THE ADEQUACY OF COMMERCIAL MANUALS FOR INTERMEDIATE AND DEPOT LEVEL MAINTENANCE

THESIS

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List of Acronyms

AA	American Airlines
ADCOP	Acquisition and Distribution of Commercial Products
AF	Air Force
AFAD	Air Force Acquisition Directive
AFLC	Air Force Logistics Command
AFSC	Air Force Systems Command
AFSCF	Air Force Satellite Control Facility
AFTO	Air Force Technical Order
ALC	Air Logistics Center
ASD	Aeronautical Systems Division
ATA	Air Transportation Association
CCAP	Commercial Commodity Acquisition
CD	Compact Disk
CFE/CFAE	Contractor Furnished Equipment/Contractor Furnished Aeronautical Equipment
CISP	Commercial Item Support Program
CLS	Contract Logistics Support
CM	Commercial Manual
COGP	Commission On Government Procurement
COTS	Commercial Off The Shelf
DFAR	DoD Federal Acquisition Requirements Supplement
DID	Data Item Description
DoD	Department of Defense

DPML	Deputy Program Manager for Logistics
ECO	Engineering Change Order
ESO	Engineering Service Orders
FD	Flight Directives
GE	General Electric
GFE	Government Furnished Equipment
HF	High Frequency
IOC	Initial Operating Capability
IOT&E	Initial Operations Test and Evaluation
IPB	Illustrated Parts Breakdown
IPR	In Process Review
LCC	Life Cycle Cost
LSAO	Logistics Support Analysis Office
MIL-SPEC	Military Specification
NDI	Non-Development Items
PL	Public Law
PMEL	Precision Materiel Evaluation Lab
R&M	Reliability and Maintainability
SE	Support Equipment
SMR	Source Maintenance Recoverability Code
SOW	Statement Of Work
SPO	System Program Office
TISS	Tactical Electronic Warfare Support System
TMCR	Technical Manual Contract Requirement
TOMA	Technical Order Management Agency
UHF	Ultra High Frequency

Abstract

The objective of this research was to analyze the adequacy of using commercial manuals and to identify the correct acquisition process to obtaining adequate commercial manuals.

A questionnaire was developed and a survey was accomplished. The survey was distributed to Deputy Program Managers for Logistics (DPML) and Air Logistics Centers that utilized commercial manuals. The most significant result indicated that the commercial manuals that were determined to be adequate, actually had not been thoroughly reviewed. This resulted in additional funding requirements for manual supplements and system interim contract support. Other significant issues included: the importance of early involvement in the acquisition program phase; and, the DID and the SOW as effective contract mediums.

Recommendations to improve the effectiveness of the commercial manual review included:

1. Establishing a universal specification that would be used in all contracts.

2. Establishing verification procedures for commercial manuals on equipment that is integrated into a system.

3. Establishing an internal technical writing department that will do the changes to commercial manuals.

4. Establishing the use of similar hardware (CD readers) to the industrial contractors.

THE ADEQUACY OF COMMERCIAL MANUALS FOR INTERMEDIATE AND DEPOT LEVEL MAINTENANCE

I. Introduction

Problem Statement

The Deputy Assistant Secretary of Defense (Logistics) is concerned with shortening the acquisition cycle and reducing the cost of repairing Non-Development Items/Commercial-Off-The-Shelf Equipment (NDI/COTS). Currently, the repair of NDI/COTS equipment can be accomplished by Contractor Logistics Support (CLS) (permanent contractor maintenance support); Interim Contractor Support (ICS) (temporary contractor maintenance support); or Organic Support (AF depot maintenance). The type of support will depend upon the economics, security, and war readiness capability requirements of each respective system.

Specific Problem

The Air Force (AF) spends millions of dollars on weapon systems that require "adequate" technical documentation, especially for organic depot support. This data should be thorough enough that operations and maintenance can occur in a timely and cost efficient manner. A major concern is the incomplete publications procured to support weapon systems.

Currently, technical publications are being procured that do not reflect current hardware configuration, nor do they consider equipment standardization. Configuration management is a procedure for applying technical and administrative direction and surveillance to (a) identify and document the functional and physical characteristics of an item or system, (b) control any changes to such characteristics and (c) record and report the change, process, and implementation status [3:13]. Since the government does not have configuration management control in commercial manual acquisitions, the contractor may decide to update equipment in order to advance with technology or to make a one-time fix. In some instances, these changes modify internal configurations but do not get documented into the technical documentation. Permanent changes are documented when they affect the contractor's entire inventory. These one-time changes reduce equipment standardization (each like system being identical), add to equipment repair time, and sometimes add to reverse engineering cost.

Research Objective

Questions were developed to test the hypothesis that commercial manuals are not always the most cost effective method when considering the cost of buying adequate documentation vs the cost of developing documentation, the cost of reverse engineering, and the increase in maintenance turnaround time. To support this hypothesis, a questionnaire

was developed and then presented to Deputy Program Managers for Logistics and depot maintenance personnel within AFSC and AFLC. The personnel were selected by systems known to have NDI equipment. The developed survey used to collect data to support this hypothesis is attached as Appendix A.

Background

The government requires accurate data in order to maintain and operate their weapon systems. Since the 1950's, the DoD has been scrutinizing the issue of commercial equipment and proprietary rights. In 1964, DoD adopted a policy stating that they would honor rights to technical data pertaining to items, components, or processes "developed at private expense" if contractors would deliver such data to the government for use in operating and maintaining military hardware [7:51].

The remainder of this background section will involve three discussions concerning commercial equipment and commercial manuals. The first will identify the events leading up to the Packard Commission's recommendation to utilize commercial equipment. The Packard Commission's Blue Ribbon study led by David Packard was the first in depth study on commercial equipment usage. The discussion will include the Packard Commission's recommendation, the Competition Act of 1984, and the latest public laws concerning proprietary data rights; along with how the balance between the contractor and the government concerning

data rights was disrupted by these actions. The second discussion will identify current problems associated with use of commercial manuals. The final discussion will emphasize the concern of the dependency being developed on contractor support.

Prior to the Packard Commission's recommendation, many events occurred. Following is a brief summary of those events:

- In 1972 the commission on government procurement (COGP) had a shift in philosophy and recommended placing greater reliance on privately developed off-the-shelf products and established commercial distribution channels to support those products [2:2].

- In May 1976 the COGP recommendations became policies in memorandum format. According to Klein and East's 1976 memo, "the government should purchase commercial off the shelf (COTS) products whenever they would adequately serve the government's requirements, provided the products have established commercial market acceptability [2:2-3]."

- In 1977 the Commercial Commodity Acquisition Program (CCAP), a Defense Logistics Agency, documented cases of commercial acquisitions accomplished without detailed specification. Also, the Commercial Item Support Program (CISP) began a review to minimize the level of centralized management required for potentially commercial distribution channels [2:3].

- In 1978 both the CCAP and the CISP were included in DoD Directive 5000.37 thus developing Commercial Item Acquisition and Distribution of Commercial Products (ADCOP) [2:5].

- In early 1980 the Army began work based on the ADCOP concepts [2:6].

- April 1986, the Packard Commission's Blue Ribbon report was presented to the President.

In April 1986, the Blue Ribbon Commission on Defense Management reported that rather than relying on excessively rigid military specifications, DoD should make greater use of components, systems and services available from the private sector. It should develop new or custom-made items only when it had been established that those readily available commercial items were clearly inadequate to meet military requirements. Their report stated:

> "The DoD should make greater use of components, systems, and services available "off the shelf," developing new or custom-made items only when "off-the-shelf" ones do not meet military needs."
>
> "Federal law and DoD regulations should provide for substantially increased use of commercial-style competition, emphasizing quality and established performance as a price, particularly for research and development and for professional services [9:60]."

The commission's main concern was to reduce over all program cost and expedite the "fielding" of acquisition systems. With the acceptance of these recommendations, three-to-five years of the development time can be transferred to usable time. It also aids in reducing research and development costs of systems already available. Packard cites two methods attributing to the time and cost problem--"user pull and technology push." [9:45] "User pull" is where the users (who may or may not be technically knowledgeable) define the system with all the "wish list" features. "Technology pull" is when the government wants the most up to date, state of the art technology possible.

Both methods direct programs toward high-cost and long life cycles from the beginning.

The commission's concern is strengthened by General Richard H. Thompson's speech on shortening the acquisition strategy:

> "We can no longer afford to design equipment to meet the entire realm of environmental possibilities, especially if the environment will encounter those conditions only 10 to 15 percent of the time. We must start designing for the "expected" rather than routinely designing for the "worse case." We must question and tailor specifications that don't make good sense in meeting product requirements [5:35]."

The Defense Authorization Act of 1984, Section 907 of Public Law (PL) 99-661, Preference for Nondevelopmental Items, was passed. This requires the DoD to state requirements for supplies in terms of functions to be performed, performance required, essential physical characteristics, and definition of those requirements so that non-development items (NDI) can be procured to fulfill them [2:2-3]. This law amended Chapter 137 of Title 10 United States Codes to require maximum utilization for NDI.

Now that the law prefers the acquisition of nondevelopment items, the DoD still feels the necessity to have data that normally is not sold with the commercial equipment and to the customer for competitive procurement purposes as indicated in one of the recommendations by the Procurement Round Table, a follow-on committee to the Packard Commission [7:53]. This has impacted the contractors

willingness to give out the information. As the Packard Commission points out,

> "DoD can use its unique position to enhance U. S. industry's worldwide technological position; or unwittingly, through the pursuit of other shorter term goals, to reduce incentive for developing new technology; or, even worse, make commercially valuable technology available to international competitors [9:64]."

Since the use of nondevelopmental equipment is becoming more prevalent, the use of the "old-ways" or boilerplating the contractor's requirements are not adequate.

While commercial equipment went through a decade of events, a battle began and continues today over data rights. When the government acquired mostly MIL-SPEC systems, the contractor provided nearly all of the required data. The only exception was information developed at private industry's own expense. As the events led to utilizing more commercial equipment, the contractors began to feel threatened. If they gave up this information, they would no longer have a competitive edge on the market. It equates out to losing military secrets to the enemy. Through an unwritten code, the contractors struck a balance on commercial data rights to the government. The contractors would provide proprietary rights to the government as long as it was not used outside of the intended maintenance use. However, this pushed the government into high cost systems because it forced reprocurement buys from sole sources. In order to combat these high costs through competition, the

Contracting Act of 1984 was issued. It made reprocurement competitive, however, the balance between government and contractor technical data rights was broken [7:51]. Further research into the current data rights requirements was then accomplished by the Procurement Round Table in 1987 [10:24].

Current data rights requirements are P.L. 98-525 and P.L. 98-577 of 1984, and P.L. 99-661 of 1984. It must be noted that it was not until May 12, 1987 that the DoD FAR Supplement (DFAR) was updated to reflect these laws. It is DFAR 27.4 [7:51-53 and 4:51-55].

Between the passing of the three laws and the updating of the DFAR, two more acts were passed to accelerate DoD enactment. After many attempts to define the technical data rights requirements, the 1987 DoD Authorization Act was enacted on January 16, 1987. Here congress (1) detailed the specific provisions to be included in the new DoD clause, (2) instructed the DoD to consider how to address rights in jointly funded development data, and (3) set a new deadline for the promulgation of the new regulation. Then on April 16, 1987, the DAR council issued final regulations implementing section 953 of public law 99-500, the Defense Acquisition Improvement Act [11:36].

All of this activity and time lag attributes to the confusion for both the government and the contractor. More attempts have been made and are being made to clarify this situation. Currently, the Procurement Round Table has

recommended a new policy with five elements. the five elements are:

1. A single regulation;
2. Separate technical data for computer programs;
3. Protecting commercial rights in technical data;
4. Compensation for licensing of competitors; and,
5. Controlling the techniques used to obtain competition [7:52-53].

Using nondevelopmental equipment has not been without other problems. The technical data rights are only one complication. When the government procures NDI equipment, they lose control of configuration, cost, manufacturing, repair parts replacement (supportability), and maintenance (maintainability). Overall, the question must be addressed concerning the AF system supportability and availability posture when "combat" logistics become necessary.

Some of the preceding conclusions in the above paragraph are from the DoD Logistics Support Analysis Office (LSAO) study accomplished in 1986. The LSAO conclusion to the use of nondevelopment items is that it is not always beneficial. They state,

> "NDI acquisitions will cause item proliferation if sufficient technical data is not acquired [6:iv]."
>
> "Some areas of counter productivity are "repair part standardization, NATO standardization (or any standardization for that matter), the competition breakdown program, and service policies to procure all technical data and have National Stock Numbers (NSN) for all spares before fielding the system [6:7]."

For systems with a life cycle exceeding five years, LSAO is concerned that the contractor will have changed parts or configuration of the sub-assemblies or the entire system. In some instances the contractor may decide it is not economical to continue making the system and quit making the parts. When this happens, the government loses equipment standardization and support for the item. Thus, causing the government to find a replacement for the equipment [12].

Improper technical data can cause a lack of configuration control which impacts the government's commercial manuals and its systems. This adverse effect is illustrated through the AN/RQA-17 monitor. This program has organic depot support. While the monitor was going down the production line, the manufacturer would substitute components on printed circuit boards if they ran out of the correct component. The substitute components would keep the equipment electronically compatible; however, it created trouble for the maintainer. The AF bought the recommended spares, however, these spares only worked on some of the serial numbered parts. As a result, the Air Force had to build a matrix showing the serial number of each unit cross referenced to the layout of the components and the electronic value of the components. In one instance the manufacturer ran out of a 47k ohm resistor. They replaced it with a 33k ohm resistor with another resistor added

elsewhere to compensate for the substitution. The contractor did not document this in the commercial manual.

When this board with the substitution was sent to the maintainer, the resistor was burnt beyond recognition. The maintainer had followed the instructions in the commercial manual, unaware of the substitution, only to find that the repair failed. Through trial and error the maintainer found the appropriate resistor. This took up needless time and money [12]. What if this had been in a battlefield situation?

There is concern about the cost of obtaining "adequate" technical data. Data which is adequate to maintain and operate equipment, may be too costly. The high price tag for purchasing "proprietary data" is used by the contractor as a protection device. Contractors are afraid trade secrets will be lost to other companies. Therefore, they must protect their competitive edge. These high price tags must be compared to the cost of contractor maintenance for the life of the system (CLS). In the short run, CLS is more cost effective than buying data rights. However, can we afford it in the long run?

After the government has bought and fielded the system, the contractor may decide that it is no longer profitable to make the same system or to make spares for the old models. They may decide it is more profitable to update the system. In any case, the government is negatively impacted because

commercial manuals are often not updated. They may be supplemented, but not in enough detail.

One example of the commercial manual not accurately portraying the equipment is the AN/GIQ-18 monitor. The AN/GIQ-18 demonstrates the impact of lost configuration control. In this monitor there are eight different configurations under the same part number [12]. This creates numerous problems for the maintainer. The problems range from what needs correcting to what part number is needed to repair it.

Another impact from procuring nondevelopment equipment is the procurement of replacement parts through sole source efforts. This happens even though the government has stressed competitive buys. Since requisitioning occurs from the part numbers in the commercial manual, the reprocurement of the repair parts is frequently from a sole source [1:i]. This is because the commercial developers assign their own part number, which is also their internal inventory number. These inventory numbers appear in the commercial manuals. Even if a part is a suitable substitute for the old system, the part number needs to appear in the commercial manual for the maintenance person to requisition the part.

Because of the impacts previously mentioned, the government is in a position of dependence on the commercial developer to maintain spares support for the life cycle of the equipment [1:i]. In cases where there will be organic

support, the commercial manuals often are not ready when the system is fielded. An example is the acquisition of the AN/USM-488, general purpose oscilloscope. The oscilloscope's performance range is direct current 0 to 100MHz. The purchase was for 8000 items. Due to quality problems in the commercial manuals, there was approximately a ten-month delay in their availability [2:app a]. The government had to depend on the contractor's interim support (ICS) which cost additional money.

For weapon systems that have CLS, are the contractors willing to do annual training for combat situations? Are they willing to take up arms? If they are not, is it fair to have the AF maintainer put in a position to defend the contractor on the battlefield? Or is it feasible to have the AF maintainer open the equipment for the first time and repair it quickly? Not only are they untrained for the particular "black-box", they are under combat duress.

A situation that illustrates this position occurred in World War II on Wake Island. There were 400 Marines and 1100 civilian construction contractors on the island at the time the Japanese bombed Pearl Harbor, Hawaii. When the Japanese attacked Wake Island, the Marines had the additional duty to protect the civilian contractors. In their strategic and tactical planning they had to take them into consideration. The Marines could not force the contractors to fight, however, about half of them

volunteered. There were not enough weapons, so they helped with the trench digging etc. Then as Marines fell, they took up their arms and fought back. The other half of the contractors felt that if they did not fight the Japanese would treat them differently and that they would be safe if the island were overtaken. The island was overtaken, and the contractors that had fought were sent with the marines to a prisoner of war camp. The remaining contractors were used as a labor force on the island and then shot when they were no longer needed [8].

This story illustrates the additional responsibility the contractor may place on the soldier during times of conflict. It raises the concern about becoming critically dependent on a civilian force during peacetime.

This NDI/COTS review indicates that the use of commercial manuals and equipment can negatively impact, (1) the supportability (spares) caused by the lack of configuration management; (2) the availability (delay in start date); and (3) the maintainability (not being able to repair due to improper procedures and the lack of spares) [6:iv; 7:36].

II. Methodology

Justification

Since the Packard Commission's study, emphasis has been placed on the procurement of NDI/COTS equipment.

Technical orders are used by all DoD services for the operations and maintenance of weapon systems at all levels (organizational, intermediate, and depot). If the users or the maintainers do not have complete technical documentation, the systems productivity can be hindered. Also, extensive damage could occur due to inappropriate operating and maintaining procedures.

By utilizing NDI/COTS equipment, the cost of developing and researching weapon systems can be reduced; however, not eliminated. For 100 percent NDI/COTS equipment, the cost is absorbed by the contractor since the R & D occurred prior to DoD consideration.

Also, the use of NDI/COTS equipment is suppose to reduce the cost of technical documentation (drawings, manuals, etc.) However, the DoD must consider whether or not these commercial manuals meet the requirements to fulfill operational and maintenance obligations. In some instances, the commercial manuals are so incomplete that the DoD becomes dependent on the contractor to support the equipment after fielding.

As a result of the Packard Commission's 1986 report, the Deputy Assistant Secretary of Defense (logistics)

requested studies be accomplished to re-evaluate "the implications of NDI Systems Acquisition" and to provide further study areas [letter 3 Jul 1986]. One area requiring further research is NDI/COTS manuals. Within this area, commercial manuals are impacted if equipment is not standardized or the manuals are not updated to equipment changes. The operator and maintainer requires manuals, commercial or military, that correspond to the same model as being operated or maintained.

When the DoD procures military manuals (MIL-SPEC TO), specific requirements are put on contract prior to the manual's development. Then, throughout the manual's development, the services do in-process-reviews (IPR), verifications, testings, and pre-publication reviews. However, when the DoD procures a commercial manual, the manual has already been developed and published. In some instances, the service may review the commercial manual prior to the contract or use the manual for testing prior to initial operating capability (IOC). In the latter use, the logistical consequence is realized late in the acquisition cycle, and interim contract support must be used.

The surveys and interviews that will be done in support of this thesis will demonstrate the adequacies and inadequacies of commercial manuals and the developing dependency for Contract Logistics Support (CLS).

Instrument

The questionnaire (Appendix A) was designed into seven sections. Each section provides an inter-/intra-relationship to commercial manuals.

Section one refers to the relationship between commercial manuals and the overall system. The questions address the program phase, the maintenance concept (organic or contract,) and the type of weapon system being surveyed. These questions will be used to find if the elements of the program phase influence whether or not commercial manuals should or should not be used through a frequency table.

Section two refers to the commercial manuals and their relationship to the system (section one) and to MIL-SPEC manuals (section three). Currently, the Air Force does not have a requirement to review the commercial manuals prior to the contract, and do not have a set of in-process-reviews that will be accomplished after the contract award. The only formalized review stems from MIL-M-7298C. This military standard provides a checklist of requirements that the contractor and the Technical Order Management Agency (TOMA) reviews. A desktop review without equipment availability is usually accomplished against this checklist.

In section two, an attempt is being made to identify a correlation between the review procedures and the quality and adequacy of commercial manuals from the Air Force's perspective. The analysis will compare variables from

section two to the same variables of section three, and variables from section two to variable 88. Variable 88 identifies the commercial manuals and service bulletins adequacy for use by level 5 and 7 technicians.

Section three refers to the MIL-SPEC manuals, manuals that are developed during the acquisition phase, then reviewed and tested prior to the equipment fielding. Questions in section three were used to compare the governments approach in procuring MIL-SPEC manuals to their approach in procuring commercial manuals. The questions are identical to section two, commercial manuals.

Section four refers to the contractual requirements (ordering, reviewing, and approving) for commercial manuals. Also, this section is used to identify if additional funding is required after contract award. Both analyses will be presented through a frequency table.

Section five refers to the users perception of the adequacy of the finished commercial manual. These questions respond to the issue of equipment standardization and configurations identified in the commercial manual. If either issue is identified, the person has been requested to address how the issue(s) were resolved and the amount of additional time that was required to resolve the problem(s).

Section six refers to the need and the adequacy of service bulletins, notices from the contractor of equipment changes or equipment safety factors. First, the questions

establish whether or not the commercial manuals, without supplementation, are usable to the same level as the MIL-SPEC manuals. If they are not, the person must identify how much supplementing is required to raise the manuals to a usable level. Second, the questions ask whether or not the users are receiving the updated service bulletins.

Section seven allows the participants to respond, in their own words, to the problems and/or advantages of using commercial manuals. These statements are encouraged to be open, not necessarily along the "thought-stream" of the questionnaire. Some of the responses may be issues that will be open for further research.

Sample/Population

There are two methods of research that will be used, interviewing and surveying. Contacts were selected from weapon system program offices (SPO), depot maintenance personnel, and deputy program managers for logistics (DPML) for NDI/COTS systems. The discussion during the interviews will be a closer evaluation of the problems; whereas, the survey questionnaire identifies if a model for adequate commercial manuals can be built.

The surveyed were selected from a complete list of DPMLs provided by the AMIS office at Wright-Patterson AFB. Each office at ASD and Space Division was called and asked if their weapon system involved commercial equipment and if they would participate in the survey. However, the DPML

from Electronics Systems Division were selected at random. Approximately forty responded positively. Of these forty, they were asked to provide the office symbols of the corresponding maintenance facilities and air logistics centers (ALC) requirement branches. In total, sixty surveys were distributed. One week after the surveys were to be returned, follow-up phone calls were made to gather the remaining surveys. Only thirty-five were returned.

The interviewed were selected through individuals who indicated that they wanted to talk in person during the previously mentioned phone calls; and, individuals known to have experience with commercial manuals. Also, in order to perceive the commercial companies preparation procedures in developing commercial manuals, representatives from General Electric were interviewed.

Data Collection Plan

The survey data collection consist of 59 questions. These questions were catagorized into 92 independent variables. The independent variables are listed below. The first number is the variable number. The second number, which appears in parenthesis after the variable title, is the value assigned for a specific response during analysis.

Section One.

1 = Program Phase
Conceptual Phase (1)
Demonstration/Validation Phase (2)
Full Scale Development Phase (3)
Production Phase (4)
Deployment Phase (5)

2 = Maintenance Concept
2-level (Organization, Depot) (1)
3-level (Organization, Intermediate, Depot) (2)
Other (0)

3 = Is the depot level maintenance done through organic support?
Yes (1) No (0)

4 = Is the depot level maintenance done through contract support?
Yes (1)
No (0)

5 = Is the intermediate maintenance done through organic support?
Yes (1)
No (0)

6 = Is the intermediate maintenance done through contract support?
Yes (1)
No (0)

7 = How many years will interim contract support be used?
Less than 1 year (.5)
1-3 years (2)
4-6 years (5)
7-10 years (8.5)
over 10 years (11)

8 = End item quantity of the system
1-5 (3)
6-15 (10.5)
16-30 (23)
31-50 (40.5)
over 50 (51)

9 = Equipment type
Communications Equipment (1)
Support Equipment (2)
Aircraft (3)
Computer Resources (4)
Space System (5)
Other (6)

10 = Was a cost comparison done between the commercial manual and supplemental cost versus MIL-STD technical order development cost?
Yes (1)
No (0)

Section Two.

11 = Are the commercial manuals used at the intermediate facility?
Yes (1)
No (0)

12 = Are the commercial manuals used at the depot facility?
Yes (1)
No (0)

13 = Commercial manuals make-up what percent of the total system manuals?
Less then 10% (.5)
10-30% (.2)
31-50% (.405)
Over 50% (.51)

14 = Did the contract require the contractor to review the commercial manuals in accordance with MIL-M-7298C?
Yes (1)
No (0)

15 = Was the contractor or the government required to review the commercial manuals prior to contract award?
Yes (1)
No (0)

*Variables 16 - 43 were only answered if variable 15 was yes.

16 = Number of days allotted to review the manuals prior to contract award.
0-10 days (5)
11-30 days (20.5)
31-60 days (45.5)
over 60 days (61)

Government representatives that reviewed the commercial manuals

17 = Integrating Contractor
Yes (1)
No (0)

18 = Logistics Support Contractor
Yes (1)
No (0)

19 = Program Manager
Yes (1)
No (0)

20 = Logistics Manager
Yes (1)
No (0)

21 = Equipment Specialist
Yes (1)
No (0)

22 = Engineer
Yes (1)
No (0)

23 = Technical Order Specialist
Yes (1)
No (0)

24 = Maintenance Technician
Yes (1)
No (0)

25 = Using Command
Yes (1)
No (0)

Purpose of the commercial manual review

26 = Maintenance Procedures
Yes (1)
No (0)

27 = Data rights Restrictions
Yes (1)
No (0)

28 = Part Number Accuracy
Yes (1)
No (0)

29 = Safety Warning Notices
Yes (1)
No (0)

30 = Hardware Accuracy
Yes (1)
No (0)

Type of quality check used for the commercial manuals

31 = Validation
Yes (1)
No (0)

32 = Verification
Yes (1)
No (0)

33 = In Process Review
Yes (1)
No (0)

34 = If a verification, validation, or in-process review was accomplished, were there differences between the original operational procedures and the actual findings?
Yes (2)
No (1)
Do not know (0)

Location of the commercial manual review

35 = Contractor's Facility
Yes (1)
No (0)

36 = Air Force Facility
Yes (1)
No (0)

37 = Was the actual equipment available during the commercial manual review?
Yes (1)
No (0)

38 = Was the equipment used during the commercial manual review?
Yes (1)
No (0)

39 = Reading grade level of the commercial manuals
Ninth grade (1)
Twelfth grade (2)
Fourteenth grade (3)
Other (4)
No requirement (0)

40 = Average number of volumes per commercial manual
1 (1)
2 (2)
3 (3)
4 (4)
5 or more (5)

41 = Are detailed diagrams or graphics used to show the maintenance procedures step by step?
Yes (1)
No (0)

42 = Does an illustrated parts breakdown come with the commercial manuals?
Yes (1)
No (0)

43 = Do the illustrated parts breakdown diagrams cross reference each other and the text?
Yes (1)
No (0)

Section Three.

44 = Are the MIL-SPEC manuals used at the intermediate facility?
Yes (1)
No (0)

45 = Are the MIL-SPEC manuals used at the depot facility?
Yes (1)
No (0)

46 = MIL-SPEC manuals make-up what percent of the total system manuals?
Less then 10% (.05)
10-30% (.20)
31-50% (.405)
Over 50% (.51)

47 = Did the contract require the contractor to review the MIL-SPEC manuals in accordance with MIL-M-38784?
Yes (1)
No (0)

Type of quality check used for the MIL-SPEC manuals
48 = Validation
Yes (1)
No (0)
49 = Verification
Yes (1)
No (0)
50 = In Process Review
Yes (1)
No (0)

Government representatives that reviewed the MIL-SPEC manuals

51 = Integrating Contractor
Yes (1)
No (0)

52 = Logistics Support Contractor
Yes (1)
No (0)

53 = Program Manager
Yes (1)
No (0)

54 = Logistics Manager
Yes (1)
No (0)

55 = Equipment Specialist
Yes (1)
No (0)

56 = Engineer
Yes (1)
No (0)

57 = Technical Order Specialist
Yes (1)
No (0)

58 = Maintenance Technician
Yes (1)
No (0)

59 = Using Command
Yes (1)
No (0)

Purpose of the MIL-SPEC manual review

60 = Maintenance Procedures
Yes (1)
No (0)

61 = Data rights Restrictions
Yes (1)
No (0)

62 = Part Number Accuracy
Yes (1)
No (0)

63 = Safety Warning Notices
Yes (1)
No (0)

64 = Hardware Accuracy
Yes (1)
No (0)

65 = If a verification, validation, or in-process review was accomplished, were there differences between the original operational procedures and the actual findings?
Yes (2)
No (1)
None accomplished (0)

Location of the MIL-SPEC manual review

66 = Contractor's Facility
Yes (1)
No (0)

67 = Air Force Facility
Yes (1)
No (0)

68 = Was the actual equipment available during the commercial manual review?
Yes (1)
No (0)

69 = Was the equipment used during the MIL-SPEC manual review?
Yes (1)
No (0)

70 = Number of days allotted to review the manuals prior to contract award.
0-10 days (5)
11-30 days (20.5)
31-60 days (45.5)
over 60 days (61)

71 = Reading grade level of the MIL-SPEC manuals
Ninth grade (1)
Twelfth grade (2)
Fourteenth grade (3)
Other (4)
No requirement (0)

72 = Average number of volumes per MIL-SPEC manual
1 (1)
2 (2)
3 (3)
4 (4)
5 or more (5)

73 = Are detailed diagrams or graphics used to show the maintenance procedures step by step?
Yes (1)
No (0)

74 = Does an illustrated parts breakdown come with the commercial manuals?
Yes (1)
No (0)

75 = Do the illustrated parts breakdown diagrams cross reference each other and the text?
Yes (1)
No (0)

Section Four.

Commercial manual contract requirements

76 = TMCR 86-01
Yes (1)
No (0)

77 = Data Item Descriptions
Yes (1)
No (0)

78 = CFE/CFAE Notices
Yes (1)
No (0)

79 = AFADs
Yes (1)
No (0)

80 = SOW
Yes (1)
No (0)

81 = Did the commercial manuals require additional funding above the original contract projection?
Yes (1)
No (0)

Section Five.

82 = How did the program office or maintenance facility handle the standardization of parts in commercial systems?
Submitted TO change (2)
Went back to the contractor to correct (1)
Other (0)

83 = Did the contractor charge for corrections required in the commercial manuals?
Yes (1)
No (0)

84 = What caused the lack of standardization?
The maintenance facility (2)
The contractor facility (1)
Both (3)
Other (0)

85 = Were there any cases of the actual equipment configuration not matching the technical documentation during subsequent repair activities?
Yes (1)
No (0)

86 = Number of mismatches found in the commercial manuals
0-2 (1)
3-5 (4)
6-8 (7)
9-11 (10)
over 11 (13)

87 = Once a problem was solved, was a supplement or TO change accomplished?
Yes (1)
No (0)

Section Six.

88 = Are the commercial manuals and service bulletins adequate for use by military 5 and 7 level technicians in repairing the equipment to the same levels the AF maintains MIL-STD equipment?
Yes (1)
No (0)

89 = To what extent does the commercial documentation require supplementation?
Under 5% (.025)
6-10% (.08)
11-20% (.155)
21-30% (.255)
Over 30% (.31)

90 = Are sufficient, in-depth documentation that complies with the system's maintenance concept being received?
Yes (1)
No (0)

91 = Was the contractor required to provide updates and changes with commercial equipment modifications?
Yes (1)
No (0)

92 = Are all the users getting the service bulletins and interim safety supplements?
Yes (1)
No (0)

Statistical Tests

After the interviews and surveys have been accomplished, the data will require some statistical testing. Sections two and three will require an analysis of variance to be accomplished. This will indicate if there is a procedure or review difference between the commercial manuals and the MIL-SPEC manuals that is significant. Sections one and five will be used for a regression analysis to analyze the correlation between the type of maintenance (organic or contract) and the commercial manuals shortfalls. Next, sections two and four will be used in a regression analysis. This analysis will be used to indicate which factors are more significant to the success of adequate commercial manuals. All of the data will be used to identify the successful procedures that have been used and have averted problems.

The most significant hurdle will be assuring the interviewed and the surveyed complete anonymity so that factual data can be collected.

III. Findings and Analysis

Description of the Survey

The survey consisted of sixty questions regarding the adequacy of commercial manuals. It separated into six sections. Each section, with section one being the exception, was directed towards an element that may or may not impact the quality of the manual the Air Force receives as a deliverable product. Section one, the system, was used to establish whether or not the program being surveyed had reached the deployment stage. As noted in chapter two, the six sections are: the system, the commercial manual, the MIL-SPEC manual, the contract requirements, the technician's response to the commercial manual, and the personal responses of the survey participants. Appendix A contains a copy of the survey and the response percentages for each of the survey questions. The survey did not deviate from the original design set up in the methodology. However, the survey failed to require the participants to respond to a set of questions regarding the adequacy of the MIL-M-7298C review. The questions should have been similar to the set asked of the pre-contract award review (variables 16-43). This exclusion caused the statistical test to omit a comparison between "in-process" reviews and adequate commercial manuals at the time of deployment. Also, the survey failed to have the participants identify whether or not the MIL-SPEC manuals were adequate for use by a 5 or 7

level maintenance technician. This oversight caused the statistical test comparing the review process differences of commercial manuals and MIL-SPEC manuals to be omitted.

Recording of Findings

The format of Appendix A is identical to the survey questionnaire, with the exception of the last two columns. The first of these columns identifies the number of responses for each variable element; and the last column is the overall percentage for the variable element. The percentages for questions 1 - 15 and 44 - 92 are based on thirty-five responses. The percentages for question 16 - 43 are based on fifteen responses. Question 16 - 43 were only to be answered if question 15 was responded to with a yes. Also, some questions were not answered by all of the participants. In these cases, "No response" was added and totaled. The raw data used in the statistical test are contained in Appendix B.

Following the statistical test against the survey, a summary of the oral interview with General Electric (GE) is provided. (Specific questions and responses are contained in Appendix D.)

Statistical Tests

Statistical percentage comparisons were accomplished on the dependent variable (X88), the commercial manuals usefulness by a 5 or 7 level technician, using the list of

independent variables shown in Table I. The list is divided into five groups. Group one contains the general elements concerning the surveyed system. Group two represents the job titles of the pre-contract reviewers. Group three represents the elements used for review. Group four represents the contract elements that were used to put the commercial manuals on contract. Finally, group five contains the elements used to analyze the cause of additional costs. Since the percentage of not adequate responses were larger than the adequate responses by 20% under variable X88, this study assumed that the commercial manuals were not adequate for a 5 or 7 level technician at the time of deployment. In the few cases where the commercial manuals were adequate, the study analyzed the results to find what was being done correctly. However, the analysis confirmed that the inadequate manuals were reviewed properly, and that the adequate manuals were not. The data to support these statements will be developed in subsequent paragraphs.

Comparison Analysis

Table II compares the independent variable, identified in Table 1, of adequate manuals to the inadequate manuals. In total, there were thirty-five observations from the survey. For the adequate manuals, there were fourteen "yes" responses from variable X88. The remaining twenty-one "no"

TABLE I

LIST OF INDEPENDENT VARIABLES

Group One

X1. . . . . Program Phase
X3. . . . . Depot/Organic Support
X4. . . . . Depot/Contract Support
X5. . . . . Intermediate/Organic Support
X6. . . . . Intermediate/Contract Support
X9. . . . . Program Type
X14 . . . . . Reviewed against MIL-M-7298C
X15 . . . . . Pre-Contract Review Accomplished

Group Two

X17 . . . . . Integrating Contract
X18 . . . . . Logistics Support Contractor
X19 . . . . . Program Manager
X20 . . . . . Logistics Manager
X21 . . . . . Equipment Specialist
X22 . . . . . Engineer
X23 . . . . . Technical Order Specialist
X24 . . . . . Maintenance Technician
X25 . . . . . Using Command Representative

Group Three

X26 . . . . . Maintenance Procedures
X27 . . . . . Data Rights Restrictions
X28 . . . . . Part Number Accuracy
X29 . . . . . Safety Warning Notice
X30 . . . . . Hardware Accuracy

Group Four

X76 . . . . . TMCR 86-01
X77 . . . . . Data Item Description
X78 . . . . . CFE/CFAE Notices
X79 . . . . . AFAD
X80 . . . . . Statement of Work

Group Five

X81 . . . . . Additional Funding Required
X86 . . . . . Number of Mismatches Found

TABLE II

ADEQUATE VERSUS NON-ADEQUATE

Independent Variable	ADEQUATE* "Yes" Response	%	NON-ADEQUATE** "Yes" Response	%	OVERALL*** %
X1 (deployment)	6	42.8	3	14.2	25.7
(production)	2	14.2	3	14.2	14.2
(FSD)	5	35.7	5	23.8	28.6
X3	8	57.1	11	52.4	54.3
X4	8	57.1	13	61.9	60.0
X5	10	71.4	8	38.1	51.4
X6	6	42.8	6	28.5	34.3
X9 (Comm Elect)	2	14.2	3	14.2	14.2
(Supp Equip)	5	35.7	5	23.8	28.6
(Aircraft) .	4	28.5	5	23.8	25.7
(Computers).	1	7.1	1	4.7	5.7
(Space). . .	1	7.1	5	47.6	17.1
X14	9	64.3	13	61.9	62.8
X15	8	57.1	7	33.3	42.9
X17	1	12.5	1	14.2	13.3
X18	3	37.5	0	00.0	20.0
X19	3	37.5	1	14.2	26.7
X20	3	37.5	5	71.4	53.3
X21	4	50.0	5	71.4	60.0
X22	3	37.5	0	00.0	20.0
X23	5	62.5	6	85.7	73.3
X24	2	25.0	5	71.4	46.7
X25	5	62.5	6	85.7	73.3
X26	6	75.0	7	100.0	86.7
X27	2	25.0	3	42.8	33.3
X28	1	12.5	3	42.8	26.7
X29	1	12.5	6	85.7	46.7
X30	4	62.5	5	71.4	60.0
X34	2	25.0	2	28.5	26.7
X76	0	00.0	1	4.7	2.8
X77	9	64.2	5	23.8	40.0
X78	4	28.5	11	52.3	42.8
X79	3	21.4	8	38.0	31.4
X80	8	57.1	6	28.5	40.0
X81	3	60.0	4	44.4	50.0
X86	5	35.7	9	42.8	40.0

* n=14 for all independent variables except, X17-X34 where n=8, and, X81 where n=5

** n=21 for all independent variables except, X17-X34 where n=7, and, X81 where n=9

*** n=35 for all independent variables except, X17-X34 where n=15, and, X81 where n=14

responses were separated and analyzed for the non-adequate manuals. This table identified the following possibilities.

1. The majority of the adequate responses were from programs in the deployment phase (42.8%). whereas, the majority of the non-adequate responses were in the full-scale development phase (23.8%). This indicates that changes to the commercial manuals that will elevate them to an adequate level occurs between the full scale development phase and the deployment phase.

2. The most successful programs to use commercial manuals are Support Equipment programs (35.7%); whereas, commercial manuals are least successful for Space Systems (47.6%).

3. The reviews that were accomplished prior to contract award benefited the final manual. 57.1% of the fourteen "yes" responses accomplished pre-contract reviews.

4. The technical order specialist (62.5%) and the using command representative (62.5%) were the key reviewers for the pre-contract reviews.

5. The maintenance procedures (86.7%) and the hardware accuracy (60.0%) were the key elements reviewed in both scenarios (adequate or non-adequate); however, only the non-adequate scenario concentrated on a thorough review for data rights restrictions, part number accuracy, and safety warning notices.

6. The Data Items Description (DID) (64.2%) and the Statement of Work (SOW) (57.1%) were the most effective contract vehicle to use for commercial manuals; while, the CFE/CFAE notices (28.5%) were the most ineffective. TMCR 86-01 was not considered a complete failure due to its' limited usage to date.

7. Both scenarios found errors in the context of the manuals and required some additional funding (50.0%).

Possibilities 4, 5, and 7 were then further analyzed for validity. The other possibilities were left as optional and can be used for further study later.

Table III compares the reviewer to the review element. Within the table, the figures appear as a fraction. The top figure represents the total number of the reviewer(s) from the adequate manuals that were reviewed for the specific elements. Whereas, the bottom figure is the same for the non-adequate commercial manuals. In addition, there is a line drawn after the first four elements. Above the line are the reviewers (X17, X18, X19, and X22) that participated in the reviews for adequate, but, rarely participated for non-adequate. Below the line are the reviewers (X20, X21, X23, X24, and X25) that had the strongest participation in the non-adequate reviews.

As the table indicates, the first four reviewers checked partially for the maintenance procedures and some for the hardware accuracy. They did not check data

restriction issues, part number accuracy or safety notices. Even though the review teams did not consist of only these reviewers, the other reviewers basically reviewed for the same components. Only in one instance did the other reviewers check for the data restrictions, part number accuracy, or safety notices.

TABLE III

REVIEWER VERSUS REVIEWED

Independent Variable w/ Full Potential	X26	X27	X28	X29	X30
X17 (1/1)*	1/1	0/1	0/1	0/1	0/1
X18 (3/0)	2/0	0/0	0/0	0/0	1/0
X19 (3/1)	2/1	1/1	0/0	0/1	1/0
X22 (3/0)	2/0	1/0	0/0	0/0	1/0
X23 (5/6)	3/6	1/3	1/3	1/5	2/4
X21 (4/5)	3/5	0/3	0/3	0/5	0/4
X20 (3/5)	1/5	0/2	0/2	0/4	2/3
X24 (2/5)	1/4	1/3	1/2	1/5	1/4
X25 (5/6)	4/6	1/2	1/3	1/5	2/5
TOTAL (29/29)	19/28	5/15	3/14	3/26	10/21
% adequate	65.5	17.2	10.3	10.3	34.5
% non-adequate	96.5	51.7	48.3	90.0	72.4

*NOTE: Adequate/Non-adequate

On the other hand, the non-adequate review teams were comprised mostly of the technical order specialist, the equipment specialist, the logistics management specialist, the maintenance technician, and the using command. The

main emphases of their review were on the maintenance procedures, the safety notices, and the hardware accuracy. Part number accuracy and data restrictions were a concern, but only to a lesser degree.

This table summarizes that the manuals deemed non-adequate were reviewed for all of the review elements. While, the adequate manuals lacked a thorough review. It can be assumed that the only reason for the hardware accuracy not being 100% for the non-adequate reviews was due to the lack of equipment availability.

Table IV summarizes the number of errors found during the pre-contract review to the type of review and whether or not additional funding was required. Again, the table compares the adequate responses to the non-adequate responses. From the table, the assumption can be made that the majority of errors were due to faulty maintenance procedures. In addition, the categories with the majority of maintenance changes also required extra funding. There is the possibility that the extra funding was due to lack of part number accuracy, safety notices, or hardware accuracy.

The final table compares the commercial manual usage at the depot and the intermediate level to the programs that will also use interim contract support (ICS) and additional funding. Table V indicates that at the depot level, of the fourteen adequate responses, seven will utilize ICS at the depot and six at the intermediate level. Of this, two

TABLE IV

THE NUMBER OF ERRORS IN COMPARISON TO ADDITIONAL FUNDING REQUIREMENTS

# of changes w/ Full Potential		X26	X27	X28	X29	X30	X81
0-1	(2/1)*	2/1	1/1	0/0	0/1	1/0	1/1
3-5	(0/2)	0/2	0/1	0/1	0/1	0/1	0/1
6-8	(0/0)	0/0	0/0	0/0	0/0	0/0	0/0
9-11	(0/0)	0/0	0/0	0/0	0/0	0/0	0/0
11+	(0/3)	0/3	0/0	0/1	0/3	0/3	0/1
TOTAL	(2/6)	2/6	1/2	0/2	0/5	1/4	1/3
%		100/100	50/33	0/33	0/33	50/66	

*NOTE: Adequate/Non-adequate

TABLE V

INTERIM CONTRACT SUPPORT/ADDITIONAL FUNDING REQUIREMENTS

	Interim Contract Support Required	%	Additional Funding Required	%
Depot	7/13	59/62	2/1	28.5/7.6
Adequate	6/6	43/28.5	3/2	50/33

Note: The percentages are based upon n=14 (adequate) and n=21 (non-adequate).

required additional funding. For the twenty-one non-adequate responses, thirteen required ICS at the depot level and six at the intermediate level. Of the non-adequate, one of the depot and two of the intermediate required additional funding. These figures indicate that up to 50% of the programs that utilize commercial manuals requires ICS and up to 50% of these program require additional funding.

Overall Statistical Findings

In summary, the comparison analysis indicates that commercial manuals are not adequate for use by 5 and 7 level maintenance technicians unless supplements are provided and, in some instances, interim contract support is given. Both additions can add thousands of dollars each year to the operations and support budget. For example, observaticn 50 of the survey required an additional $587K to upgrade the commercial manuals in order to bring them to an adequate standard. However, on the reverse side, observation 58 required additional funding to produce MIL-SPEC technical orders when the commercial manuals could not be supplemented adequately.

If only 40% of the commercial manuals were considered adequate, the question must be asked, "were they really adequate?" The survey results indicated that 66.7% were reviewed for maintenance procedures, 18.5% for data restrictions, 11.1% for part number accuracy and safety notices, and 37.0% for hardware accuracy.

Interview Results

To obtain a knowledge of the commercial vendors procedures, an informal interview was accomplished with General Electric (GE).

The GE interview was held with Hazel Hackney, Director of Maintenance Data Operations, and John Bowers, Technical Publications Manager. Each representative was asked to openly discuss the contractors procedures in commercial equipment buys by non-military industries, and how they differ from military contracts.

Two major differences were found. As Ms. Hackney stated, "it's easier to operate in the commercial world than to adhere to military specification."

The first major difference is the vehicle used on a contract to obtain the commercial manuals. In the military there are at least five vehicles: Contractor Furnished Equipment/Contractor Furnished Aeronautical Equipment Notices, Air Force Acquisition Directives, Statements Of Work, Technical Manual Contract Requirement 86-01, and Data Items Descriptions. In the commercial world, the contract is let with one standard specification that is used worldwide. This specification is Air Transport Association (ATA) -100 and -200. The 100 series establish the format (full page), the numbering system, and the chapters for the manuals and service bulletins. While the 200 series establish the same for the illustrated parts catalogs and

provisioning. (Currently, the ATA-200 is under revision and will be republished as ATA-2000.)

There are three reasons for the universal support of the ATA specifications. They are:

1. All specifications are updated or revised at least once a year. An annual meeting is held for representatives of the airline industry to present change proposals. Prior to the meeting's completion, the changes are either approved or disapproved and implemented into the specification as an update.

2. All industries (electronics, communications, etc.) abide by these specifications. When a company sees this specification on contract, they are already familiar with the publication requirements.

3. These specifications are used worldwide. They are not limited to use in the United States only.

Also, the ATA series specifications are used to establish a universal data base that will be used by each company. This data base allows speedy corrections and easy accessibility to any manual, generic or specialized. Within this data base, the commercial manuals are filed by task numbers. The first three numbers identify the part of the aircraft (engine), the module the part is located in, and the piece part of the engine. The task number then continues and tells the function (repair or disassembly), and the type of repair (weld, etc.). As a result, the sub-

vendors of an end item then set up a Reliability and Maintainability (R&M) data base using the same task numbers. The R&M data base is used to identify the level of repair, whether the item is a consumable, the task level, etc. (The data collected in this data base is similar to the information recorded on the D sheet of the Logistics Support Analysis Records.) The sub-vendors submit the R&M information to the prime contractor on magnetic tape. Currently, the ATA is working on a procedure where all of the information will be passed on in the form of compact disk (CD).

The second major difference between the non-military contracts and the military contracts is publication changes or supplements. In the non-military environment, the rewriting is done by a technical writing department, either in or out of house at the customers facility.

When the commercial manual is procured through the ATA specification, the customer is given a two year "verification" period to find procedural errors. The specification does not provide for an official verification against the manuals or the changes, however, the company "feels" confident that the manuals have been reviewed by competent individuals and are accurate to the best extent possible. If procedural errors are submitted back to the original contractor in the form of a Publication Clarification Request (the contractor's equivalent to the

AFTO-22) at no expense to the customer (unless the contractor deems the request as non-procedural.) Once received, the technical publications department reviews the submittal and responds: 1) Good idea, further research; 2) Bad idea, no further research; or, 3) Bad idea, fund and we will research. These submittals are accumulated for 90 days. At the end of every 90 days, the publication clarification request are put into a change notice and distributed to all manual holders. Changes required in formatting or rewording, the customer has bought the commercial manuals "as-is". It is left up to the customers technical writers to rewrite. Legal implications are avoided because the prime contractor has the original in a data base and does not assume responsibility for the changes made by the customer after purchase.

IV. Conclusions and Recommendations

Significant Results of Survey

The statistical findings support the first part of the hypothesis. The hypothesis states that the cost effectiveness of commercial manuals is not always present when tested against adequacy, reverse engineering, or maintenance turnaround time. Due to improper survey questions, reverse engineering and maintenance turnaround time were not tested effectively. However, the analysis did indicate four significant facts. They are:

1. The review process is currently inadequate.

2. The DID and the SOW are the most effective contract medium for adequate commercial manuals.

3. Early involvement in the acquisition program phase is important when reviewing the commercial manuals.

4. Additional expense is usually incurred prior to the final acceptance of the manual by the Air Force.

The survey did support the existence of inadequacy in commercial manuals. At first, the overall percentage of 40.0% adequate and 60.0% non-adequate leads one to believe that the manuals have questionable adequacy. However, when a closer look was taken at what caused the commercial manuals to be adequate, it was found that the adequate manuals were not reviewed thoroughly for maintenance procedures, safety and warning notices, data rights, part number adequacy, or hardware adequacy. Also, the adequate

manuals were reviewed by personnel having the least knowledge on the day to day functions of technical manual development. Whereas, the manuals found to be inadequate were reviewed by personnel intimate with the process, i.e. the technical order specialist, the equipment specialist, the logistics management specialist, the maintenance technician, and the using command. In addition, they were reviewed for the maintenance procedures, safety procedures, hardware accuracy, data rights, and part numbers. (This has been listed in the order of precedence calculated through the survey instrument.)

The second significant finding indicates that the full scale development phase is crucial. The survey indicated the highest percentage (23.8%) of the manuals were non-adequate at full scale development, while, the highest percentage (42.8%) of the manuals were adequate during the deployment phase. Therefore, it is assumed that the system has been developed enough to test the manuals. Also, it is early enough to begin supplementing if necessary and be ready for deployment.

The survey also support that the additional cost of adequate commercial manuals is not realized by the Air Force until a system has reached the production or deployment phase. This additional cost of using commercial manuals is associated with interim contractor support and technical order supplements.

Of the thirty five observations, fourteen were in the deployment phase and eight were in the production phase. Of the fourteen, only five systems had adequate commercial manuals and nine used interim contract support (ICS) up to six years. Also, of the eight only two were adequate with four using ICS from two to over ten years. This averages out to only 31.8% of the overall commercial manuals used by the maintainers were adequate.

In addition, three of the fourteen observations required additional funding for technical manual changes of 25.5% or over. Only in one instance was it for a change that involved only 2.5% of all of the manuals. As for the eight production phase observations, two required additional funding for changes that encompassed over 15.5% of the manuals. The survey did not examine whether or not these changes involved operational or format procedures.

In eight out of the fourteen observations, during the full scale development phase, the contractor was required by contract to make changes and updates. However, in two of the eight, additional funding was required. One of the two was for a change involving 25.5% of the manual. In five of the eight observations, the contractor was required by contract to make changes and updates. However, in one of the five, where more that 25.5% of the manual was changed, additional funding was required.

Practical Implications of the Results

The Packard Commission's Blue Ribbon Study indicated that the use of the commercial equipment was cost effective since the DoD did not fund the research and development. In addition, the commercial equipment could be used with relatively few changes to the hardware or the commercial manuals. However, this study indicates that procedural changes in the review process must be accomplished in order to achieve this "cost effectiveness." Initially, the manuals should be reviewed thoroughly by a standardized review process. Second, the DoD should implement procedures similar to the commercial market when putting commercial manuals on contract.

First, this study must address what is an adequate manual. For the purposes of the results, an adequate manual must be usable for operations and maintenance to include correct maintenance procedures, accurate part numbers, accurate hardware descriptions, pertinent safety or warning notices, and limited data restrictions.

As the statistical findings actually indicate, the "adequate" manuals are not always adequate. Steps must be taken to assure the manuals are corrected prior to the deployment phase with minimal additional cost. The manuals should be reviewed as early as possible, similar to the review process of the MIL-SPEC manuals. As soon as a piece of commercial equipment is identified for use on a system,

the manuals should be reviewed for compliance with MIL-M-7298C by the technical order specialist, the equipment specialist, the logistics management specialist, and the using command. The number of days allowed for the review should be decided by the number of manuals to be reviewed in one period and not by a standard 30 day review period. For example, if the contractor submits twenty manuals to be reviewed, it should not be expected of the government to have them thoroughly reviewed in thirty calendar days. The contract should allow two days per manual. (Two days was selected, because a small manual (30-60 pages) can be reviewed in approximately one day, whereas a large manual (over 200 pages) can be reviewed in approximately three days. This averages to two days.)

Once the system has been integrated, the manuals should be verified along with the MIL-SPEC manuals. If technical errors are found, and the error is not caused by the system integration or personal preference (i.e. format), then the contractor should be responsible for the change at no additional cost to the government.

Also, as errors are found and changes are made by other commercial customers, the change or supplement should be forwarded to the government.

If the DoD continues with this philosophy, they should consider developing a universal specification that is agreed upon by all departments (Air Force, Army, Navy, Marines).

This specification should be modeled after the ATA series used by commercial customers of the industry. Some examples of what the specification would cover would include format, changes, and numbers. For format, the requirement would mirror the contract requirement. If we are going to use commercial equipment to reduce cost, then we should use the commercial manuals in the same manner. If changes were approved as an operational change and not just a format change, the contractor would be responsible. All other changes would be the government's responsibility. For number assignment, a cover sheet would identify the DoD department number with a note referring back to the contractors number for the manual. This specification would require an elite group to gather and research possible changes to the specification continually. Annually, the group would meet with the commercial ATA representatives and review the accumulation of DoD approved recommendations. Once the commercial side also approved the changes, they would be incorporated into a revision to the original specification. (Revisions released after the date of contract award would not effect the current contract.)

As far as putting the specification on contract, the specification would have its' own Data Item Description (DID). Tailoring or the DID could be accomplished in the contract data requirements list and the statement of work.

In addition to developing the specification, the DoD should consider using the same or similar hardware as the commercial world. The commercial world is beginning to write and sell the commercial manuals on compact disk (CD). This requires a CD reader that attaches to the personal computers. The CD reader would allow the user to make the required changes. As previously noted, the contractor is not liable for the changes made by the customer.

I do not recommend that each user be given the opportunity to automatically make changes. However, I do recommend that the DoD consider instituting a specialized technical writing department that will make appropriate changes and distributions. This would reduce the contractors cost of setting up individual data bases for the military and the supplementing cost for integrated and militarized commercial equipment.

Recommendations for Follow-on Studies

There are three studies that should be accomplished. The first would analyze the cost of setting up a specialized department for writing commercial manual changes internally versus contracting to civilian technical writing firms. The second would expand the questionnaire to include whether or not the MIL-SPEC manuals reviewed in section three were adequate. If the majority were, then appropriate reviews should be required of the commercial manuals in order to find out operational errors and to negotiate changes to the

manuals while early in the acquisition cycle. The third study would expand the questionnaire to analyze the successfulness of the reviews under MIL-M-7298C.

Finally, the latter two studies could be compared and the "specifics" of a commercial manual review could be established.

Appendix A: Questionnaire and Response Totals

Purpose: The objective of the research is to determine whether or not commercial manuals are the most cost effective method when considering the cost of buying adequate documentation versus the cost of developing MIL-SPEC manuals, the cost of reverse engineering, and the increase in maintenance turnaround. This information will aid in the analysis of an important Air Force problem.

Definitions

Commercial Manuals: Commercial publications contain technical information on the assembly, installation, service, disassembly, overhaul and assembly of equipment and parts identification. These publications are manuals, booklets, or like data that are furnished by manufacturers to purchasers of their products. [TO 00-5-01, 2-7]

Commercial Off the Shelf Equipment: 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 when acquired by the government. [FAR 11.001]

Custom Products: A commercial item modified to meet some government-peculiar physical requirement or addition or otherwise identified differently from its normal commercial counter parts. [FAR 11.001]

Standardization: The process by which member nations achieve the closest practicable cooperation among forces, the most efficient use of research development and production resources, and agreement to adopt on the broadest possible basis the use of: (1) common or compatible operational, administrative, and logistics procedures; (2) common or compatible technical procedures and criteria: (3) common, compatible, or interchangeable supplies, components weapons, or equipment; and (4) common or compatible tactical doctrine with corresponding organizational compatibility. [AFR 800-34]

Direction: Please specify the answer to the corresponding number (A=1, B=2, C=3, D=4, E=5) on the attached opti-scan form using a No. 2 lead pencil. For questions stating "other, please specify," attach a separate sheet with the corresponding question. If a question is not applicable to the selected end item, leave blank. If more than one answer is applicable, check all of the correct answers. Thank you.

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Section One

1 =	Program Phase		
	Conceptual Phase (1)	1	2.8%
	Demonstration/Validation Phase (2)	0	0.0%
	Full Scale Development Phase (3)	11	31.4%
	Production Phase (4)	8	22.8%
	Deployment Phase (5)	15	42.8%
2 =	Maintenance Concept		
	2-level (Organization, Depot) (1)	6	17.1%
	3-level (Organization, Intermediate, Depot) (2)	22	62.8%
	Other (0)	7	20.0%
3 =	Is the depot level maintenance done through organic support?		
	Yes (1)	19	54.3%
	No (0)	16	45.7%
4 =	Is the depot level maintenance done through contract support?		
	Yes (1)	21	60.0%
	No (0)	14	40.0%
5 =	Is the intermediate maintenance done through organic support?		
	Yes (1)	18	51.4%
	No (0)	17	48.6%
6 =	Is the intermediate maintenance done through contract support?		
	Yes (1)	12	34.3%
	No (0)	23	65.7%
7 =	How many years will interim contract support be used?		
	Less than 1 year (.5)	5	14.3%
	1-3 years (2)	16	45.7%
	4-6 years (5)	9	25.7%
	7-10 years (8.5)	1	2.8%
	Over 10 years (11)	1	2.8%
	No response	3	8.6%
8 =	End item quantity of the system		
	1-5 (3)	5	14.3%
	6-15 (10.5)	7	20.0%
	16-30 (23)	3	8.6%
	31-50 (40.5)	4	11.4%
	Over 50 (51)	16	45.7%

9 = Equipment type

Communications Equipment (1)	5	14.3%
Support Equipment (2)	10	28.6%
Aircraft (3)	9	25.7%
Computer Resources (4)	2	5.7%
Space System (5)	5	14.3%
Other (0)	4	11.4%

10 = Was a cost comparison done between the commercial manual and supplemental cost versus MIL-STD technical order development cost?

Yes (1)	23	65.7%
No (0)	12	34.3%

Section Two

11 = Are the commercial manuals used at the intermediate facility?

Yes (1)	22	62.8%
No (0)	13	37.1%

12 = Are the commercial manuals used at the depot facility?

Yes (1)	23	65.7%
No (0)	12	34.3%

13 = Commercial manuals make-up what percent of the total system manuals?

Less then 10% (.05)	8	22.8%
10-30% (.2)	7	20.0%
31-50% (.405)	5	14.3%
Over 50% (.51)	12	34.3%
No response	2	5.7%

14 = Did the contract require the contractor to review the commercial manuals in accordance with MIL-M-7298C?

Yes (1)	22	62.8%
No (0)	13	37.1%

15 = Was the contractor or the government required to review the commercial manuals prior to contract award?

Yes (1)	15	42.8%
No (0)	20	57.1%

*Variables 16 - 43 were only answered if variable 15 was yes.

16 = Number of days allotted to review the manuals prior to contract award.

0-10 days (5)	4	26.4%
11-30 days (20.5)	4	26.4%
31-60 days (45.5)	6	40.0%
Over 60 days (61)	0	0.0%
No Response	1	6.7%

Government representatives that reviewed the commercial manuals

17 = Integrating Contractor

Yes (1)	2	13.3%
No (0)	13	86.7%

18 = Logistics Support Contractor

Yes (1)	3	20.0%
No (0)	12	80.0%

19 = Program Manager

Yes (1)	4	26.7%
No (1)	11	73.3%

20 = Logistics Manager

Yes (1)	7	46.7%
No (0)	8	53.3%

21 = Equipment Specialist

Yes (1)	8	53.3%
No (0)	7	46.7%

22 = Engineer

Yes (1)	3	20.0%
No (0)	12	80.0%

23 = Technical Order Specialist

Yes (1)	10	66.7%
No (0)	5	33.3%

24 = Maintenance Technician

Yes (1)	7	46.7%
No (0)	8	53.3%

25 = Using Command

Yes (1)	10	66.7%
No (0)	5	33.3%

Purpose of the commercial manual review

26 =	Maintenance Procedures		
	Yes (1)	12	80.0%
	No (0)	3	20.0%
27 =	Data rights Restrictions		
	Yes (1)	5	33.3%
	No (0)	10	66.7%
28 =	Part Number Accuracy		
	Yes (1)	3	20.0%
	No (0)	12	80.0%
29 =	Safety Warning Notices		
	Yes (1)	6	40.0%
	No (0)	9	60.0%
30 =	Hardware Accuracy		
	Yes (1)	8	53.3%
	No (0)	7	46.7%

Type of quality check used for the commercial manuals

31 =	Validation		
	Yes (1)	5	33.3%
	No (0)	10	66.7%
32 =	Verification		
	Yes (1)	6	40.0%
	No (0)	9	60.0%
33 =	In Process Review		
	Yes (1)	4	26.7%
	No (0)	11	73.3%
34 =	If a verification, validation, or in-process review was accomplished, were there differences between the original operational procedures and the actual findings?		
	Yes (2)	2	13.3%
	No (1)	3	20.0%
	Do not know (0)	10	66.7%

Location of the commercial manual review

35 =	Contractor's Facility		
	Yes (1)	7	46.7%
	No (0)	8	53.3%

36 = Air Force Facility

Yes (1)	6	40.0%
No (0)	9	60.0%

37 = Was the actual equipment available during the commercial manual review?

Yes (1)	6	40.0%
No (0)	9	60.0%

38 = Was the equipment used during the commercial manual review?

Yes (1)	6	40.0%
No (0)	9	60.0%

39 = Reading grade level of the commercial manuals

Ninth grade (1)	3	20.0%
Twelfth grade (2)	0	00.0%
Fourteenth grade (3)	2	13.3%
Other (4)	1	6.7%
No requirement (0)	9	60.0%

40 = Average number of volumes per commercial manual

1 (1)	5	33.3%
2 (2)	2	13.3%
3 (3)	1	6.7%
4 (4)	3	20.0%
5 or more (5)	3	20.0%
No Response	1	6.7%

41 = Are detailed diagrams or graphics used to show the maintenance procedures step by step?

Yes (1)	6	40.0%
No (0)	9	60.0%

42 = Does an illustrated parts breakdown come with the commercial manuals?

Yes (1)	11	73.3%
No (0)	4	26.7%

43 = Do the illustrated parts breakdown diagrams cross reference each other and the text?

Yes (1)	5	33.3%
No (0)	10	66.7%

Section Three

44 = Are the MIL-SPEC manuals used at the intermediate facility?

Yes (1)	24	68.6%
No (0)	11	31.4%

45 = Are the MIL-SPEC manuals used at the depot facility?

Yes (1)	21	60.0%
No (0)	14	40.0%

46 = MIL-SPEC manuals make-up what percent of the total system manuals?

Less then 10% (.05)	4	11.4%
10-30% (.20)	3	8.6%
31-50% (.405)	4	11.4%
Over 50% (.51)	20	57.1%
No response	4	11.4%

47 = Did the contract require the contractor to review the MIL-SPEC manuals in accordance with MIL-M-38784?

Yes (1)	23	65.7%
No (0)	12	34.3%

Type of quality check used for the MIL-SPEC manuals

48 = Validation

Yes (1)	25	71.4%
No (0)	9	25.7%
No response	1	2.8%

49 = Verification

Yes (1)	22	62.8%
No (0)	13	37.1%

50 = In Process Review

Yes (1)	2	5.7%
No (0)	33	94.3%

Government representatives that reviewed the MIL-SPEC manuals

51 = Integrating Contractor

Yes (1)	14	40.0%
No (0)	21	60.0%

52 = Logistics Support Contractor

Yes (1)	9	25.7%
No (0)	26	74.3%

53 = Program Manager

Yes (1)	8	22.8%
No (0)	27	77.1%

54 = Logistics Manager

Yes (1)	13	37.1%
No (0)	22	62.8%

55 = Equipment Specialist			
	Yes (1)	21	60.0%
	No (0)	14	40.0%
56 = Engineer			
	Yes (1)	12	34.3%
	No (0)	23	65.7%
57 = Technical Order Specialist			
	Yes (1)	22	62.8%
	No (0)	13	37.1%
58 = Maintenance Technician			
	Yes (1)	19	54.3%
	No (0)	16	45.7%
59 = Using Command			
	Yes (1)	24	68.6%
	No (0)	11	31.4%
Purpose of the MIL-SPEC manual review			
60 = Maintenance Procedures			
	Yes (1)	24	68.6%
	No (0)	11	31.4%
61 = Data rights Restrictions			
	Yes (1)	7	20.0%
	No (0)	28	80.0%
62 = Part Number Accuracy			
	Yes (1)	20	57.1%
	No (0)	15	42.8%
63 = Safety Warning Notices			
	Yes (1)	18	51.4%
	No (0)	17	48.6%
64 = Hardware Accuracy			
	Yes (1)	22	62.8%
	No (0)	13	37.1%
65 = If a verification, validation, or in-process review was accomplished, were there differences between the original operational procedures and the actual findings?			
	Yes (2)	18	51.4%
	No (1)	5	14.3%
	None accomplished (0)	12	34.3%

Location of the MIL-SPEC manual review

66 =	Contractor's Facility		
	Yes (1)	25	71.4%
	No (0)	10	28.6%
67 =	Air Force Facility		
	Yes (1)	14	40.0%
	No (0)	21	60.0%
68 =	Was the actual equipment available during the commercial manual review?		
	Yes (1)	17	48.6%
	No (0)	18	51.4%
69 =	Was the equipment used during the commercial manual review?		
	Yes (1)	18	51.4%
	No (0)	17	48.6%
70 =	Number of days allotted to review the manuals.		
	0-10 days (5)	10	28.6%
	11-30 days (20.5)	7	20.0%
	31-60 days (45.5)	3	8.6%
	Over 60 days (61)	6	17.1%
	No response	9	25.7%
71 =	Reading grade level of the MIL-SPEC manuals		
	Ninth grade (1)	6	17.1%
	Twelfth grade (2)	8	22.8%
	Fourteenth grade (3)	2	5.7%
	Other (4)	0	0.0%
	No requirement (0)	19	54.3%
72 =	Average number of volumes per MIL-SPEC manual		
	1 (1)	9	25.7%
	2 (2)	4	11.4%
	3 (3)	4	11.4%
	4 (4)	1	2.8%
	5 or more (5)	8	22.8%
	No response	9	25.7%
73 =	Are detailed diagrams or graphics used to show the maintenance procedures step by step?		
	Yes (1)	14	40.0%
	No (0)	21	60.0%
74 =	Does an illustrated parts breakdown come with the MIL-SPEC manuals?		
	Yes (1)	19	54.3%
	No (0)	16	45.7%

75 = Do the illustrated parts breakdown diagrams cross reference each other and the text?

Yes (1)	18	51.4%
No (0)	17	48.6%

Section Four

Commercial manual contract requirements

76 = TMCR 86-01

Yes (1)	1	2.8%
No (0)	34	97.1%

77 = Data Item Descriptions

Yes (1)	14	40.0%
No (0)	21	60.0%

78 = CFE/CFAE Notices

Yes (1)	15	42.8%
No (0)	20	57.1%

79 = AFADs

Yes (1)	11	31.4%
No (0)	24	68.6%

80 = SOW

Yes (1)	14	40.0%
No (0)	21	60.0%

81 = Did the commercial manuals require additional funding above the original contract projection?

Yes (1)	8	22.8%
No (0)	27	77.1%

Section Five

82 = How did the program office or maintenance facility handle the standardization of parts in commercial systems?

Submitted TO change (2)	2	5.7%
Went back to the contractor to correct (1)	10	28.6%
Other (0)	23	65.7%

83 = Did the contractor charge for corrections required in the commercial manuals?

Yes (1)	2	5.7%
No (0)	33	94.3%

84 = What caused the lack of standardization?

The maintenance facility (2)	2	5.7%
The contractor facility (1)	11	31.4%
Both (3)	1	2.8%
Other (0)	21	60.0%

85 = Were there any cases of the actual equipment configuration not matching the technical documentation during subsequent repair activities?

Yes (1)	10	28.6%
No (0)	25	71.4%

86 = Number of mismatches found in the commercial manuals

0-2 (1)	6	17.1%
3-5 (4)	3	8.6%
6-8 (7)	0	0.0%
9-11 (10)	0	0.0%
Over 11 (13)	5	14.3%
No response	21	60.0%

87 = Once a problem was solved, was a supplement or TO change accomplished?

Yes (1)	9	25.7%
No (0)	26	74.3%

Section Six

88 = Are the commercial manuals and service bulletins adequate for use by military 5 and 7 level technicians in repairing the equipment to the same levels the AF maintains MIL-STD equipment?

Yes (1)	14	40.0%
No (0)	21	60.0%

89 = To what extent does the commercial documentation require supplementation?

Under 5% (.025)	1	2.8%
6-10% (.08)	0	0.0%
11-20% (.155)	1	2.8%
21-30% (.255)	3	8.6%
Over 30% (.31)	6	17.1%
No response	24	68.6%

90 = Are sufficient, in-depth documentation that comply's with the system's maintenance concept being received?

Yes (1)	17	48.6%
No (0)	18	51.4%

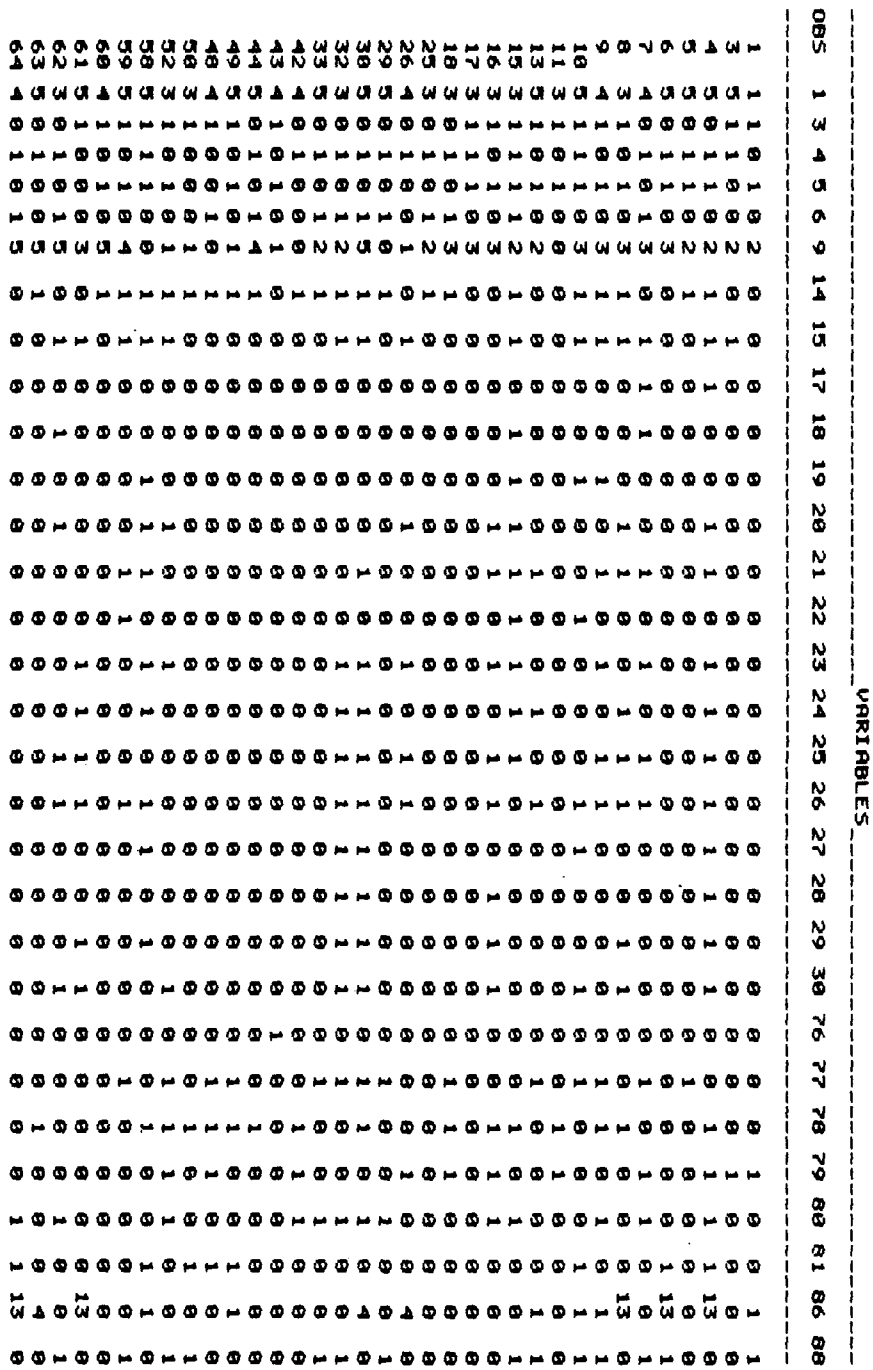
91 = Was the contractor required to provide updates and changes with commercial equipment modifications?

Yes (1)	19	54.3%
No (0)	16	45.5%

92 = Are all the users getting the service bulletins and interim safety supplements?

Yes (1)	14	40.0%
No (0)	21	60.0%

Appendix B: Raw Data



Appendix C: Expanded Responses from Questionnaire

Actual Survey Response To Question 7

- Contractor support will be required for the life of the system for non stocklisted items. Numerous Boeing 707 parts were removed from salvaged aircraft, refurbished and put in the supply system because of limited parts supply.

Actual Survey Response to Question 14

- This entire area of reviewing manuals could use some work in my opinion. I was the first line shop supervisor when the commercial manuals were sent to the maintenance shop for a maintenance review. We had two days to review over 20 manuals, some 4,000+ pages of technical material, and needless to say our review was not extensive enough to make anything but a very general statement on the adequacy of the books. A better method would require the contractor to provide a deliverable item which would show a comparison of the CM to a AF manual or the MIL-STD.

Actual Survey Response to Question 19

- The C-18A aircraft technical orders developed by Boeing received an in-process review and pre-publication reviews prior to delivery.
- No quality checks are being made to the standard commercial manuals (other than the original MIL-M-7298 review) although the manuals receive spot checks during

review of the unique information which is being added to them. The unique information is being in-process reviewed, validated, and verified. These commercial manuals have been in existence since 1973 and are very accurate.

- Quality of commercial manuals is checked at the commercial manual reviews. In-turn, this determines the adequacy of the commercial manual for field usage. (see MIL-M-7298C) Commercial manuals are not validated or verified, however, MIL-SPEC supplements to commercial manuals will be validated and verified.

Actual Survey Response to Question 25

- The commercial manuals are divided by ATA-100 chapter into separate TOs.
- Quality of manuals for F-15 tactical electronic warfare support system (TISS) were checked through three in-process reviews. A quality check prior to preliminary publication (ensuring all IPR comments were incorporated), validation, and a two step verification process.

Actual Survey Response To Question 27

- The IPBs were inadequate in that the illustrations were not detailed enough to locate bit piece parts locations.

Actual Survey Response To Question 31

- Air Force Satellite Control Facility (AFSCF) Standard 310-2.

Actual Survey Responses To Question 32

- Manuals were validated and verified in the usual (and simplistic) sense of TO 00-5-1. However, program integrated support required the manuals to be included and correlated during design reviews, audits, maintainability demos, test/evaluation, etc.
- By in-process review also.
- No quality check was performed. However, the manuals were reviewed for missing portions, i.e. IPBs.

Actual Survey Response To Question 46

- Cost should have been incurred, but SPO refused to allow recommended changes to be made.

Actual Survey Response To Question 47

- The procurement cost of the commercial manuals was included in the equipment price. However, the cost to upgrade them to MIL-C-7298C was not. They were not upgraded, so no costs were incurred.
- Yes--the contract only covered the cost of the commercial manual submittals and CFE/CFAE notices. The cost to supplement/rewrite and purchase additional manuals were covered in a task change proposal to the basic contract.
- Added contract change requirements at the user's request.

- $587k has been spent to modify seven commercial manuals. This program is still in IOT&E and the manuals have not been used by the field yet. Changes that have been made are the result of verification of these commercial manuals.
- The commercial manuals for the IFF subsystem were so inadequate [that] MIL-SPEC TOs were procured requiring additional funding.

Actual Survey Response To Question 48

- The problem was not solved although some errors were found during the production phase were corrected by the commercial item vendor and the prime contractor at no additional costs. The reduction of operational dependency on commercial publications was achieved as a program objective, so we're not using the manuals enough to detect any additional errors. However, it is certain that they exist.

  Source control techniques were used to positively identify the series, make, model, and part number of commercial items. This was done to place more responsibility for functional configuration on commercial vendors during reprocurement actions. In essence, we are saying that we aren't too concerned about what we are sold under the source control number, as long as it is exactly like -- or equivalent to -- the original item which was used. Realistically, this equivalence can only

be determined by the vendor and then only if we can tell the vendor precisely what was originally used. This initiative is one of many implemented within the context of our totally integrated support concept, unusual in systems acquisition. Our program objective is to provide a full-time, operationally suitable tester. To do this, we accommodated the characteristics of commercial equipment -- benefits and shortcomings -- in a "customer oriented" way which includes all aspects of our military needs. During our accommodating process, we learned that commercial manuals weren't required in any but two roles: First, as source data for relevant military manuals and second, as a form of data useful to logistics managers and engineers in their ongoing materiel management efforts.

- [These was] no attempt to standardize parts on commercial equipment.

Actual Survey Responses To Question 50

- Commercial carriers modified selected components to fit their mode of operation. Normally form and fit were the same but function changed. These unique items have to go back to the original repair facility using carrier part numbers to be repaired to obtain replacement parts.

Actual Survey Responses To Question 53

- There were two incidents where the users discovered that the Illustrated Parts Breakdown did not match the actual hardware. However, the AFAD required the contractor to furnish necessary changes throughout the life of the contract. Therefore, there will be no additional cost to the government.
- Returned to original contractor support facility.

Actual Survey Response To Question 54

- By submitting a COD to contractor for a no cost change/supplement. (1 year warranty clause)

Actual Survey Response To Question 56

- While there are no supplements to the manuals, the AF unique information is being "rolled into" the manuals to reflect the unique configuration. This action was a contractual requirement from the start.

Actual Survey Responses To Question 60

- Commercial equipment publications are only one of many factors which impact commercial equipment support. Our management systems are designed to support military equipment and are adequate if we adequately accommodate commercial equipment. The application of MIL-M-7298C is one part of this "militarization." Other "militarization" actually converts commercial equipment into military equipment. If done well, this is an

excellent approach, but the end product is not commercial equipment -- a point lost on many equipment managers.

Too often, our approach is "militarization" is little beyond a rote attempt to force a commercial item into the military operational and support scene. The results are partially responsible for this questionnaire. Militarization of equipment which is wrong for its intended use doesn't make the equipment more suitable. Similarly, the application of MIL-M-7298C to manuals which are wrong for their intended use only militarizes unsuitable manuals.

Responding to long-standing, well known commercial equipment support problems, this program accepted an ILS objective to achieve suitable support for its commercial equipment. As implemented, selection of commercial equipment included publications reviews and support assurances from the commercial vendors. In other words, as the customers, we explained our military requirements to the vendors, then selected those most sensitive to our needs. This approach has proven more or less effective, depending on the size of the vendor.

We have encountered some blase' attitudes, especially among the large vendors, which could result in support problems. However, our system is designed to allow form, fit, and function "substitutions." So, if support problems materialize, then other vendors will

help to solve them through normal, commercial competition. That is, if AFLC can be convinced to implement and exploit this approach.

On this program, we were able to radically reduce the technical manual burden by using commercial manuals as source data for the preparation of modified military technical orders. "Modified" means that the manuals were prepared using the MIL-SPECs as guidelines, but deviations were made where it made sense.

We were able to eliminate over eight linear feet of manuals, all of various sizes, shapes, costs, and usefulness. The most dramatic reduction involved manuals for the computer subsystem: Over six linear feet of commercial publications costing over $5K per set (28 sets were procured) were reduced to only a few pages of operationally relevant matter in our military manual. deleted data wasn't compatible with out training, skills, reading comprehension, AFTO maintenance methods, system maintenance/support capabilities, and etc. so it was neither relevant nor suitable.

Also, we were able to significantly reduce our support equipment burden. Usually, integrating contractors simply identify (to us) whatever SE is identified in the various commercial manuals without regard for our operational situation. We required the contractor to identify only that SE relevant to our

operational and support requirements -- as defined by our integrated support efforts. This effectively eliminated nearly all SE for the commercial equipment we use since virtually none is repaired in the field -- outside of PMEL and PMEL usually has an existing capability and it routinely uses commercial publications in their original form.

Finally, the commercial data eliminated at the field level is relevant to our total support management effort, but as a form of "logistics engineering data" or data useful for materiel management and support, but neither formal engineering data nor technical manuals. To date, a AFLC dogma has refused to consider the data under such a category, choosing instead to force the data into the AFTO system where it will languish and evolve its obsolescence.

- To 4950 TESTW/MASV is to TOMA for the EC-18B aircraft, SMILS, OPTICS and ECCM/Advanced Radar Test Bed Aircraft. We also supervise the TO development for selected ASD System Program Offices. The survey was completed based on the American Airlines (AA) Boeing 707 aircraft purchased, in FY82, by ASD/AFY for the 4950th Test Wing. This purchase was unique since the aircraft were used and purchased from the carrier (AA) with existing commercial data supplied.

The technical data for the 707 aircraft had been developed to Air Transport Association (ATA) 100, revision 3 specifications. Two hard copies and numerous film cartridges were delivered with the aircraft along with film cartridges of Engineering Change Orders (ECO), Engineering Service Orders (ESO), and Flight Directives (FD). The commercial aircraft manuals were to be entered into the Air force technical order Systems and maintained by an engineering contract. Since Boeing did not maintain the data for AA, they would not verify that the data was accurate; therefore, new maintenance manuals were developed.

Boeing used their existing 707 maintenance data and incorporated the AA ECOs and FDs, which have been accomplished on the aircraft. They also incorporated some unique AF data i.e., fuel systems maintenance/aircraft grounding. In addition to the new technical orders, the AA ESOs are still being used to perform some off-equipment maintenance. ESOs are changes to commercial maintenance instructions required by carrier unique modifications. ESOs can also be driven by service bulletins selected for accomplishment by the carrier. The ESOs do not have technical order numbers affixed, since the quality of the data is unknown. The only way to determine the accuracy of the ESOs is to perform a verification. OC-ALC is reviewing the ESOs being used by

the Test Wing, trying to determine how to approach the ESO problem. Presently, there is no method to get changes into the ESOs other than at user level. No provisioning was accomplished for the aircraft, after purchase, so the maintenance personnel work the discrepancies as far as possible and use the CLS contract when it goes beyond our maintenance capability. Since the 707 has numerous items which are stock listed in the supply system, existing technical orders are used to perform intermediate level maintenance when available.

For of the eight C-18A aircraft were modified to EC-18B aircraft by the 4950th Test Wing Modification Center. OC-ALC required that "stand-alone" aircraft maintenance manuals be developed to operate and maintain the aircraft after mod. The C-18A aircraft manuals were used as baseline technical information and the ARIA engineering data package was used as source data by Boeing to develop the EC-18B aircraft technical orders. Flight manuals and maintenance manuals/illustrated parts catalogs have been developed for the EC-18B aircraft configuration. An update is required to the technical orders because of the lag in engineering data completion by the Mod Center. Based on latest estimates, update will occur in FY91/92 time frame.

4950th Test Wing/MASV is also involved in the commercial manual world on aircraft programs being

managed by ASD. Here again, the manuals are in ATA 100 specification developed for the "green" aircraft purchased. Normally, GFE or GFE compatible equipment such as UHF and HF radios, IFF, TACAN, and INS are installed prior to delivery. The commercial world includes the item equipment manual as the maintenance instructions in the "green" aircraft manual, along with a wiring interface, but no troubleshooting instructions for newly installed equipment. For Air Force use, maintenance instructions and aircraft interface for these systems are normally developed as supplemental data, or may be folded into the commercial manuals prior to delivery. Since the commercial inspection system is not used in the military, the inspection criteria is normally generated by the contractor in MIL-SPEC requirements. flight manuals and check lists are developed from the commercial flight manual but are formatted to MIL-M-7700[illegible] Specs.

Commercial aircraft maintenance manuals are adequate for use by Air Force technicians. The main problem is learning how to find the information in the manuals, since maintenance efforts are not normally duplicated for performing check-outs. The organizational maintenance manuals and illustrated parts catalog (IPC) also contain maintenance instructions and parts breakdown for off-equipment tasks which are considered by the Air Force

intermediate and depot level maintenance. For the 4950th Test Wing, this is good because we are not restricted to the level of work we can accomplish.

The procurement of commercial manuals uses MIL-M-7298 as evaluation criteria. Amendment 5 to this specification requires source maintenance and recoverability codes to be established for the IPC. The spec also requires that the commercial instructions are to be reviewed prior to purchase for usability by acquiring, using and supporting commands. This is all well and good for items as specified in MIL-M-7298C; however, it is impossible to comply when purchasing aircraft operation and maintenance manuals, because of the size of the effort to provision the aircraft and the thousands of pages of technicalnical information supplied to review. One additional item of interest is the use of ATA 100 specifications. ATA 100 was issues 1 Jun 56. Since that time, the spec has been revised 25 times. The commercial world views the spec as a guideline to follow--not how to do the work, which is what we use the MIL-SPEC for. Therefore, it is hard to pin a contractor down on format and procedure arrangement. Also, the contractor may have updated the manuals for old aircraft which are still in production--thus, not all manuals are made to the same spec revision.

In conclusion, the commercial manual world for aircraft varies depending on who is getting the aircraft and the maintenance concept for deployment. Since the commercial off-the-shelf purchase of aircraft is relatively new, mistakes made in the technical manual area during acquisition will not be known for several years. A possible solution is to warranty the commercial manuals for a specified period of time after purchase, since the off-the-shelf aircraft acquisition normally spans a short time period and aircraft PMRT before the technical manuals are completed. The warranty would require the contractor to make specific changes if certain procedures were discovered unusable by government personnel, or did not match hardware configuration.

- As far as I can see, the AF will have few, if any, problems with the commercial data being procured in this program. The technicians who will use this data are all very skilled and experienced people. The data could also be usable by 3- and 5- level technicians if they were given any real training. The writers of these manuals assume that the person using them is an experienced technician and writes the manuals accordingly. These manuals appear to be very accurate and complete.
- The reason so many questions were left blank is: we are early in FSD and not that many manuals have been written to date. We have not had a chance to review any

commercial data, we have only review changes to existing Group A technical data.

- If commercial manuals exist, use them. Please don't rewrite to a relaxed -1 format just to have an official looking TO! In the Automatic Test Equipment area we see a wide range of manuals, the normal operation, maintenance, overhaul and IPB for hardware along with operator (user), programming and language manuals for software. Most are very good. Often much technical information is lost when commercial manuals are molded in the MIL-M-38784 format. We must keep in mind "why we need technical manuals and the purpose they are to serve." Marketing tendency to be optimistic is stating equipment performance and specmanship must be filtered out of our number of computer manuals written by the English Department that cause much confusion and waste, technical accuracy is a must. Provide technical information directly and clearly.
- One electrical drawer the TRR receiver, was being verified when it was realized that it was impossible to remove two of the LRU's. This problem required changes to the TM to the level of sparing. Provisioning had been accomplished and sparing ordered, new spare items where ordered and old ones where canceled. Life cycle cost figures had to be changed and R&M figures where also effected.

- This reply is for the Comfy Sword III Phase 2 (CS III-2) program. CS III-2 is a one of a kind system that will be used at Nellis Range and will have CLS maintenance for the life of the system. Our program has both commercial manuals and MIL-STD manuals. Commercial manuals were submitted under CFE notices, which were reviewed and approved through the normal CFE approval process by SM-ALC. We intend to verify the commercial manuals IAW TO 00-5-1 at the same time as we verify the MIL-STD manuals. The contractor is in the process of validating the MIL-STD manuals; the government will then verify them.

  Because CS III-2 has not yet been turned over to the user, it is not clear at this time what problems there will be with commercial manuals. We have had at least one manufacturer of our commercial equipment go out of business, which also caused a problem in obtaining manuals. We also should have but did not have the user involved in review and approval of commercial manuals.
- IPTS is a quick pace program. We are having the contractor convert commercial manuals to MIL-SPEC manuals. the contractor is in the process of writing the manuals so I could not answer some of your verification questions since we haven't started yet. One of the problems I have with contractors is over optimism. They always believe their manuals have no problems and will easily pass verification and thus allow no time for

correction and follow-on verification. No prepublication is ever factored into their time lines or time for SM-ALC to accomplish printing. Manuals are inevitably delivered 30 days prior to user need not taking into account these above factors. Although the contractor feels he has met the requirement manuals are still not available to the field. If it wasn't for slips in schedule unrelated to logistics manuals would be late and thus delay supportability.

- I can't provide much information on Sentinel Bright commercial manuals. Most of the work was completed prior to my arrival in IC. But, I can tell you that the intent is to support the system with contract support for the life of the system. We have updates and service bulletins subscription to supplement the commercial manuals. We feel this will aid in making the contract support contract more competitive. Most of the equipment is commercial off-the-shelf.
- Most commercial manuals do not provide the kind of information required to perform maintenance in accordance with the assigned SMR code. In other words, piece part repair of SRUs cannot adequately be performed using commercial manuals (in many cases). Proprietary data rights is often the obstacle to acquiring more detailed information. Cost is also a big problem. With so much COTS equipment, we must be smarter in our handling of

technical data. We in OTH-B have attacked the problem from several angles to keep costs down.

(1) MIL-SPEC'ing as <u>few</u> manuals as possible.

(2) Use commercial manuals as is--buy missing information to bring manual up to acceptable maintenance level (without worrying about 7298C format).

(3) Revisiting SMR code assignment--Is it realistic?

(4) Buying additional manuals directly from the vendor. Don't fight copyright laws just so government can reproduce manuals.

(5) See if ALCs can supplement manuals. The ALCs have a wealth of talent in their MA shops.

(6) Combining similar commercial manuals into one.

- Commercial manuals are generic and do not always show differences in models of their product. The equipment is difficult to maintain when a technician must use a MIL-SPEC supplement cross referenced to a commercial manual. For example, the MILTOPE-MSU and the ITT supplement. A mix of commercial manuals and MIL-SPEC for a single item should be avoided.
- Some valuable lessons learned have been experienced on this program as a result of using 65% COTS with some 62 CFAE/CFE notices generated.

Need to assure the integrating contractor reviews all commercial manuals for preventive maintenance inspection (PMI) requirements.

Need to review the manual to assure the troubleshooting procedures go down to the piece part level for depot maintenance.

In the case where several COTS items have been integrated into a complete unit has the integrating contractor been tasked to develop troubleshooting procedures to get you to the individual commercial item.

How do you apply new terms generated by the FAR when your contract was let under the DAR and these terms had a different meaning? i.e. Modified COTS vs. custom product or modified COTS vs. commercial type?

This program has not been able to get a very good response from the ALC on commercial manuals through the CFAE/CFE notice procedures. Many of our commercial manuals have been at the ALC for 18-24 months with no response and/or approval/disapproval. Commercial manuals have always been a problem and will continue to be a problem until we move the management of technical data under one roof (AFLC vs. AFSC.)

- The entire subject of commercial manuals for repair of Air Force assets is to large to addressed here with specifics. Manuals provided by a contractor are as varied in scope and content as the contractors

themselves. Since we, the Air Force, deal mainly with the largest corporations on acquisitions for weapon systems a standard for acceptable manuals would not seem so difficult a problem until you begin to look at the multitude of small subcontractors that provide parts of the system to the prime contractor. The problem is further exacerbated by contract law that I really do not have the expertise to address but I do know there are "cans and cannots" associated with every specification/requirement you levy on a contractor. My personal opinion is that there is no single answer, or even multiple answers. The overall solution will be a process whereby we will adapt to commercial manuals as best we can, develop the necessary data where we must and buy MIL-SPEC TOs when there is a necessity to do so.

- The F108-CF-100 engine Intermediate Maintenance Preliminary technical Orders in MIL-SPEC format were delivered to the government in Sep 84. Verification of these manuals has begun. The Illustrated Parts Breakdown in MIL-SPEC format is due to be delivered for verification 15 Oct 84. The depot Maintenance Manual set in MIL-SPEC format is scheduled for 50% In Process Review 23 Oct through 1 Nov 84.

Past experience with JT3 engine commercial maintenance manuals show the cost to be approximately $700 per manual. CFMI has pointed out in the past that

only the first 20 each preliminary copies of the commercial manuals would be furnished "free" of cost to the government. Future copies and future change costs would have to be negotiated. Initial distribution for existing engine depot maintenance manuals is approximately 300 copies. Cost of updating a MIL-SPEC TO is an average of $200 per page on a TO update contract. Using that cost percentage, we don't understand the high cost quote to ASD unless it is for development, not just a changed page.

There are other expenses which would be incurred as result of a decision to use commercial manuals for the depot repair manual. Our maintenance personnel are not all well trained or experienced as commercially certified mechanics. This would require training and/or in-house supplementation as a result of less detailed manuals. Costs of training and supplements have not been considered in ASD's cost figures. Supplements would also be necessary to furnish Air Force only data which would not be included in the commercial set of manuals. Examples of these would be nuclear hardening, corrosion control procedures, and comprehensive engine management system data. The commercial manuals do no generate different limits for military versus commercial customers; therefore, engine repair concepts do not differ. If any changes become necessary, they would be

incorporated as supplements. Supplementation increases the cost of the commercial manuals and leads to errors in the manuals as changes are made which affect other parts and makes use of the technical data by shop personnel very difficult.

Additionally, the commercial Illustrated Parts Catalog (IPC) contains all airline ad Air Force configurations. A training program would be necessary to instruct Air Force personnel how to use the IPC. The IPC also does not include source maintenance recoverability (SMR) codes for the field to know the level of repair or spare parts authorization. On the other hand, the MIL-SPEC Illustrated Parts Breakdown (IPB) would facilitate Air Force control of standard DOD engine parts; otherwise, commercial sole source procurement would be necessary. Commercial airline changes will continuously be added to the commercial manuals and would always be a point of confusion to maintenance personnel.

The commercial overhaul manuals are broken out by component and contain multiple processes, assembly, disassembly, repair and inspection procedures in the same section. OC-ALC maintenance concept is setup by work station. Each station has a specific task to perform. The MIL-SPEC work package TO was developed for this concept. Only work packages necessary for each task performed at a work station need be filed at the work

station. Each work package consists of a title page and data necessary to complete the task. Commercial manuals do not have a title page for the sections, thus cannot be broken out by tasks and placed at work stations. Using the work package concept, only an average of 25 pages need be kept at a work station. if a commercial manual is used the whole TO would be kept within a shop area (approximately 50,000 pages at each work station would be impractical) and the worker would have to go away from his work station to the manual to look up information. This is costly in the time a task is to be completed and will impact the amount of time spent within the shop.

Further, CMFI has stated in the past if a USAF repair was submitted for inclusion and they (CMFI) did not agree with it, they would incorporate the change. However, they would disclaim it and note it as USAF repair only. This would, consequently, absolve any warranties the USAF might have.

OC-ALC/MME feels that dollar savings now, if any, would be lost during a future technical data conversion and could be further impacted by the requirement to manage the commercial data on a peculiar basis.

It has been the desire of OC-ALC in the past to maintain a high degree of commonalty between the F101-GE-102, F110-GE-100, and the F108-CF-100 engines in order to reduce logistics support costs and improve support

management. The same applies to technical data. F101 and F110 manuals will be in MIL-SPEC format. .pa

Wartime surge will be adversely affected. The F108 will probably be co-located with various USAF engines covered by MIL-SPEC TOs. Because of the extreme differences in the commercial vs. MIL-SPEC TOs it would be hard to put personnel onto this engine and expect good results for the surge. This point should not be taken lightly.

CFMI representatives have been questioned as to the Reading Grade Level (RGL) on commercial manuals, they report it to be about 14. MIL-SPEC format TOs are structured to 9.1 RGL and this difference is significant when we consider the maintenance personnel are for the most part high school graduates.

- SPO decision to CLS on contract precluded contracting for logistics deliverables to support using command maintenance concept or AFLC depot level support. Additionally, the lack of maintenance data precludes competitive repair contracts for depot level support which results in sole source maintenance contracting to the prime contracts. Lack of logistics data precludes future changes to the maintenance concept IAW using and supporting commands desires based on cost life cycle estimates. this "worst case" support scenario gets worse...prime contractor refuses to bid on a maintenance

contract with SPO. Additionally, rumors indicate prime contractor is to declare chapter 13 bankruptcy which will result in a non-supportable program. No data precludes release of contract to other agencies. In the event of bankruptcy--contractor is required to provide available data to government. However, prime contractor is an integrating contractor who had not developed data, but relied on vendors for equipment deliveries. Therefore, data may never be available.

All the above scenario is based on independent SPO decision for a support concept (CLS) without a higher reviewing/approving authority. No single agency (Air Staff) is tasked to approve CLS decisions bases on LCC models.

- Historically, HQ SD used contractors for their logistics support of all their systems. The general feeling from them is, AFLC requirements are to expensive and they do not understand our kind of operations. Thus they see logistics command as draining their program dollars without any thought that LCC would be reduced if our needs are met. They continually refuse our inputs and our recommendations. My personal concern is so great I feel we must have an audit to surface the problems we have encountered so far.

Commercial equipment poses so unique problems, but not insurmountable. Organic depot can repair COTS, but we must be aware of the pitfalls:

(1) Full documentation may not be available

a. Level 2 engineering data can be used to complete, but only for form-fit-function.

b. Configuration control still cannot be performed but we may request level 3 data on the follow-on contract, if we find it is cost effective or the system is of a highly critical nature.

2. TOs (a subset of engineering data) may back in completeness, but repair can still be affected.

3. Spares may not be available for sometime but we can perform some type of spares allocation. Even COTs contain many parts that are stocklisted, so the provisioning effort may not be that large.

The bottom line is, SPO must have logistics as one of his major concerns and have responsibility for LCC of system they are bringing into the inventory.

- COTS design is based on market factors (profit, marketability).

-- Applicability to government application is based on commercial specification, therefore, little to no government influence on system specification/design for specific military applications.

- COTS equipment software also developed for commercial applications to meet market factors (profit, sales...)
  -- Also little government influence on COTS software
- Unique military requirements drive modification of COTS software or development of military unique software.
  -- Military can influence design of only military portion of software modification--not influence commercial COTS software.
  -- Military can obtain support/data for military modification portion of the software modification and control software configuration of that military modification portion only the limited data rights for future configuration control, is limited by fact that contractor changes to COTS software may make military modification portion unusable--military must then redevelop COTS portion of software due to commercial discontinuation of software version, or military is forced to buy software version life cycle support.
  -- Military developed software/equipment--full data rights in future life cycle support if support data/compatibilities bought, ease of configuration control for future system mode, changes, replacement programs.
- COTS equipment changes design by market forces--no military stability.

-- Military modified or military uniquely developed software is different for COTS software developed for the COTS equipment.

-- Military modifications and military unique software developed for meeting a specific military application is developed/designed to operate on specific (generally COTS) equipment.

-- Changes in COTS (contractor terminated product line, changes product line, or replaces it with a new version/similar product) may or may not have backward compatibility to operate the prior version of COTS software. Also, military unique software or COTS software tailored for a unique military application, may also not operate on new COTS equipment replacing the old version.

-- If COTS equipment the military software operates on is terminated by the vendor (terminates product line), guarantee/warranty clauses in contract my cover only military paid for modifications to the software. Cost of COTS software data rights (terminated by contractor) may be prohibitive (no life cycle sparing, data for reprocurement, etc. = insupportable even though data offered to government.)

-- New replacement COTS may not be able to operate military software developed for prior version of COTS equipment.

-- Saves maintaining older version of COTS equipment through life cycle sparing, buying data rights, etc.= high cost in order to maintain system and configuration control to that baselined system.

-- If numerous changes to system using the COTS are anticipated it doesn't make sense to maintain an old system configuration.

-- New version equipment would not have been designed to use military unique software or prior COTS software modified for military application. New COTS developed to use COTS software.

-- Forces buying new COTS equipment with COTS software, and either redevelopment of the COTS software for military unique application (modify COTS, or develop new military COTS)--all over again.

-- Military in some position over a barrel--no configuration control, [and] money to contractors.

- COTS or not COTS (AFR 800-21, chapter 7)

-- Commercially available equipment (COTS)

-- Meets military requirement

-- Includes both software and equipment as available for military requirement

-- No modification of equipment on software and firmware

-- Military has no influence on design or performance--take "as is"

-- Limited to no data rights to military

-- No control of COTS equipment/software changes

-- Military must remain current in COTS configuration for equipment/software

-- Increased likelihood of CLS for support to prime manufactures due to limited data availability for competitive requisitions. All support dependent on prime contractor, can't compete spare due to lack of data = violation of FAR/public law possible.

- MOTS (Military off the shelf equipment)

  -- COTS equipment and/or software modified for military requirements.

  -- Data on modification paid by military only

  -- Configuration control design or performance of COTS but military modification portion alone -- limited design/performance influence by military.

  -- Military still subject to contract for support

- Military developed equipment

  -- Full data available

  -- Military can control design/performance

  -- Lift support available to meet changing military requirements

- NOTE: Per AFR 800-21, Chapter 7 under review, any change to system design or performance (including software) make the system non-COTS.

Appendix D: Expanded Response from General Electric Interview

General Electric Response.

Q Is the commercial side of the house moving a head more rapidly in automation then the military?

A Absolutely. The commercial side of the house has a data base to customize data (core data base.) We code all data by engine model, aircraft it is used in, and configuration level by service bulletin number. It can retrieve a customized version at anytime. For example, the new CF682 engine (basic family) has 10 models, is used in 4 different aircraft, and has 15 different customers. Through task numbering, a system's engine and aircraft is built into the data base. This enables the airline to have a shelf support system or a line maintenance support system based on the task numbers. (This data base does not tie into the LSA data base.)

The task number identifies the part of the engine, module of the engine, piece part of the engine through the first three numbers. Then, it goes on and tells the function (repair or disassembly) in repair and the type of repair (weld, etc.)

Then, each industry sets up another data base and feeds in their reliability and maintainability data that will compare to some LSA element. This R & M data identifies the skill level, consumerable, task level, etc. There is a requirement in the commercial world to

maintain data bases and provide magnetic tape to the airlines.

Currently the commercial world is working on a compact disk and real-time network.

When dealing with the military, we [GE] must create a new data base because the military wants special formats (2 columns vs. full page.) If the military were to use this system, we could add the Air Force unique data through the existing data base.

Q The problem with the F-108 engines was mostly due to the format of the manuals?

A Mostly, the overhaul shop (depot) OC-ALC absolutely refused to except the commercial books. Therefore, we ended up with, even though it was sold as a commercial program, the parts and provisioning being done in a commercial way; while, the publications were done in a military format. There were some differences in the engines, but, it was felt that the depot drove this decision.

Q To supplement the F-108 engine publications, if they would have stayed with he commercial books, how would you have gone about doing that?

A I don't precisely remember the recommendation. But, here's a navy example: We have a program where there are available commercial manuals covering accessories. Wherever there is no difference, the Navy is having us put their designation on the cover. But where there is a

difference, (6 or 8), we are putting supplemental pages in each by processing a change.

Q For instance, if you have a contract with the Navy or the Air Force using a commercial manual, part of which would be updates and changes, so that as you change that manual and as those changes go out to your commercial customers, would they also go out to the military so that the manual would also stay current?

A Yes, absolutely. If it is military, it must be on contract to cover that. There's a contract on the F-103. Sometimes changes do not occur on a timely schedule or different approvals. It's difficult to keep the military concurrent with the commercial because of the procedure differences.

Q Concerning the ATA series specifications. What are some recent events for the supplemental data base?

A 1. Basic requirements to support a task number manual is five years old and the standards and requirements have changed.

2. Task force put out new standards for the data base and magnetic tapes that goes out to the airlines.

3. Now working on compact disk standards. The CD will hold the major manuals. The stands will cover the physical disk, what will be seen on the screen, should color be used for warnings, what data items the airlines want to retrieve, etc. The disk will be able to use the disk from nay company because it is standardized (all companies will use the same format.) The airlines will be able to select their own equipment (portable

computers) to use with the CD's. The CD will hold 71-72K pages of text, pictures, and graphics.

Q Will the airlines be able to manipulate this data?

A Yes. Part of the standard will be to alter the document on a floppy disk. They will be able to tailor it to their own needs.

Q Do you have a recommendation for military contracts that will use commercial equipment and commercial manuals?

A The military does not have a cohesive (continuity) group. Each branch of the military wants to do it their way!

The military should look at what the commercial world has designed. "When you can take an aircraft, and go to a specification and find that everything in that aircraft can be identified with a number that is already set up and established. It is not that much work on the various military aircraft to adapt the same type of numbering system." The aircraft uses the MIDAS numbering system and 863 specifications.

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Title: THE ADEQUACY OF COMMERCIAL MANUALS FOR INTERMEDIATE AND DEPOT LEVEL MAINTENANCE

Thesis Chairman: Mr. Arthur A. Munguia
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Approved for public release IAW AFR 190-1.

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Box 19: Abstract

The objective of this research was to analyze the adequacy of using commercial manuals and to identify the correct acquisition process to obtaining adequate commercial manuals.

A questionnaire was developed and a survey was accomplished. The survey was distributed to Deputy Program Managers for Logistics (DPML) and Air Logistics Centers that utilized commercial manuals. The most significant result indicated that the commercial manuals that were determined to be adequate, actually had not been thoroughly reviewed. This resulted in additional funding requirements for manual supplements and system interim contract support. Other significant issues included: the importance of early involvement in the acquisition program phase; and, the DID and the SOW as effective contract mediums.

Recommendations to improve the effectiveness of the commercial manual review included:

1. Establishing a universal specification that would be used in all contracts.

2. Establishing verification procedures for commercial manuals on equipment that is integrated into a system.

3. Establishing an internal technical writing department that will do the changes to commercial manuals.

4. Establishing the use of similar hardware (CD readers) to the industrial contractors.