and SC. Paragraph 3e depicts the policy as it currently exists.

6. In paragraph 4a(2) clarify, "class of commercial."

Evaluation: Concur with the comment. Comment at the end of the

sentence can include, "(e.g., best commercial practices, commercial-type, or COTS)."

7. In paragraph 4a(3) capitalize the "c", "l", and "s" in the words contractor logistics support.

Evaluation: Concur with comment.

8. Paragraph 4a(5) is too wordy.

Evaluation: Concur with the comment. Paragraph wording can be shortened without changing the context.

9. In paragraph 4a(7), what is meant by "form, fit, and function level."

Evaluation: On a system-by-system basis the form, fit, and function level for COTS will need to be worked out between Air Force logistics planners and the prime contractor and his vendors. Since the Air Force does not control the piece-part configuration of COTS, agreement must be reached between these parties as to which level of breakdown will represent a known and stable configuration. In other words, a dividing line must be worked out to determine which modules or subchassis can be provisioned for sparing and still ensure interchangeability. This agreed to level is the form, fit, and function level.

10. In paragraph 4a(15) insert "in the contract." at the end of the first sentence.

Evaluation: Concur with comment.

11. In paragraph 5a(3) change "Specify that equipment" to "Specify what equipment will."

Evaluation: Concur with comment. Provides the user and the system manager the flexibility to install some or all revision changes.

12. Clarify "range and quantity" in paragraph 5a(6).

Evaluation: Concur with the comment. Rather than clarify, "range and quantity" will be deleted. The sentence should read, "Provide for maintenance of the items in the CLS support package."

13. Recommend deleting Section 6 and moving this guidance to AFLCR 523-1.

Evaluation: Nonconcur. Clarification of the assignment of management responsibility similar to that proposed by HQ AFLC/XPKD needs to be made in section 6. Similar wording should be included in the current draft rewrite of AFLCR 523-1.

14. In the Supportability Market Analysis attachment, recommend deleting second sentence of question 9 and all of 13.

Evaluation: Nonconcur. The average time between model changes and the length the product has been produced are both good indicators of the computer system's configuration stability.

e. WR-ALC non-concurred with the proposed revision in its entirety; stating that the draft, as written and circulated for review, did not reflect comments previously submitted by WR-ALC as recommended changes to the For Comment Draft AFLC COTS Policy, 28 January 88 version (83:1).

Evaluation: As stated above, a reply along this line was anticipated. All of WR-ALC's initial comments were editorial and not policy related. Since very little of the initial draft policy was used in the rewrite, one would expect few editorial comments to still be applicable, which was the case. Although not officially stated, the author believes the nonconcurrence is not based on the exclusion of previously submitted comments, rather the issue here is decentralization of FSG-70 item management responsibility.

f. HQ AFLC/XPXD comments were directed at paragraphs 6a through 6e which discuss the assignment of item and system management responsibilities for FSG-70. Their concern was that these paragraphs seemed to "usurp the Cataloging and Standardization Center's (CASC) FSG identification process during provisioning and the Material Management Aggregation Coding (MMAC) assignment process (54:1).

Evaluation: The intent of these paragraphs was not to circumvent the existing cataloging and assignment process, rather the intention was to clarify that certain categories of mission critical computer resources cataloged and assigned to federal supply group 70 could be more effectively managed if assigned to the next higher assembly manager (see comment b. above). Recommend working with XPXD to clarify the wording in these paragraphs.

g. AFLC LOC/SDCS concurred with the policy as written (10:1).

h. HQ AFLC/MMTEC concurred with the policy with minor changes. MMTEC recommended further guidance be given for using the supportability market analysis attachment. Also, MMTEC proposed that the new policy be used for developing a joint Air Force Logistics Command and Air Force Systems Command (AFSC) COTS computer resources regulation (61:1).

Evaluation: Both comments have merit. The supportability market analysis questions could be tailored into a decision tree or flow chart format to aid managers in making the COTS computer resources procurement decision. The significance of the second comment cannot be overstated. The degree to which the Air Force will benefit from the advantages of using COTS computer resources in military systems is directly related to the quality of planning for COTS logistics support. Therefore, for most

weapon systems, AFLC's COTS support will be a reflection of AFSCs logistics planning. With the exception of the limited COTS computer resources procurement guidance provided in AFR 800-14, no other regulation addresses the detailed logistics planning requirements for COTS computer resources. A joint AFLC/AFSC COTS computer resources regulation would fill this void.

Policy Assessment

Given some minor changes, the proposed policy can have a significant impact on the acquisition and support of COTS computer resources. Although written as an AFLC policy, the policy's greatest payback may come from its development as a joint AFLC/AFSC COTS regulation.

In general, the AFLC review of the proposed policy was very favorable. Since the proposed policy advocates a new management approach some resistance to change should be expected. If the political implications of decentralized management can be overcome, the proposed policy, as modified by the comments and suggestions received, could be implemented following a coordination process review.

Recommended Research

Further study can be performed in two related areas. First, the question of actual life cycle cost savings should be further investigated. Intuitively, up front procurement cost saving would be expected for a COTS acquisition, but from the perspective of life cycle cost the author was unable to locate any reports or studies that had validated the life cycle cost saving for commercial equipment used in weapon system applications.

This finding is somewhat disconcerting considering the maximum use of COTS has already been mandated by public law.

A second area for research would involve identifying the incidence of COTS modification. It was pointed out earlier in this thesis that the advantages associated with using COTS are limited to unmodified commercial off-the-shelf equipment and software. Once modified, the system support costs can quickly skyrocket and special arrangements must be made to assure continued support.

Appendix A: Definitions of Terms

1. Automatic Data Processing Equipment - general purpose, automatic data processing components and the equipment systems created from them, regardless of use, size, capacity, or price, that are designed to be applied to the solution or processing of a variety of problems or applications and are not specifically designed to be applied to the solution or processing of a variety of problems or applications and are not specially designed (rather than configured) for any specific application (12:70.2-1).
2. Agency Procurement Request - a request by a DOD component for the General Services Administration (GSA) to contract for ADPE, commercially available software, or maintenance services or for GSA to delegate the authority to contract for these items (12:70.2-1).
3. Best Commercial Practice - design and fabrication of a product using techniques and parts employed by competent suppliers to the civilian market; conforming to military specifications (MIL-SPEC) or using government standard parts only by coincidence (72:24).
4. Commercial Item - an item developed and used for other than government purposes; sold or traded to the general public in the course of normal business operations and used unchanged (or, "off-the-shelf") when acquired by the government (72:24).
5. Commercial-type Item - a commercial item modified to meet some government-peculiar physical requirement or addition or otherwise identified differently from its normal commercial counterparts (72:24).
6. Configuration - the functional and physical characteristics of hardware/software as set forth in technical documentation and achieved in product (72:24).
7. Contract Maintenance - maintenance performed under contract by private, commercial organizations using contractor personnel and facilities or government furnished material and facilities (9:4).
8. Control Drawing - an engineering drawing that discloses configuration and configuration limitations (i.e., form, fit, and function); performance and test requirements; weight and space limitations; access clearance, pipe and cable attachments, etc., to the extent necessary that an item can be developed or acquired on the commercial market to meet the stated requirements; or, for the installation or co-functioning of an item to be installed with related items. Control drawings are identified as envelope, specification control, source control, altered item, selected item, interface control, and installation control (72:25).
9. Custom Product - a commercial product developed by a vendor who retains the rights to the design, but sells the product exclusively or nearly exclusively to the government (72:24).

10. Delegation of Procurement Authority - a written notification from the General Services Administration to a DOD component in response to an Agency Procurement Request, granting contracting authority to the DOD component (12:70.2-2).

11. Embedded Computer System - a configuration of computer resources which is integral to a defense system and has the primary purpose of controlling, sensing, interpreting, processing, or otherwise assisting the operation of a larger system (38:4).

12. Federal Supply Group (FSG) 70 - commercially available general purpose automatic data processing equipment, components, and the data processing equipment systems configured from them regardless of use, size, capacity or price that are designed to be applied to the solution or processing of a variety of problems and applications and are not specially designed, as opposed to configured, for any specific application. Excluded from this group is general purpose ADPE which, prior to acquisition, is modified to meet Government specifications to the extent that:

- a. It no longer has a commercial market;
- b. It cannot be used to process a variety of problems or applications;
- c. It can be used only as integral part of a non-ADP higher order system (23:38).

13. Form, fit, function (F3) - the descriptors that permit the fabrication of an interchangeable item by any competent manufacturer in the trade without disclosing internal design detail. Generally expressed in the various types of Level 3 control drawing (72:25).

14. F3 Level - in the hierarchy of engineering data, the level above which detailed design is disclosed (full design disclosure); at which form, fit, and function are depicted by control drawings (F3); and below which there can be expected to be no design disclosure (72:25).

15. Full Design Disclosure - in engineering data, Level 3 drawings that set forth internal design detail sufficiently complete that any competent manufacturer in the trade can fabricate an essentially identical item without recourse to the original designer. Coverage is usually down to the piece part and detailed manufacturing process (72:25).

16. Item Management - the functions, processes, disciplines, and assignments directly devoted to selecting, acquiring, and maintaining, controlling inventory, and maintaining materiel support for an item. Typically it includes materiel requirements, budgeting, item repair scheduling, service engineering, directing distribution, initiating procurements, inventory planning, item utilization, disposition, and modification (37:10).

17. MIL-SPEC - having to do with, or under the control of U.S. military or government specifications or standards; militarized (72:25).

18. Organic Maintenance - maintenance performed by the Air Force using government-owned or controlled facilities, equipment, and military and/or civilian government personnel (9:4).

19. System Management - the Air Force concept for the technical and business management of a particular system based on the principles of decentralized management and the use of a designated single management authority. The management authority is responsible for projecting required resources, time-phasing/scheduling actions and tasks to other involved activities, issuing program direction and authorizations, reporting performance and resource utilization, and providing managerial and operational decisions (37:12).

COMMERCIAL OFF-THE-SHELF (COTS) COMPUTERS,
PERIPHERAL, AND SOFTWARE (FSG-70)

7-1. Scope. This chapter describes the acquisition and operational support for commercial off-the-shelf computers, associated peripherals and software.

7-2. Terms Explained:

a. FSG-70 Equipment. Commercial off-the-shelf devices or a collective set of these devices, regardless of use, size, capacity, or price, that can be applied to the solution or processing of a variety of problems or tasks and aren't specifically designed, as opposed to configured, for any specific ECS application. The H2-1/H2-2 Cataloging Handbooks, FSG-70, have examples of equipment included in this category. Commercial off-the-shelf devices satisfy specific system, development or product specification requirements of a major or less-than-major weapons system, especially support systems. These devices may or may not be common with other major systems or ECS subsystems or a major system.

b. Non-FSG-70 Equipment. Commercial off-the-shelf equipment which prior to acquisition is specifically designed or redesigned either partially or totally, as opposed to configured, for a peculiar ECS application. This equipment may or may not have a commercial market and:

- (1) The item can't be used to process a variety of applications in its current design or configuration; or,
- (2) The item can be used only as an integral part of higher order

system that isn't itself an FSG-70.

c. FSG-70 Software. Software provided by the manufacturer (vendor) of the commercial off-the-shelf devices that hasn't been designed, redesigned, or supplemented for a particular application. Examples are executive, compiler, and some diagnostic programs. For a detailed definition, see AFR 300-2, attachment 2, paragraph 2i(1). Any software that satisfies unique design requirements of a particular major system application (that is, operational software) is excluded.

d. Non-FSG-70 Software. Commercial software that has been designed, redesigned, or supplemented for a specific application.

7-3. Policy:

a. FSG-70 and non-FSG-70 equipment including software is type-designated according to MIL-STD-196.

b. WR-ALC/MMI manages FSG-70 equipment. Non-FSG-70 equipment may be managed by the applicable SM/IM with the next higher assembly (for example, non-FSG-70 equipment for an ISF may be managed by the ISF manager) based upon a decision tree analysis conducted by the SM/IM. The responsible management organization controls and maintains current required engineering and user documentation. It also manages and obtains funding for the logistics support and maintenance of assigned equipment. Logistics support requirements are identified in the applicable major systems CRISP and O/S CMP.

c. When a non-FSG-70 no longer satisfies the definition to be identified as a non-FSG-70 item, management responsibility transfers from the SM/IM to WR-ALC/MMI. Logistics support and funding requirements for that item are negotiated. Transfers are on a case-by-case basis according

AFLCR 523-1. Support agreements and requirements between the losing SM/IM and WR-ALC/MMI are documented in the Applicable CRISP and O/S CMP. The updated CRISP and O/S CMP must address funding, documentation, and timeliness of support. WR-ALC/MMI controls the engineering and user documentation of the transferred equipment. Transferred non-FSG-70 equipment is reclassified as FSG-70 equipment and supported/funded accordingly. WR-ALC/MMI submits the required DD Forms 61, Request of Nomenclature.

d. AFALD, before PMRT and the SM/IM, after PMRT, must coordinate with WR-ALC/MMI and identify planning and CRWG meetings to the responsible equipment management organization. The responsible management organization provides AFALD or the SM/IM, as appropriate, its logistics support requirements (for example, documentation requirements). AFALD and the SM/IM must obtain and ensure inclusion of these logistics support requirements in the applicable CRISP, O/S CMP, and contractual documents applicable to the system being acquired.

e. Before non-FSG-70 equipment is acquired or replaced, management organizations must coordinate with and obtain recommendations from WR-ALC/MMI. Recommendations by WR-ALC/MMI must be based on current inventoried and baselined FSG-70 equipment. Recommended FSG-70 equipment must satisfy the applicable requirements. The management organization initiating the request for the WR-ALC/MMI recommendation will make the determination whether to accept the recommendation or not. When a WR-ALC/MMI FSG-70 item is selected as the replacement, WR-ALC/MMI must acquire the replacement (FSG-70) equipment. In this case, WR-ALC/MMI

controls and maintains the applicable specifications and interface control documents.

f. Procurement requirements are processed under the acquisition policies of AFR 800-series regulations.

g. Appropriate managers:

(1) Maintain configuration of non-FSG-70 and FSG-70 items according to AFR 57-4, paragraph 21(2) and (3) and AFLCR 57-21, chapters 4 and 5.

(2) Provide support as required by the applicable O/S CMP and CRISP.

h. Non-FSG-70 and FSG-70 items acquired under AFR 800-series procedures don't require a Delegation of Procurement Authority (DPA) if they meet the guidelines in the interim DOD-wide criteria for acquiring ADPE and ADP services under 10 USC 137 Section III (Armed Forces Procurement Act) and 40 USC 795 Section III, (the Brooks Act) Attachment 3 or the program management directive (PMD) states that a DPA isn't needed.

i. An AFLC Form 75 must be prepared and processed through the CPCSB for FSG-70 software acquisition and changes.

7-4. Concept of Operation:

a. System Acquisitions:

(1) AFALD identifies requirements for commercial off-the-shelf equipment to the appropriate management organization, as early as possible. AFALD also ensures that MIL-STD-196 and DD Form 61 submittals are contractually required for all equipment. AFALD ensures that design requirements which qualify equipment/software classification as non-FSG-70 are specifically defined.

(2) Non-FSG-70 and FSG-70 equipment organizations:

(a) Program and fund follow-on logistics and engineering support of assigned items.

(b) Take part in CRWG meetings, formal reviews, data calls, and audits as directed in AFR 800-14.

(c) Take part in equipment testing, as required.

(d) Comply with policies and procedures for CM and inventorying item as prescribed in Chapter 11.

(e) Make sure the item's delivered configuration is current with the manufacturers current revision level.

b. Operational Support. Non-FSG-70 and FSG-70 equipment management organizations:

(1) Provide support as defined in the applicable CRISP, O/S CMP, and this regulation.

(2) Maintain, control, and ensure currency of engineering and user documentation, hardware, and software. Currency will be to the degree required by the major system SM/IM and users. Interface responsibility for an item is that it satisfies interface control drawings requirements applicable to that item. The SM/IM makes sure the item satisfies engineering documentation requirements. Software changes that cross an interface or have an interface impact are approved or disapproved by the major system CPCSB or CCB, as appropriate.

(3) Are members of the CCB/CPCSB for systems that use their item.

(4) Obtain item support. When a vendor will no longer provide support for an item, the responsible SM/IM investigates the available alternatives (that is, alternate support sources, acquisition of a

replacement item, acquisition of spares for the life of the item, acquisition "hot spare", acquisition of used functional components/boards/computers, etc) to provide the necessary support. The alternative selected must be the most economical and satisfy the item and system support, engineering documentation, and user documentation requirements.

(5) Obtain appropriate engineering support.

(6) Identify, define, and document all modifications/changes.

Procedures of this regulation and AFLCR 57-21 apply. SM/IMs identify and define all system modification/changes which affect another IM item, and notify that IM. The affected IM must provide recommendations within applicable time frames (AFLCR 66-15 and O/S CMP) to the SM/IM.

Recommendations address the planning and programming requirements for accomplishing that item's portion of the modification/change.

(7) Identify on the AFLC Form 775, USAF Class IV Modification Budgetary Requirement, the requirements for (1) item hardware, peripherals, and/or software; (2) engineering documentation requirements; (3) user documentation requirements. SM/IM provide this information to non-FSG-70 and FSG-70 managers at the time of AFLC Form 775 preparation.

(8) Establish material improvement projects (MIP) to process MDRs for changes/developments to item hardware and software.

(9) Use the appropriate type of TCTO to announce changes to item hardware and software configuration items. The TCTO must reference the vendor's service requirement document and authorize work to be accomplished according to the vendor document, if applicable.

(10) Provide technical support and representatives to the CRWG;

design and technical meetings; and CRISP, O/S CMP, PMD, etc development revision.

(11) Advise users of approved vendor modifications/changes to hardware and software.

(12) Contract for contractor maintenance of spares and incorporation of contractor-developed improvements/changes to the item or its components.

Appendix C: For Comment Draft AFLC COTS Policy, 28 January 1988

COMMERCIAL OFF-THE-SHELF (COTS) COMPUTERS

PERIPHERAL AND SOFTWARE (FSG-70)

1. Scope. This document describes acquisition and support policies and responsibilities for Commercial Off-The-Shelf computers, associated peripherals and software. It applies to Mission Critical Computer Resources procured and managed under the AFR 800 series regulations.

2. Terms Explained:

a. FSG-70 Equipment. Commercial Off-The-Shelf (COTS) devices or a collective set of COTS devices, regardless of use, size, capacity, or price, that can be applied to the solution or processing of a variety of problems or tasks and are not specifically designed, as opposed to configured, for any specific Mission Critical Computer Resources (MCCR) application. The H2-1/H2-2 cataloging handbooks, have examples of equipment included in this category. Commercial Off-The-Shelf devices satisfy specific system, development or product specification requirements of a major or less-than-major weapons system, especially support systems. These devices may or may not be common with other major systems or MCCR subsystems of a major system. This definition specifically excludes any COTS computer resources which have been altered in any manner from the vendor's commercial version to satisfy a particular application.

b. Non-FSG-70 Equipment. COTS equipment, designed to military specifications, and/or for a specific application, or that has been modified to the extent it no longer has commercial application is excluded

from management as FSG-70 COTS.

c. FSG-70 Software. COTS software that has not been designed, redesigned, supplemented or altered in any way for a particular military application.

d. Non-FSG-70 Software. COTS software that is designed, redesigned, supplemented or altered in any way for a specific military application.

3. Policy:

a. It is essential that FSG-70 COTS computer resources be correctly identified/cataloged as outlined in paragraph 2 above. The configuration of COTS equipment and software is controlled by commercial markets and independent contractor/vendor action rather than by the Air Force. Prompt logistics support and maintenance is dependent on maintaining COTS equipment at the latest revision level. There are three basic elements of logistics activity associated with FSG-70 COTS computer resources that must be provided by the appropriate COTS management activity. These are:

(1) Subscription Services. This is a contractual arrangement with the manufacturer or vendor of acquired COTS equipment and software to provide for notifications to WR-ALC/MMI, System Program Managers, and users of changes to acquired COTS.

(2) Acquisition and Implementation of Changes. These are Engineering Change Orders (ECOs) or Field Change Orders (FCOs) derived from subscription services.

(3) Operational Support/Maintenance. These elements must be addressed in the Computer Resources Life Cycle Management Plan (CRLCMP) by the assigned management activity.

b. AFLC will determine COTS Depot Maintenance Sources of Repair (SOR)

according to Decision Tree Analysis (DTA) procedures contained in AFR 66-7, and Depot Maintenance Interservicing (DMI) procedures contained in AFLCR 800-30. Technology Repair Center (TRC) assignments for items and equipment determined to be candidates for accomplishment will be made through the AFLC posture planning process.

c. Unless mission requirements dictate organic support, competitive commercial practices will be used in maintaining FSG-70 resources. This entails:

(1) Contracts will specify that hardware and vendor software will be maintained at the current revision level.

(2) Contract Logistics Support (CLS) contracts will be written in coordination with users and specify the user's requirements.

(3) When Organizational and Intermediate (O&I) level maintenance support is included in AFLC contracts it will normally be budgeted and funded by the using command with funding transferred to AFLC through a Military Interdepartmental Purchase Request (MIPR, DD FORM 448) to pay for the contractual work required. AFLC will continue to budget and fund for depot maintenance logistics support.

(4) Contracts will provide multiple-year coverage specifying user-defined operational effectiveness levels and penalties when effectiveness drops below contracted levels of support.

(5) If the system support concept calls for full CLS (O&I, Depot and Supply), then commercial engineering and technical data will be acceptable for FSG-70 equipment support. Otherwise, engineering and technical data will be screened to determine if it is adequate to support the selected maintenance concept.

d. Recompetition of FSG-70.

(1) For systems with planned life cycles longer than five years, recompetition for follow on logistics support and modification contracts is required by AFR 800-35, AF Competition Advocate Program. To provide the capability to recompute CLS for FSG-70 equipment, the Air Force will purchase a CLS support package which includes the minimum number of support resources (e.g., spares, support equipment and data) required to provide future recompetition of logistics support. This includes complex long lead type items. Normally, items and materials readily available on the commercial market will not be included in the CLS support package. Instead they will be the contractor's responsibility under the CLS contract, although, maintenance and support concepts may dictate that the Air Force own spares.

(2) The CLS contract will provide for maintenance of the established range and quantity of items in the support package. This includes repair, replenishment, update, calibration as applicable and general maintenance. In this way, the items in the support package will be available in the latest configuration to transfer to a succeeding contractor if another contractor wins the support contract.

e. WR-ALC/MMI, in conjunction with the user, will develop contingency plans for supporting FSG-70 resources in the event of contractor non-performance.

f. Unless the mission dictates otherwise, FSG-70 equipment and software not currently supported by CLS will be phased into a method of CLS.

g. WR-ALC/MMI will manage FSG-70 resources as defined above.

Non-FSG-70 resources will be managed by the applicable weapon system SPM/IM and cataloged with the next higher assembly. For example, non-FSG-70 equipment that is part of, or applicable to a NHA or Integration Support Facility (ISF) will be stocklisted with the NHA stock class or ISF and managed by the applicable weapon system SPM/IM Federal Supply Class (FSC) residual manager. The SPM/IM controls and maintains current the required engineering and user documentation. It also manages and obtains funding for the logistics support and maintenance of assigned equipment.

h. Changes in Application

(1) Prior to PMRT, when an FSG-70 COTS item is modified, in any way so that the item no longer satisfies the definition of FSG-70 COTS or has been directed in the Program Management Directive (PMD) to the Next Higher Assembly (NHA) SPM/IM, management responsibility will be Materiel Management Acquisition Coded (MMAC) to the NHA SPM/IM. The gaining NHA SPM/IM will assume control of the engineering and user documentation of the transferred non-FSG-70 item.

(2) After PMRT when an FSG-70 COTS item is modified or altered in any way so that the item no longer satisfies the definition of FSG-70 COTS, management responsibility transfers from WR-ALC/MMI to the NHA SPM/IM. Support and funding requirements for that item will be negotiated between WR-ALC/MMI and the gaining SPM/IM on a case-by-case basis in accordance with AFLCR 523-1, and results will be documented in the applicable CRLCMP. The updated CRLCMP will include funding, documentation and timeliness of support. The gaining NHA SPM/IM will assume control of the engineering and user documentation of the transferred non-FSG-70 item.

(3) When a non-FSG-70 item no longer satisfies the definition of a non-FSG-70 item, management transfers from the NHA SPM/IM to WR-ALC/MMI. Support and funding requirements for that item will be negotiated with WR-ALC/MMI on a case-by-case basis in accordance with AFLCR 523-1, and the results will be documented in the applicable CRLCMP. The updated CRLCMP will include funding, documentation, and timeliness of support. WR-ALC/MMI will assume control of the engineering and user documentation of the transferred COTS equipment, and will update the CRLCMP.

i. AFALC (assigned DPML) before PMRT, and the SPM/IM, after PMRT, will coordinate with and identify FSG-70 COTS requirements for a determination of support philosophy by the responsible management organization (Ref para 3g). This determination will be reviewed at planning and CRWg meetings and provided to the applicable CRLCMP by the appropriate management organization, WR-ALC/MMI for FSG-70 COTS and the applicable SPM/IM for non-FSG-70. The DPML and the SPM/IM must also ensure inclusion of these logistics support requirements in the contractual documents applicable to the system being supported.

j. Before FSG-70 COTS equipment is acquired or replaced, management organizations will coordinate with and obtain recommendations from WR-ALC/MMI. Recommendations by WR-ALC/MMI must be based on current inventoried and baselined FSG-70 equipment and satisfy requirements. The management organization initiating the request will make the determination whether to accept the recommendation or not. When a WR-ALC/MMI managed FSG-70 stocklisted item is selected as the replacement, WR-ALC/MMI will budget for and acquire the replacement equipment. In this case, WR-ALC/MMI

controls and manages the logistics support of the FSG-70 equipment only. The SPM/IM will be responsible for and control application software and computer interface/integration requirements and documentation.

k. The SPM/IM will accomplish modification of non-FSG-70 items according to AFR 57-4 and AFLCR 57-21. All non-FSG-70 modifications must be identified and distributed using a TCTO in accordance with TO 00-5-15, paragraph 1-1c. The NHA SPM/IM manager will take necessary action to ensure continued receipt of subscription service bulletins through contractual action.

1. Dependent on the type of support provided by the commercial manufacturer, WR-ALC/MMI will maintain configuration of FSG-70 equipment as follows:

(1) Contractually arrange for notification of revision level changes through subscription services with the FSG-70 COTS manufacturers or vendors.

(2) When appropriate, budget for modification funding using procedures of AFLCR 57-21. See paragraph 4i above.

(3) Programmed Depot Level Maintenance (PDLM) or CLS will also be used as appropriate by WR-ALC/MMI for incorporation of vendor FCOs and ECOs at the authorized sites for modernization, conversion, or depot level maintenance or integration of COTS equipment.

(4) Certify that all vendor prepared Service Bulletins (FCOs/ECOs) satisfy engineering requirements and that those changes crossing an interface or having interface impacts are approved or disapproved by the weapon system and user CCBs and SCCSBs. All vendor changes will require a system level test and approval before installation.

Specific procedures for accomplishing this test should be determined between the weapon system SPM/IM and WR-ALC/MMI and included in the applicable CRLCMP.

m. Non-FSG-70 and FSG-70 general purpose computers as defined in AFR 700-4, Vol II, paragraph 1-5b(5), which are to be acquired under AFR 800-2, AFR 800-14, and DOD-STD-2167 procedures, do not require a Delegation of Procurement Authority (DPA) if they have been designated as MCCR according to procedures in AFR 700-4, Vol II, paragraph 3-4b.

n. An AFLC Form 75, Computer Program Configuration Sub-Board Item Record, will be prepared and processed through the Software Configuration Control Sub-Board (SCCSB) for COTS software acquisitions and changes.

4. Concept of Operations:

a. System Acquisition:

(1) AFALC (DPML) will:

(a) Identify requirements for COTS computer equipment and software to the appropriate management organization, as early as possible in the acquisition process. Subsequently, WR-ALC/MMI will provide the necessary logistics requirements for new FSG-70 COTS acquisitions.

(b) Ensure that subscription service submittals are contractually required for all equipment.

(c) Ensure that design requirements which qualify equipment and software classification as non-FSG-70 are specifically defined.

(d) Ensure the SPO maintains configuration of COTS resources at vendor latest approved revision levels through contractual subscription service and appropriate contractual logistics support action as necessary to ensure the revision level of the commercial manufacturer's or vendor's

equipment is current at PMRT.

(e) Ensure economy benefits are realized through equipment life expectancy by procuring necessary subscription services and CLS in multi-year increments. Such contract management will be transferred to the supporting command after PMRT date for follow on logistics support.

(2) FSG-70 management Organizations will:

(a) Program for and fund follow-on logistics and engineering support of assigned items.

(b) Take part in formal reviews, data calls, and audits as directed in AFR 800-14 and this regulation.

(c) Take part in equipment testing as required.

(d) Maintain configuration and current inventory of equipment and software at vendor's latest approved revision level through contractual subscription service and appropriate contractual logistics support action.

b. Operational Support. Non-FSG-70 and FSG-70 management organizations will:

(1) Provide support as defined in the applicable CRLCMP and this directive. Provide for maintenance of spares, on-site depot level repair, Programmed Depot Level Maintenance (PDLM) and CLS.

(2) Maintain hardware and software, control changes, and ensure currency of engineering, commercial, and user documentation, hardware, software, and interfaces. Currency will be to the degree required by the weapon system SPM/IM and users. It must be recognized that effective logistics support from the commercial manufacturer or vendor may be provided only for the current commercial revision level. Currency of

interface means that the items changed satisfy interface control drawing requirements applicable to that item. The SPM/IM makes sure the item satisfies engineering documentation requirements.

(3) Are members of the CMB/SCCSBs for systems which use their item.

(4) Obtain item support. When a vendor no longer provides support for an item, investigate the available alternatives to provide the necessary support. That is, identify alternative support sources for acquisition of high failure components, spares for life of the item, used functional components, boards and computers or replacement of the item. The alternative selected must be the most economical, and it must satisfy the requirements for system support, engineering documentation and user documentation. When replacement of COTS equipment becomes necessary, the operating or application software may be affected. The CRLCMP will identify the management organization that will initiate and integrate the change, and make the final determination as to what equipment is and is not acceptable as a replacement.

(5) Identify, define, and document all modifications and changes. SPM/IMs identify and define all system modifications and changes, and notify other IMs of modifications and changes which affect other IMs. The affected IM must provide recommendations within time frames specified in AFLCR 66-15 to the SPM/IM, and will address planning and programming requirements for accomplishing modification or change of the affected item.

(6) When Class IV modification action is appropriate, identify requirements for item hardware, peripherals, software, and engineering and

user documentation in the appropriate funding documents at the time of budget preparation. That is, prepare AFLC Form 775 (BP1100) or P Series Form (BP8300) and AFLC Form 48 to obtain CCB approval of COTS resources modifications in accordance with AFR 57-4 and AFLCR 57-21. Vendor prepared service bulletins used as ECOs or FCOs may be used as installation instructions for FSG-70 modifications by assigning these a TCTO and data code number, issue and recession date and authority line.

(7) Establish Materiel Improvement Projects (MIP) to process Materiel Deficiency Reports (MDRs) and changes/developments to item hardware and software.

(8) Use appropriate type of Time Compliance Technical Order (TCTO) to announce changes to COTS hardware and software configuration items. The TCTO must reference the vendor service requirement document and authorize work to be accomplished according to the vendor document, if applicable.

(9) Provide representatives and technical support to the CRWG, design and technical meetings, and assist in development and updating of CRLCMP and PMD.

(10) Although budgeting and funding of licensing fees is considered to be an O&I expenditure, when given sufficient lead time, the SPM/IM in coordination with the user may assume this responsibility. The following budgeting and funding procedures apply for licensing fees of COTS:

- (a) Fund with EEIC 592TB when acquiring software only.
- (b) Fund with Other Procurement (57*3080) when acquiring a

system that includes both hardware and software (AFR 172-1, Vol I, Para 10-65).

(c) Funding requirements are included in the annual POM, Budget Estimate Submission (BES), and the financial plan.

Bibliography

1. Air Force Acquisition Logistics Center, Air Force Logistics Command. AFALC Lessons Learned Bulletin Commercial Off-The-Shelf (COTS). AFALC/LSL Directorate of Systems Support, Wright-Patterson AFB OH, 1988.
2. Air Force Audit Agency. Follow-up Audit -- Maintenance Alternatives for Automatic Data Processing Equipment. Project 5195417. Washington: Government Printing Office, 3 June 1986.
3. Brady, Sharon E. "Getting a Hand on Maintenance Costs," Datamation, 33: 63+ (15 August 1987).
4. Burns, Capt Thomas J. "AFLC Management of Commercial off-the-shelf (COTS) Computer Resources." HQ AFLC/MMT briefing to HQ AFLC/CV. Wright-Patterson AFB OH, May 1988.
5. Carlquist, Lt Col Jerry C. Comments to Proposed FSG-70 Policy. LOGNET1.UUCP Message. 26 November 1985.
6. Carson, Charles. "WR-ALC/MMI Management of Commercial Computers and Peripherals (FSG-70)." WR-ALC/MMI briefing to WR-ALC/MM. Robins AFB GA, 22 June 1984.
7. Carson, Charles. "WR-ALC/MMI Management of Commercial Computers and Peripherals (FSG-70)." WR-ALC/MMIM briefing to HQ AFLC/MME. Robins AFB GA, 1985.
8. Childress, Col James S. "Contractor Logistics Support (CLS) of Commercial Off-The-Shelf (COTS) Computers/Peripherals (FSG-70)." WR-ALC/MMI briefing to HQ AFLC/MM. Robins AFB GA, 1988.
9. Childress, Major Robert E. Contractor vs Organic Maintenance for Space Command Automatic Data Processing Equipment. MS Thesis, AFIT/GLM/LSM/85S-13. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1985 (AD-A162-307).
10. Cutler, George, Communication-Electronics and Space Systems Logistics Manager. Personal interview. AFLC LOC/SDCS, Wright-Patterson AFB OH, 1 August 1988.
11. Debastiani, Col Richard J. Computers on the Battlefield. National Security Affairs Monograph Series 83-5. Washington: National Defense University Press, 1983.

12. Department of Defense. Acquisition and Logistics Support of Nondevelopmental item (NDI). DOD Directive 5000.37. Washington: Government Printing Office, 25 September 1987.
13. Department of Defense. DOD Federal Acquisition Regulation Supplement Part 7C -- Acquisition of Computer Resources. Washington: Government Printing Office, 6 January 1986.
14. Department of Defense. National Supply System. DOD Directive 5030.47. Washington: Government Printing Office, 27 May 1971.
15. Department of the Air Force. Air Force Budgeting and Procedures. AFR 172-1, Vol I (C1). Washington: HQ USAF, 15 August 1987.
16. Department of the Air Force. Air Force Participation in the Federal Catalog System. AFR 72-1. Washington: HQ USAF, 26 October 1985.
17. Department of the Air Force. Information Systems Program Management. AFR 700-4 Vol I. Washington: HQ USAF, 15 March 1985.
18. Department of the Air Force. Information Systems Acquisition and Major Automated Information System Review Requirements. AFR 700-4 Vol II. Washington: HQ USAF, 15 March 1985.
19. Department of the Air Force. Information Systems Requirements. AFR 700-7. Washington: HQ USAF, 15 December 1986.
20. Department of the Air Force. Lifecycle Management of Computer Resources in Systems. AFR 800-14. Washington: HQ USAF, 29 September 1986.
21. Department of the Air Force. Management of Air Force Information Systems. AFR 700-1. Washington: HQ USAF, 2 March 1984.
22. Department of the Air Force. Secretary of the Air Force Order. SAF 560.1. Washington: HQ USAF, 4 December 1978.
23. Department of the Army. Federal Supply Classification Part 1 Groups and Class. Cataloging Handbook H 2-1. Battle Creek MI: Defense Logistics Agency and Defense Logistics Center, December 1986.
24. Department of the Army. Integrated Logistics Support. AR 700-127. Washington: HQ ARMY DCS Logistics, 16 January 1987.

25. Department of the Army. Army Materiel Maintenance Concepts and Policies. AR 750-1. Washington: HQ ARMY, 15 April 1983.
26. Department of the Navy. Life Cycle Management of Mission-Critical Computer Resources (MCCR) For Navy Systems Managed Under the Research, Development, and (RDA) Process. OPNAV Instruction 5200.28. Washington: Chief of Naval Operations, 25 September 1986.
27. Ely, E.S. "Third-Party Maintenance Grows Up," Datamation, 32: 121-124 (15 September 1986).
28. Eparza, Mary S. "Computer Maintenance: Bypassing Politics," Infosystems, 34: 51-53 (September 1987).
29. Ferens, Daniel V. Class handout distributed in AMGT 553, Software Project Management. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 1988.
30. Fisher, C. "Commercial Product Support." ESD/PLL-S Briefing. Hanscom AFB MA. 1988.
31. General Accounting Office. Effective Management of Computer Leasing Needed to Reduce Government Costs. GAO/IMTEC-85-3. Washington: Government Printing Office, 21 March 1985.
32. General Accounting Office. Conversion: A Costly, Disruptive Process That Must be Considered When Buying Computers. FGMSD-80-35. Washington: Government Printing Office, 3 June 1980.
33. Headquarters Air Force Logistics Command. AFLC Federal Acquisition Regulation Supplement. 17.7402-91 Provisioning of Commercial End Items. Wright-Patterson AFB OH: HQ AFLC, 30 May 1986.
34. Headquarters Air Force Logistics Command. Draft Mission Assignment Policy. AFLCR 523-1. Wright-Patterson AFB OH: HQ AFLC, 1988.
35. Headquarters Air Force Logistics Command. Information Systems Program Management. AFLC Supplement 1 AFR 700-4, Vol I. Wright-Patterson AFB OH: HQ AFLC, 21 May 1986.
36. Headquarters Air Force Logistics Command. Information Systems Acquisition and Major Automated Information System Review Requirements. AFLC Supplement 1 AFR 700-4, Vol II. Wright-Patterson AFB OH: HQ AFLC, 10 July 1987.
37. Headquarters Air Force Logistics Command. Logistics Management Policy. AFLCR 400-1. Wright-Patterson AFB OH: HQ AFLC, 10 February 1978.

38. Headquarters Air Force Logistics Command. Management and Support Procedures for Computer Resources Used in Defense Systems.
AFLCR 800-21. Wright-Patterson AFB OH: HQ AFLC, 21 January 1983.
39. Headquarters Air Force Logistics Command. Mission Assignment Policy. AFLCR 523-1. Wright-Patterson AFB OH: HQ AFLC,
10 August 1977.
40. Headquarters Air Force Systems Command and Headquarters Air Force Logistics Command. LifeCycle Management of Computer Resources in Systems. AFSC/AFLC Supplement 1 AFR 800-14. Andrews AFB MD and Wright-Patterson AFB OH: HQ AFSC and HQ AFLC, 14 September 1987.
41. Headquarters Naval Materiel Command. Master Plan for Embedded Computer Resources. Washington: HQ NMC, April 1982.
42. Headquarters Strategic Air Command. Communications-Computer Systems Requirements Board (CSRB). SAC Supplement 1 AFR 700-5.
Offutt AFB NE: HQ SAC, 22 February 1988.
43. Headquarters Strategic Air Command. Information Systems Planning. SAC Supplement 1 AFR 700-2. Offutt AFB NE: HQ SAC, 27 December 1985.
44. Headquarters Strategic Air Command. Information Systems Program Management. SAC Supplement 1 AFR 700-4, Vol I. Offutt AFB NE: HQ SAC, 9 February 1987.
45. Headquarters Tactical Air Command. Draft Tactical Air Forces Wartime Computer Support Concept. Langley AFB VA: HQ TAC,
13 April 1988.
46. Headquarters, US Army Materiel Command. Management of Computer Resources in Battlefield Automated Systems. Draft AMC-R 70-16A.
Washington: HQ AMC, 3 July 1987.
47. Headquarters, US Army Materiel Command and HQ, US Army Training and Doctrine Command. Materiel Acquisition Handbook AMC TRADOC 1987. AMC Pamphlet 7C-2 TRADOC Pamphlet 70-2. Washington: HQ AMC, 1987.
48. Headquarters, US Army Materiel Development and Readiness Command. Management of Computer Resources in Battlefield Automated Systems. DARCOM-R 70-16. Washington: HQ DARCOM, 16 July 1979.
49. HQ AFCC/AI. "Commercial Off-the-Shelf (COTS) Acquisition Policies and Procedures." Letter to SM-ALC/MM, 1 February 1988.
50. HQ AFLC/ACB. "Mission Critical Computer Resources (MCCR) FSG-70 Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTEC, 24 March 1988.

51. HQ AFLC/CC. "Communications-Computer System Management." Letter to Air Logistics Centers, 18 February 1988.
52. HQ AFLC/CV. "Command ADP Program Single Manager." Letter to Air Logistics Centers, 24 September 1979.
53. HQ AFLC/XPX. "Review and Comments on MCCR FSG-70 Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Memorandum to HQ AFLC/MMT, 23 February 1988.
54. HQ AFLC/XPXD. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 27 July 1988.
55. HQ AFLC/XR. "Aircrew training Device (ATD) Computer Management." Letter to OO-ALC/MM, 1 February 1985.
56. HQ AFSC/ALR. "Acquisition and Management of Computer Resources." Staff Summary Sheet, 22 September 1983.
57. HQ AFSPACECOM/LK. "Contractor Logistics Support (CLS) of Commercial Off-the-Shelf (COTS) for Space Defense Operations Center (SPADOC)." Letter to HQ AFLC/MM, 7 October 1987.
58. HQ LOC/SD. "Comments to AFLCR 800-21, Chapter 7 Mission Critical Computer Resources (MCCR) FSG-70 Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to LOC/AT, 23 March 1988.
59. "IBM Moves Press Svc. Firm Margins," Electronic News, 33: 20 (28 September 1987).
60. Joint Logistics Commanders. Final Report of Joint Logistics Commanders' Workshop on Post Deployment Software Support (PDSS) for Mission Critical Computer Software. Vol II Workshop Proceedings. June 1984.
61. Kvenvold, Daniel, Mission Critical Computer Resources Logistics Manager. Personal interview. AFLC LCC/SDCS, Wright-Patterson AFB OH, 4 August 1988.
62. Logistic Operations Center, Air Force Logistics Command. "Commercial Off-the-Shelf (COTS) Equipment." LOC/CF letter to HQ AFLC/MMA. Wright-Patterson AFB OH, 14 August 1985.
63. Martin, Ann C. and Kevin Deasy. Seeking the Balance Between Government and Industry Interests in Software Acquisitions. Volume I: A Basis for Reconciling DOD and Industry Needs for Rights in Software. Software Engineering Institute Technical Report CMU/SEI-87-TR-13, ESD/TR-87-114. Pittsburgh PA: Carnegie Mellon University, June 1987.

64. Matson, Cynthia H. and James F. McIn. Implications of NonDevelopmental Item Systems Acquisition for DOD Logistics Support. Logistics Systems Analysis Office (LSAO) report to the Deputy Assistant Secretary of Defense (Logistics) (DASD(L)). Washington DC, 30 December 1986.
65. OC-ALC/MMMM. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 12 August 1988.
66. OO-ALC/MMMM. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 2 August 1988.
67. OO-ALC/MMMMP. "Mission Critical Computer Resources (MCCR) FSG-70 Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTEC, 30 March 1988.
68. Presidents Blue Ribbon Commission on Defense Management. Interim Report to the President. Washington: Government Printing Office, 28 February 1986.
69. Procell, Bill. Management of Mission Critical Computer Resources in Space Systems. SM-ALC/MMA briefing to HQ AFLC/MM. Wright-Patterson AFB OH: HQ AFLC, 1988.
70. SA-ALC/MMMM. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 3 August 1988.
71. SA-ALC/MMMMP. "Mission Critical Computer Resources (MCCR) FSG-70 Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTEC, 23 March 1988.
72. Sacramento Air Logistics Center, Air Force Logistics Command. "Commercial Equipment Acquisition Handbook." SM-ALC/MMA Draft 2. McClellan AFB CA, 30 June 1987.
73. SM-ALC/MMM. "Proposed AFLC Logistics Support Concept for FSG-70 Commercial Off-the-Shelf (COTS) Computers." Letter to HQ AFLC/MMA, 30 September 1985.
74. SM-ALC/MMML. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 11 August 1988.
75. Secretary of the Air Force, Headquarters United States Air Force. "Draft Non-Development Item (NDI) Handbook." SAF/AQXA letter with 1 attachment. Washington DC, 1 March 1988.

76. Space Division, Air Force Systems Command. Minutes of IBM Maintenance Meeting (Attachments 1): Summary of Discussions with DPMLs on IBM Support. Los Angeles AFS CA, 5-6 September 1984.
77. TRW Defense and Space Systems Group. A Study of Embedded Computer Systems Support. Vol II Selected ECS Support Issues: Recommendations Alternatives (CDRL 02A), September 1979 - September 1980. Contract Number F33600-79-C-0540. Prepared for AFLC/LOEC. Wright-Patterson AFB OH.
78. Under Secretary of Defense Research and Engineering. "Acquisition of Computer Resources." Memorandum with 3 attachments. Attachment 1. "Procurement of Automatic Data Processing Equipment." Section 2315 of Title 10 U.S. Code. March 1983.
79. Under Secretary of Defense Research and Engineering. "Acquisition of Computer Resources." Memorandum with attachments. Attachment 2. "Senate Armed Service Committee Report on DOD FY 83 Authorization Act." March 1983.
80. Under Secretary of Defense Research and Engineering. "Acquisition of Computer Resources." Memorandum with 3 attachments. Attachment 3. "DOD-Wide Guidelines for Acquiring Computer Resources Under 10 U.S. Code 2315 (Armed Services Procurement Act)." March 1983.
81. U.S. Congress. National Defense Authorization Act for FY 1987. 10 U.S. Code 2325 Preference for Nondevelopmental Items. 100th Congress, First Session (1987). St. Paul MN: West Publishing Company, 1987.
82. Warner Robins Air Logistics Center, Air Force Logistics Command. "Maintenance of COTS Computer Systems." WR-ALC/MMIRF letter with 5 attachments. Robins AFB GA, 20 December 1984.
83. WR-ALC/MMM. "Mission Critical Computer Resources (MCCR) Commercial Off-the-Shelf (COTS) Policy and Responsibilities." Letter to HQ AFLC/MMTE, 29 July 1988.

VITA

Captain Gerald A. Schumacher was born in 1959, in Sioux City, Iowa. He attended the University of Iowa from which he received the degree of Bachelor of Science in Electrical Engineering in 1983. Upon graduation, he received a commission in the USAF through OTS. From November 1983 to May 1987, he was assigned to the Materiel Management DCS at HQ AFLC at Wright-Patterson AFB, Ohio. He served as a staff computer engineer, responsible for developing Mission Critical Computer Resources policy. In May 1987, he entered the School of Systems and Logistics, Air Force Institute of Technology.

Permanent address: 2050 Valencia Apt 303C
Northbrook, Ill 60062

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GSM/LSY/88S-24		7a. NAME OF MONITORING ORGANIZATION	
6a. NAME OF PERFORMING ORGANIZATION School of Systems and Logistics	6b. OFFICE SYMBOL (If applicable) AFIT/LSY	7b. ADDRESS (City, State, and ZIP Code)	
6c. ADDRESS (City, State, and ZIP Code) Air Force Institute of Technology Wright-Patterson AFB OH 45433-6583		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	10. SOURCE OF FUNDING NUMBERS	
8c. ADDRESS (City, State, and ZIP Code)		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) See Box 10			
12. PERSONAL AUTHOR(S) Gerald A. Schumacher, B.S., Capt, USAF			
13a. TYPE OF REPORT M.S. Thesis	13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) 1988 September	15. PAGE COUNT 130
16. SUPPLEMENTARY NOTES			
17. COTAS CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GR P	SUB-GROUP	
15	05		
12			
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Title: MANAGEMENT AND SUPPORT OF COMMERCIAL OFF-THE-SHELF (COTS) COMPUTER RESOURCES USED IN WEAPON SYSTEM APPLICATIONS Thesis Chairman: Daniel V. Ferens Professor of Systems Management Approved for public release IAW AFR 190-1. WILLIAM A. MAUER 17 Oct 88 Associate Dean School of Systems and Logistics Air Force Institute of Technology (AU) Wright-Patterson AFB OH 45433			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL Daniel V. Ferens		22b. TELEPHONE (Include Area Code) (513) 255-4845	22c. OFFICE SYMBOL AFIT/LSY

The purpose of this thesis was to improve the AFLC commercial off-the-shelf (COTS) mission critical computer resources (MCCR) acquisition and support strategy. A review of current service and command regulations pertaining to the management and support of mission critical, automated data processing (ADP), and nondevelopmental (NDI) commercial off-the-shelf (COTS) computer resources, plus recently-completed studies on this topic (e.g., AFLC studies and GAO reports) was used to identify the advantages and disadvantages of procuring and supporting COTS computer resources. A review of the AFLCR 800-21 commercial off-the-shelf (COTS) policy revealed the support approach for COTS computer resources was similar to the support strategy used for military specified (MIL-SPEC) equipment and did not address the unique supportability requirements associated with commercial and commercial-type computer resources.

Using the problems noted in the AFLCR 800-21 review, a list of critical supportability issues was developed, focusing mainly on the availability of commercial contractor logistics support. The review of the Air Force, Army, and Navy regulations revealed a number of innovative management and support policies which could be used to resolve the critical supportability issues. (KR)

Based on the results of the regulation analysis and recommended changes submitted by the AFLC Air Logistics Centers, the policy was revised to emphasize decentralization of COTS computer resources management and commercial contractor logistics support.