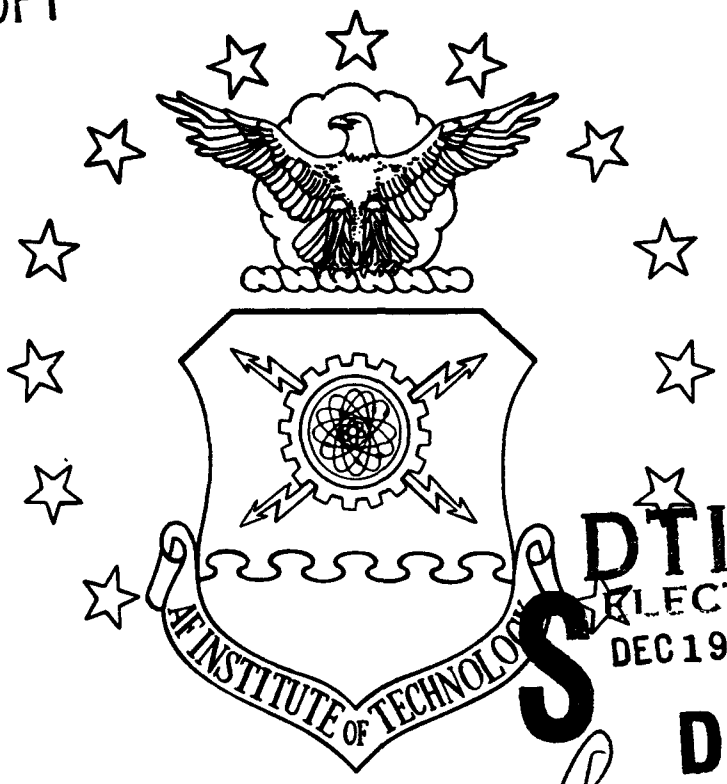

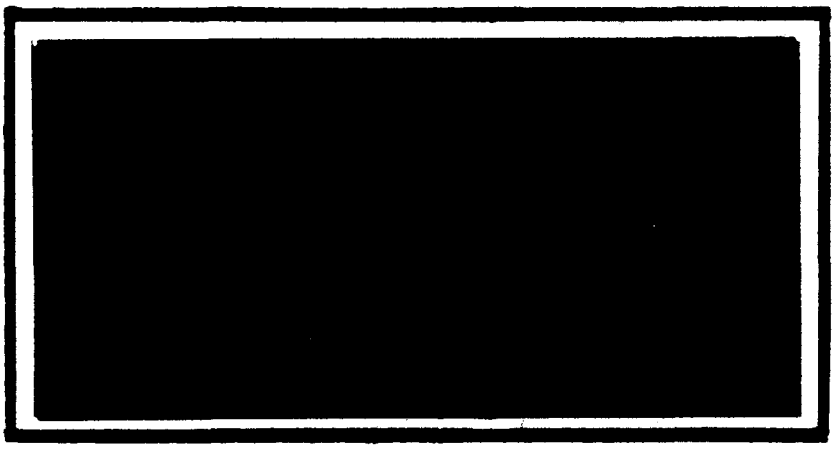

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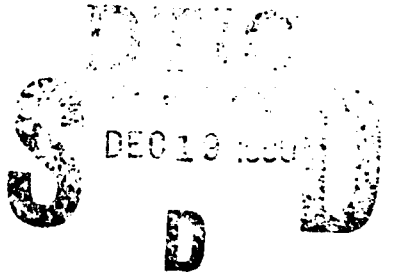

THE EFFECT OF THE COMMERCIAL SPACE LAUNCH ACT ON DEPARTMENT OF DEFENSE CONTRACT ADMINISTRATION

THESIS

Michael M. Hale, Captain, USAF

AFIT/GCM/LSP/90S-3

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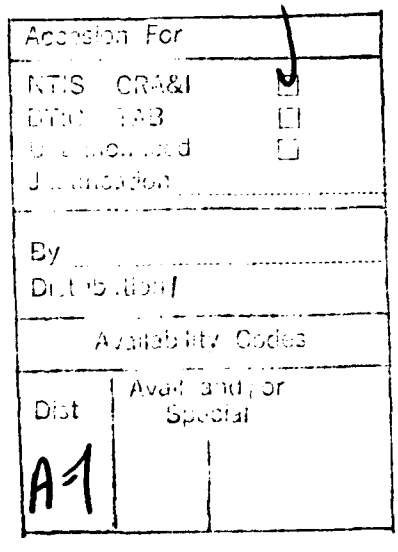

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THE EFFECT OF THE COMMERCIAL SPACE LAUNCH ACT ON DEPARTMENT OF DEFENSE CONTRACT ADMINISTRATION

THESIS

Presented to the Faculty of the School of Systems
and Logistics of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Contract Management

Michael M. Hale, B.S.
Captain, USAF

September 1990

Preface

The purpose of this study was to examine the Commercial Space Launch Act and the effect of the Act on the Department of Defense contract administration community. The research was performed by using telephone interviews of contract administration unit commanders. The results document some weaknesses in the current administration of the Act and recommendations and suggestions for improvement were made.

As the country proceeds into the next century, the necessity to learn as much as possible about the universe outside the world around us cannot be understated. The only way for any such education to occur is through the employment of launch vehicle companies in order to reach Earth orbit. The Commercial Space Launch Act is a mechanism that is to be used by this nation to encourage the commercial use of space.

I wish to thank my thesis advisor, Dr. R. Wells, for her constant support and encouraging advice throughout the research process and Lieutenant Colonel J. Ballard, Ph.D, for his overall guidance and insight which greatly aided the accomplishment of this study. I would also like to express my gratitude to my wife, Lisa, for her compassion and valuable perception during the many days and nights spent on this project.

Michael Martin Hale

Table of Contents

List of Tables

Abstract

This study analyzes the Commercial Space Launch Act and the effect of the Act on Department of Defense contract administration. The Act is the way for the United States to encourage corporate involvement in the commercial space launch industry. The literature review contained in the study provides a comprehensive overview of the Act, the current environment of space commercialization, and the future of the space launch industry. The method of acquiring the necessary data used in the study was the telephone interview. Commanders of Department of Defense contract administration organizations were surveyed to determine their knowledge and awareness of the Commercial Space Launch Act. The study found that the Act was being administered adequately at those locations which reported involvement; however, there were serious problems in the administrative guidance on the Act and the process of reimbursement for government provided contract administration services. The study makes numerous recommendations and suggestions for improvement to include: rewriting the current Commercial Space Launch Act guidance and forming a focal point for commercial space within the newly formed Defense Contract Management Command.

THE EFFECT OF THE COMMERCIAL SPACE LAUNCH ACT ON DEPARTMENT OF DEFENSE CONTRACT ADMINISTRATION

I. Introduction

Overview

This chapter provides the initial insight into the purpose and background of the study. It outlines the questions necessary to determine the answer to the problem statement.

Background

In 1984, Congress passed and the president signed Public Law 98-575 (49 United States Code 2601 to 2623) titled the Commercial Space Launch Act. The purpose of the Act was to promote the commercial launching of space vehicles (37). Various provisions of the Act, and its amendments dated 1988, effect the Department of Defense (DOD) and the Air Force.

The National Space Policy, issued in January 1988 by the president, called for the nation to strongly support the expansion of the commercial space industry (23:3). Previously, in the spring of 1986, the space shuttle Challenger disaster prompted the release of National Security Decision Directive 254. The directive prohibits

the use of the space shuttle for commercial or foreign payloads (18). The Commercial Space Launch Act provides a mechanism for allowing the commercial space launch industry to fill the void left open by the change in shuttle use policy. The Act is the means of fulfilling the wishes of the president as expressed in the National Space Policy. Those two documents show the importance of understanding the provisions of the Commercial Space Launch Act and its impact on DOD contract administration.

Research Focus

The focus of the research was the provision of the Commercial Space Launch Act that requires contractors who commercially build and sell space launch vehicles or components which receive any benefits from in-plant government contract administration services to repay the government for these services. This reimbursement is for the actual hours of effort expended by the government in support of commercial nongovernmental interests being pursued by the contractor.

Problem Statement

The guiding statement of the research was to determine how well the Commercial Space Launch Act was understood and how the Act was being complied with throughout the DOD contract administration community.

Research Questions

The general awareness of the Act within the DOD needed to be determined. This was done by assessing the knowledge of the Commercial Space Launch Act in two categories: (1) those individuals in organizations which are involved with the Act on a regular basis and (2) those individuals in organizations who do not regularly work with the Act.

The extent to which contractors had become involved in commercial space activities needed to be discovered.

The various approaches for the processing of reimbursement were examined to ascertain and evaluate the general procedures being used.

Investigative Questions

The following questions were used to answer the problem statement and research questions:

1. What types of items do contractors produce in support of commercial space launch activities?
2. How often do government contract administration organizations provide services in accordance with the Commercial Space Launch Act?
3. What knowledge do individuals in government contract administration organizations have of the Commercial Space Launch Act?

4. What types of services do government contract administration organizations provide to contractors in support of commercial space launch items?

5. How is the reimbursement of provided services handled between the contractor and the government?

6. Do aspects of the Commercial Space Launch Act cause problems or appear unclear to government contract administration personnel?

Study Scope

The research study focused on the administration of the Commercial Space Launch Act by government contract administration personnel. The study did not examine the Act and launch insurance, the Act and the sale of expendable launch vehicles by the DOD or the National Aeronautics and Space Administration (NASA), the Act and launch indemnity agreements, nor the Act and the licensing of launch contractors being performed by the Department of Transportation (DOT).

Definitions

Expendable Launch Vehicle. An expendable launch vehicle (ELV) is a vehicle used for placing objects, called payloads, into space, Earth orbit, that are only used once (37:3056). Examples of ELVs are rockets, missiles, or Intercontinental Ballistic Missiles (ICBMs).

Contract Administrative Services. Contract administrative services (contract administration) (CAS) is the surveillance of business entities possessing government contracts or subcontracts to ensure (1) the adequacy of all contractor systems and (2) the adherence and compliance of the contractor to all contractual requirements.

Contract administration personnel are those individuals responsible for performing contract administrative services. These government employees are either located within contractor plants or assigned to oversee these tasks at contractors within a certain geographic area.

Contract administration personnel collocated with contractors could previously work in an Air Force Plant Representative Office (AFPRO), a Navy Plant Representative Office (NAVPRO), an Army Plant Representative Office (ARPRO) or a Defense Contract Administrative Service Plant Representative Office (DCASPRO). The Defense Contract Administrative Service (DCAS) reported to the Defense Logistics Agency (DLA). DLA is a multiservice independent agency within the DOD that does not report to any branch of military service but to the Secretary of Defense. DLA is primarily responsible for the acquisition and management of military items which are homogenous to each military service.

DCAS is responsible for overseeing the geographic area contract administration personnel. These individuals are assigned to a Defense Contract Administrative Service Management Area (DCASMA) or to a Defense Contract Administrative Service Region (DCASR). The management areas are small apportionments of the nation which in turn report to a region; the regions correspond to large geographic divisions of the country.

The difference between a plant representative office and a management area or region is that a plant representative office is responsible for one contractor and an area or region is responsible for many contractors. The amount of government business performed at a contractor location normally determines if a contractor will have a plant representative office or be serviced by an area or region.

As a direct result of the Defense Management Review (DMR) undertaken by Secretary of Defense Richard Cheney, all DOD contract administrative services are being assimilated under a single command. The Defense Contract Management Command (DCMC) has been established for this purpose. DCMC reports to DLA and is scheduled to be fully operational before the end of the 1990 fiscal year. It appears that DCMC will closely resemble the previous DCAS organizational structure. The command will have five main regions, many small management areas, and numerous plant representative

offices. A plant representative office will be called a Defense Plant Representative Office (DPRO) in the DCMC and a management area will be referred to as a Defense Contract Management Area of Operations (DCMAO). For the purpose of this study and to allow for this period of transition, any reference to an AFPRO, an ARPRO, a NAVPRO, a DCASPRO, a DCASMA, or a DCASR in fact refers to the eventual resulting responsible DCMC presence at the corresponding contractor facility.

II. Literature Review

Overview

The review of the literature has been divided into four sections. Section one examined the Commercial Space Launch Act. This section showed the documents and background which resulted in the Act and the amendments to the Act in 1988. The section analyzed the provisions of the Commercial Space Launch Act which are applicable to this study and looked at the existing DOD administrative guidance on the Act. Section two illustrated the broad topic of the commercialization of space. This section was a general survey of the history and current status of space commercialization. Section three depicted the various companies and products which define the current United States commercial space launch industry. Each major contractor and their product was looked at along with providing some broad insight into the smaller companies vying to be part of the space launch industry. Section four examined the future outlook of the commercial space launch industry. This section presented the predictions as to what the business volume forecast would be for firms engaged in the commercial space launch industry.

The Commercial Space Launch Act

Introduction. The Commercial Space Launch Act legally embraced and solidified a new national industry. The Act tried to bolster the commerce of the nation by allowing commercial resources to naturally develop through the Act's fostering nature. In a larger sense, however, the ideas and national objectives embodied in the Act incorporate the higher ideals of the nature of the United States economy. These ideals are the reliance on the private sector to perform the nation's commerce to the maximum degree possible with the government becoming involved only to the extent necessary to protect the welfare and interests of the American people.

The issue of public space policy is central to the Commercial Space Launch Act. The new role of the government is critical to the success of the commercial launch industry. This is due to the fact that the government was the principal player in launches previously and the government will remain so by regulating the industry and being one of the industry's largest customers (32:27).

This review of the Commercial Space Launch Act concentrated specifically on (1) the genesis of the Act, (2) the provisions of the Act, and (3) the administration of the Act.

Genesis of the Act. The seeds of the Commercial Space Launch Act can be traced back to 1972. In that year, President Nixon announced the space shuttle program and declared it to be the nation's space vehicle of choice (3:2). Thus, all nonshuttle means of reaching orbit took a back seat in terms of both anticipated use and research and development. It was not until 1983 when nonshuttle launch vehicles were put on equal footing with the space shuttle. On 16 May 1983, the president released National Security Decision Directive 94 titled Commercialization of Expendable Launch Vehicles. This directive proclaimed the government's support for incentivizing commercial uses of space using either government developed launch vehicles or newly developed vehicles (17). The directive sought to allow greater commercial opportunities for launch companies with less government intervention (32:28).

Similarly, the president's 1982 National Space Policy promoted the opening of space to commercial uses while keeping the nation dedicated to the space shuttle system (22). This policy eventually led to the president issuing Executive Order 12645 dated 24 February 1984. The order designated the Department of Transportation as the lead agency for promoting and overseeing commercial space launches and mandated the cooperation of all executive

agencies in encouraging the efforts of the commercial space launch industry (20).

In the next National Space Policy, issued 15 August 1984, the president stated his plans with regard to the commercialization of space. He stated that the government would:

> Take the following initiatives: economic initiatives . . . legal and regulatory initiatives . . . research and development initiatives . . . [and] initiatives to establish and implement a commercial space policy. (21:4)

The initiatives basically proposed changing or eliminating restrictions to encourage the commercial space launch industry.

In October of 1984, Congress passed and the president signed Public Law 98-575, called the Commercial Space Launch Act. The purpose of the Act was "to promote economic growth and entrepreneurial activity" (37:3055). Another purpose of the Act was to "encourage a U.S. ELV industry" (34:5334). The Act reinforced the previously stated intentions of the president and allowed Congress to become involved in setting national space commercialization policy.

The commercial space launch industry remained small, after the passage of the Act, due to frequent space shuttle launches. The Challenger catastrophe provided, "a policy incentive sufficient to justify [private] investment in marketing of domestic commercial ELVs" (35:5526). National

Security Decision Directive 254, issued in the summer of 1986, was the incentive the commercial space launch industry needed. The directive prohibited the use of the space shuttle for commercial or foreign payloads (18). This occurrence vitalized the industry because the unequal competition of the space shuttle had been eliminated. Previously, the government had been competing with the commercial space launch industry for the same market. In fact, the Secretary of Transportation at this time, Elizabeth Dole, exclaimed:

> The greatest barrier to successful commercialization of a private sector space transportation industry was not excessive regulation, but a highly subsidized shuttle system. (32:28)

These actions, not seemingly taken for the benefit of the commercial space launch industry, made the ELV market attractive again to potential investors and companies.

On 5 January 1988, the president issued a revised National Space Policy. It stated: "the United States government shall not preclude or deter the continuing development of a separate, nongovernmental commercial space sector" (23:3). The president wanted the private sector to go further in their commercial space endeavors. The policy continued: "commercial sector space activities shall be supervised or regulated only to the extent required by law, national security, international obligations, and public safety" (23:3). The president supported reviewing the

existing procedures to make it as easy as possible for companies to get involved in the commercial space launch industry. This policy ensured the industry that the United States government would not compete with them for commercial nongovernmental launches and that government agencies were encouraged to buy launch services and not launch vehicles thereby providing the launch industry with an added demand for their service (32:29).

These developments started Congress debating as to revising the Commercial Space Launch Act. The result was the amendments to the Act dated 15 November 1988. These amendments made it simpler for contractors to receive licenses and obtain launch insurance (36). In essence, the president's position, as stated in the National Space Policy, was supported by Congress and the process of launching payloads into orbit was made easier for interested contractors.

The Provisions of the Act. Congress defined the purpose of the Commercial Space Launch Act of 1984 as the following:

> To promote economic growth and entrepreneurial activity through utilization of the space environment for peaceful purposes; to encourage the United States private sector to provide launch vehicles and associated launch services by simplifying and expediting the issuance and transfer of commercial launch licenses and by facilitating and encouraging the utilization of government-developed space technology. (37:3055-6)

The executive branch was tasked with starting and helping along the new commercial space launch industry through the

use of the mechanisms of the Commercial Space Launch Act. As alluded to previously, the main way to regulate the space launch industry was to license the corporations who wish to provide such services (37:3057). The license is issued by the DOT and is very similar to the issuance of a drivers license by a state agency after the driver has met certain criteria.

The Act established a requirement for the government to make available for sale excess launch property (37:3060). Launch property was defined by the Act as "propellants, launch vehicles and components thereof, and other physical items constructed for or used in the launch preparation or launch of a launch vehicle" (37:3056). The government property currently used by DOD contractors, which is normally classified as plant equipment, special tooling, or special test equipment, can easily be seen as being covered by this Act provision. This government property will have to be made available for use by contractors in their commercial space ventures and could be sold to the contractor in certain situations.

Government officers are allowed to observe the manufacturing facility of any licensed contractor to an extent deemed necessary and reasonable by the Secretary of Transportation (38:3060). This established a duty for licensees to allow the surveillance of in-plant production

activities. This observation can most efficiently and effectively be carried out by members of the Defense Contract Management Command who are already familiar with the contractor's systems.

As discussed earlier, in 1988, Congress amended the Commercial Space Launch Act. A major altering of the Act pertained to the area of contract administration. The amendments to the Act established the requirement for contractors receiving the benefit of in-plant surveillance to reimburse the government for:

> The actual costs that can be unambiguously associated with a commercial launch effort, and would not be borne by the United States Government in the absence of a commercial launch effort. . . . The head of any Federal agency or department may collect payment for activities involved in the production of a launch vehicle or its payload for launch if such activities were agreed to by the owners or manufactures of such launch vehicle or payload. (36:3901)

If a manufacturer of a space vehicle requests contract administrative support of their production facilities and if the government agrees to provide service, then the government will be reimbursed for the cost of this support extended to the contractor. Thus, Congress mandated the reimbursement of the United States for resources expended in support of contractors who pursue commercial ventures. This situation created a juxtaposition between the traditional government and contractor relationship which had not to this point been encountered in contract administration.

The Administration of the Act. Other than the information contained in the Act itself, the principle guidance to government personnel working with the provisions of the Act had been DOD Directive 3230.3 dated 14 October 1986. The directive is titled DOD Support for Commercial Space Launch Activities. The directive can be considered the DOD position and instruction on how to administer the provisions of the Commercial Space Launch Act. The directive allows in-plant government contract administration personnel to perform such services for the contractor in commercial space activities but only "to assure that commercial ELVs are produced to standards that would permit DOD use of an ELV for priority national security missions" (6:3). This is clearly a much narrower involvement than the Act anticipated especially in light of the amendments in 1988. This wording would also surface the question of whether such surveillance would be reasonable to charge the contractor since the government would be the true benefitting party in this scenario. A note should be mentioned that the directive is dated in 1986 and has not been updated to incorporate the 1988 act amendments. It would seem that the DOD wanted to limit government services in commercial endeavors of contractors to the maximum extent possible.

The directive addressed the various waivers and changes which had to be made to existing DOD and government documents due to the passage of the Act. The two most significant waivers are (1) waiving the recoupment of other than direct costs under DOD Instruction 7230.7 called User Charges because the Act stipulates only direct charges are eligible for reimbursement and (2) waiving the requirement for the head of the agency (the Secretary of the Air Force for example) to approve the nongovernmental use of government owned plant equipment as stated in the Federal Acquisition Regulation Part 45.407(a) because the Act allows for such use in commercial space launch ventures without specific approval (6:7).

DLA provided guidance on the Commercial Space Launch Act in DLA Regulation 8000.7 dated 27 September 1988. This regulation, titled DLA Participation in the Commercial Space Launch Program, addressed the role individual DLA members are expected to play under the Act. DLA defined the role as the following:

> Contract administrative services (CAS) is included as one of the launch services available to companies whose commercial launch vehicles are the same or similar to launch vehicles being produced under government contracts. This helps to provide assurance of product integrity should the Government need to emergently [emergency] requisition one of those commercial launch vehicles for its own use. (5:2)

In essence, this was a restatement of DOD Directive 3230.3. It does recognize the fact that administrative services

could be a necessary and needed component of a contractor's commercial space launch program.

The regulation documented the ways and the means for providing these services to a contractor. In summary, support will be provided (1) when it is in the best interest of the government, (2) it will normally be limited to quality types of inspection and government property administration, (3) it will be accomplished at the prime contractor facility or the subcontractor location, as appropriate, and (4) CAS will be performed to the same degree and extent as currently being applied to the like government item being purchased (5:3).

The reimbursement for these services would be for direct hours expended multiplied by the current National Aeronautics and Space Administration (NASA) reimbursement rate (5:4). The NASA reimbursement rate is a rate used by DOD contract administration organizations to charge NASA for the efforts expended by the administrative unit in support of NASA contracts at DOD administered contractor facilities. This mechanism should be viewed as similar to the United States Postal Service charging other government agencies for the use of the mail even though each organization is an agency or department of the government.

On 2 January 1985, the Secretary of the Air Force promulgated a memorandum which delineated the Air Force

policy on support to commercial launch vehicles. The memorandum is titled Air Force Policy on Support to Commercial Expendable Launch Vehicles. This memorandum designated the Air Force System Command (AFSC) and Space Systems Division, within AFSC, as the responsible agents for the Air Force in matters concerning commercial space launch (27:1). The memorandum stated:

> In order to minimize the impacts to us and to insure that this support does not become a financial or manpower burden, we need to establish clear policies on dealing with these commercial ELV operators. (27:1)

This guidance seemed to neglect the reimbursement aspect of the act which applies equally to the CAS support and to the range use components of the Act. The reimbursement received from contractors could be used to pay the expense of personnel and facilities which were directly involved in commercial activities under the Act.

AFSC acted on the Secretary of the Air Force memorandum by issuing, on 16 May 1988, guidance entitled Commercial Space Launch Act Implementation Instructions In-Plant Contract Administration Services. The policy stated that all requests for services must be in writing and the government will try to meet the request (8:3). The policy delineated that only common components, those items which are indistinguishable as either government or commercial, would be provided with CAS support and that such support will be reimbursed on a direct cost basis (8:3). The

reimbursement would be handled by the Air Force Contract Management Division (AFCMD). AFCMD would collect the direct hours incurred by the AFPROs and AFCMD would be bill the benefitting contractors by applying the NASA reimbursement rate to the hours reported by the AFPROs (8:4). The AFSC guide seemed to try to narrow the items which would receive CAS support. This narrowing was not consistent with the Commercial Space Launch Act.

In July of 1988, AFCMD issued its own guidance called Commercial Space Launch Program Contract Administration Services Implementation Guide. This guide fully incorporated without comment both the DLA regulation and the AFSC guidance. It offered some general question and answer type information for use by the AFPROs as a means of trying to clarify individual situations. The guidance centered on the areas of quality assurance and government property administration. It tried to outline the difference between the procedures employed in a normal government contract and those used in a commercial space launch relationship between the AFPRO and the contractor (9). The policy set out the provisions of the Commercial Space Launch Act and applied them to the likely scenario to be faced by the AFPRO (9). The instruction addressed the area of subcontractor delegation of CAS responsibility. It advised the AFPRO to clearly inform the receiver of a CAS delegation, normally a

member of DCAS, the extent to which commercial space activities are expected to be involved during the performance of the delegation (9:II-2). The guide does not provide insight as to how subcontract reimbursement is to be handled.

The AFCMD guide provided a large section on Material Requirements Planning (MRP) systems with a comment saying the discussion is appropriate (9:V-A-1). It continued, however, without ever truly discussing the rationale behind this assertion except for a comment that material could be transferred between a government and a commercial item (9:V-A-2). The relationship between the Act and MRP is the same relationship which exists between the Act and any other significant contractor system and the specific inclusion of information on MRP in the guide seemed to be ill advised.

The final method of administration involved with the Commercial Space Launch Act is titled Model Expendable Launch Vehicle Commercialization Agreement. The purpose of the agreement was to establish and clearly set in writing each of the ground rules that would be used in the government contractor commercial space launch relationship (10:1). The commercialization agreement directly addressed the area of providing CAS support to a requesting contractor. The agreement stipulated that CAS would be provided only when allowed under the AFSC implementation

instructions of the Commercial Space Launch Act (10:25). The pact outlined the following constraints for providing CAS:

> (1) Approval of the request is contingent upon determinations by the government that CAS support for the launch vehicle is (a) in the best interests of the government and (b) sufficient resources are available to provide the requested services. (2) CAS will normally be limited to quality assurance (QA) oversight of quality and production systems and hardware inspection, configuration management, and oversight of the user's management of government property in their possession. Additional contract administration services may be requested but should be limited to the responsibilities cited in FAR 42.302 [Contract Administrative Tasks]. (3) Contract administration services will be provided at the same level and to the same extent as for launch vehicles being produced under the government contract(s). (4) All government approvals and procedures required under government contracts will apply. (10:25)

Basically, the agreement said that if the manpower existed the government would provide any requested CAS as per the FAR list of CAS responsibilities and tasks contained in Part 42. These services would be performed to the same level of detail and diligence as the ongoing government work in the facility. In the current environment of a declining defense budget and shrinking resources, the stipulation in part (1)(b), above, of sufficient resources may become a constraining factor for providing CAS support in commercial space launch ventures. Additionally, the DOD realignment of CAS into a single command, the DCMC, will certainly streamline the previous NAVPRO and AFPRO organizations into smaller and differently organized units. These changes

probably will effect an office's ability to provide commercial space launch CAS support to requesting contractors.

The agreement applied equally to all subcontractors producing common components for the prime contractor (10:26). The issue of reimbursement for subcontract CAS support was not addressed. The agreement stated the following about reimbursement for CAS support:

> The user agrees to reimburse the appropriate government agency for providing CAS using the Standard reimbursement rates applicable to commercial users in effect as of the date of the billing for such reimbursements. The user will be charged an amount which represents the cost of CAS for the commercial items proportional to the cost of CAS for all (commercial and government) common components produced. (10:26)

The agreement did not define the standard reimbursement rate but it could be assumed to be the NASA reimbursement rate because the NASA rate is the only reimbursement rate currently in use in the CAS community. Another view of this rate could be that the rate would be negotiated between the contractor and the plant representative office. The second part of the reimbursement, making it based on proportionality, was interesting to the extent that it was a different basis of costs for reimbursement than the direct cost basis defined for use by the Commercial Space Launch Act Amendments of 1988. It could be reasoned that if the contractor agreed to reimburse the government in this manner

and this method was an accurate representation of the necessary reimbursement then this approach would seem to be appropriate and hard to dispute.

The question of why a contractor would even want to complicate their commercial space venture by involving the government in any way can be addressed in three parts. One, the contractor is unable, for lack of funds or lack of space or lack of whatever, to segregate the commercial and government items as they are assembled in their facility. Two, the contractor can assure their insurance agent(s) that these launch vehicles are manufactured to the same high quality standards as the vehicles the contractor produces for the government. Three, the contractor can present their launch vehicles to the potential buyers with the true claim that these vehicles are just as good as the ones produced for the government.

Commercializing Space

Introduction. President Reagan, in his 1984 State of the Union speech, described the potential of the commercial space launch industry when he said, "the market for space transportation could surpass our capacity to develop it" (33:267). Since that time, various opinions exist to the status of the industry. V.H. Reis in an article entitled "Space Industrialization -- A National Perspective" commented: "up to now, I think we can conclude, space

industrialization has evoked a lot of interest, some degree of involvement and only a little commitment" (26:51).

The challenges to the commercial launch industry are many. Donald R. Trilling, a past director of the Office of Commercial Space Transportation (the agency within the Department of Transportation established to oversee DOT activities under the Commercial Space Launch Act), outlines these challenges:

> Quick, dependable access to space at low cost is critical to the rapid development of commercial space applications and maintaining American leadership in this area. As with all modes of transportation, the shipper should have a variety of options, and select the carrier who can deliver the payload required to the place required, at the time required, at minimum cost and at minimum risk. (33:212)

The users of launch services are looking for greater flexibility at lower cost without taking too high of a risk. To meet this requirement, the industry must be able to handle all types of payloads. Courtney Stadd, another former director of the Office of Commercial Space Transportation, commented on the changing nature of the payloads expected to be placed in orbit by the launch industry:

> One of the reasons satellites are as big and expensive as they are today is because of limited access to space. Given the schedule uncertainty in the Shuttle, you had every interest to build as much capacity as you could into your platform. With the presence of multiple commercial ventures vying to provide access to space, I think customers will be looking for smaller packages because they have every interest in distributing their

> risk: rather than having one switch in orbit, it'd be awfully nice to have several. (2:25)

As the needs and the payloads of the users of launch services evolve so will the variety available from the launch industry itself.

The users of launch services have historically concentrated in six major areas:

> 1. Data Collection and Communications Systems for Remote Sites. . . . 2. Vehicle Location, Search and Rescue. . . . 3. Earth Resource Monitoring. . . . 4. Border Security Monitoring and Law Enforcement. . . . 5. Space Processing. . . . 6. Navigation and Surveying. . . . (24:180)

Some of these areas have been more successfully exploited than others. Communication satellites have been used for many years, but space processing is really untested commercially as of today (26:50). Each known area of space use creates the demand for a commercial space launch industry, and, as technology advances, new unknown ways to use space will surface.

The commercialization of space were examined by analyzing (1) the economic aspects of commercialization and (2) the history of space commercialization.

The Economic Aspects of Commercialization. Each user of launch services has a slightly different perspective on the costs of these services. J.P. Loftus Jr., R.C. Reid, and R.B. Bristow portray these outlooks in an article called "Space Transportation: Options and Opportunities":

> Space transportation advocates focused on the cost of a pound of mass to orbit; users and insures focus on the cost of transportation in relation to the cost of the payload and other assets at risk. (16:116)

The launch industry was then faced with not knowing on what basis their costs were evaluated. This causes additional uncertainty in the pricing and profit decisions of launch companies which would increase the quoted launch price.

As the launch industry continues to grow, its ongoing privatization is aided by the process of division or separation by users who specialize in one space use, like communication satellites. This specialization could lead to launch providers who also specialize thus hopefully increasing the total base number of companies involved in the launch industry (13:33).

The investment by private corporations in commercial space launch ventures has been reported as totaling over $400 million, as of 1988 (2:24). All of this money can be viewed as being invested in pursuit of the available launches which compose the commercial space launch industry.

Some experts estimate the commercial space launch industry as about a $5 billion a year enterprise (28:XVI); others feel that it is a smaller figure totalling between $1 and $3 billion (13:33). No matter which figure is correct, the space launch industry represents a substantial segment of the entire space industrialization effort within this country. It also represents a major industry within United

States commerce. Nathan Goldman in his book Space Commerce Free Enterprise on the High Frontier said, "space transportation remains the most crucial variable [in space commerce], both in terms of costs and technological feasibility" (13:33). If new ventures and technology cannot reach orbit economically and safely then the commercial use of space will cease.

The continuing specialization and growth in the commercial space launch industry may not lead to only positive outcomes. Malcolm G. Wolfe, in an article entitled "Computer-Aided Conceptual Design and Cost Modeling of Space Transportation Systems", discussed the potential negative sides of these factors:

> A primary key to the increased utilization of space by all nations is low-cost space transportation. The problem is that a vast number of competing transportation system concepts are proposed, and a system that might appear cost-effective under one scenario could be completely unacceptable economically under another. (39:66)

Wolfe would predict a commercial space launch industry that becomes plagued with overgrowth. This would eventually drive many current companies out of the launch business.

At the present, the commercial space launch industry is limited by the maximum production rates that can be sustained by companies involved in the field (19:19). The cost of each launch varies depending on the size of the payload and the company that is contracted to do the launch.

In general, launches can cost anywhere from $3,000 to $6,000 for each pound placed into a low Earth orbit (19:21). The cost of placing that same pound into a geostationary orbit, an orbit which stays relatively stable versus some point on the globe and is a much higher orbit than a low earth orbit, is far greater.

It is expected that as technology advances, either through NASA, other government paid research, or private funding, the costs of launch services should be expected to decrease over time (1:269). However, the practice of estimating launch service costs is itself in a process of change:

> Current methods for estimating launch system costs are subjective and unreliable. Improving the science of cost estimation should be part of any launch vehicle or technology development program. (19:14)

It would be hard to evaluate your company's involvement in space operations if the essential launch costs were highly stocastic or even undeterminable.

Richard DalBello commented on this aspect of launch services in an article called "Space Transportation and the Future of the U.S. Space Program":

> Current methods for estimating launch system costs are subjective and unreliable. Improving the science of cost estimation should be part of any launch vehicle or technology development program. Even if future launch vehicle demand were known, estimated costs of launch systems would still be highly uncertain because the United States' space transportation operations experience is limited compared to other mature

> industries -- such as commercial aviation and a highly detailed data base is unavailable. (4:75-76)

As experience in commercial space launch increases over time, the reliability associated with the cost estimates would be expected to increase. A stable cost estimation methodology would greatly aid the decision making process for all those wishing to become involved in space commerce.

The History of Space Commercialization. The government has tried to promote the commercial use of space for over thirty years, almost since the beginning of the space age (31:145). The use of space has always been commercial to some degree because NASA has historically contracted with private companies to manufacture space items. Goldman in his book explained these early efforts:

> As early as 1958, the United States pursued the goal of space commerce, in which it would play a joint role with public and private enterprise. The act that created NASA reflects these goals: "The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere" [National Aeronautics and Space Act of 1958, Section 102(c)(5)]. This recognition of the potential of space is truly foresighted given the international crisis that prompted the acceleration of U.S. space efforts in the 1950s. (13:31)

In a small way, the Commercial Space Launch Act can be viewed as an evolutionary extension from these words from the Act which created NASA.

One of the first government sponsored commercial ventures was the Applications Technologies Satellites

program. Linda R. Cohen and Roger G. Noll in their article called "Government R & D Programs for Commercializing Space" described this program:

> After the Sputnik launch in 1957, the American space program became a salient issue because of its connections to national prestige, defense, and political competition with the Soviet Union. The federal government responded by allocating more resources to space. One new initiative was the Applications Technologies Satellites (ATS) program to develop and to demonstrate new commercial uses for satellites. The program consisted of a series of relatively short projects, with launches every few years, and was widely acclaimed as successful. . . . In 1973, ATS was canceled as part of a general reduction in space activities. The official reason for the cancellation was that the satellite industry was now commercially viable and could advance technology without public support. Subsequent assessments of private satellite R & D contradict this judgement and conclude that the ATS cancellation stimulated foreign programs and undermined U.S. technological dominance. Here the relevant issue is the technical basis for termination in 1973. In fact, nothing had happened technically or economically to alter the program's rationale. The scale and riskiness of research remained large relative to the size of firms in the product industry . . . . Whereas one can question whether the government should ever have embarked on the program, the case for ATS had not diminished. (1:271-272)

Here the incentive for commercialization seemed to work quite well, but the program was terminated for political reasons. It can be hoped that the experience of the ATS program is forgotten by potential commercial space launch companies.

Trilling put forth the best current statement of the government's position:

> There is a long history of public policy that supports the move to commercially-owned and operated expendable

> launch vehicles. NASA and DOD have been active in the area of space transportation for twenty-five years; it has been a national policy for almost half that time that private sector space endeavors are to be encouraged by making available government-operated space transportation on a reimbursable basis. (33:206)

With this perspective, it can be seen that the Commercial Space Launch Act is one piece of a long-standing national policy to promote the peaceful, commercial use of space.

The Commercial Climate. The overall role of the United States cannot be understated in the commercialization picture:

> The most important player at this stage of the game is the government. Not only is it the primary customer for launch service firms, it insures its own merchandise, owns most of the launch ports, approves missions for launch, licenses companies to launch, determines risks, and, ultimately, writes the rules. Within its vast bureaucracies, the environment for commercial launch service will take shape. (15:7)

Over and above the status of the government is the role and the importance of money and profit to the corporations wishing to become involved with space industrialization. Jeffrey Struthers observed the following in "Encouraging a U.S. Commercial Space Industry":

> The barriers to accelerating greater commercial investment and involvement in space activities are reflected in the history of space activity and the differing motivations of the players. To those of us who would use space as a place to position satellites for practical uses, such as commercial research, analysis, production, weather forecasting, and national security, we often hear the phrase "space is a place, not a mission." This catchphrase reflects the obvious concern that where practical or economic objectives are concerned, space-based activity must compete with ground-based alternatives. But "Space" is also a

> mission and a frontier. Exploration, the pursuit of knowledge of the universe, and man's involvement in space have been implicit national goals and the central missions of NASA since its founding in 1958. (31:146)

No matter what loftier objective may be espoused by corporations the bottom-line of profit still remains. Those space activities which do not produce positive revenues or overall net gains will not be continued or not even attempted.

Stadd suggested that the government can help in this area by changing one of its basic philosophies. The government needs to continue "purchasing launch services instead of launch vehicles" (2:26). Following this strategy would encourage the launch service industry by providing a large customer who was eager and willing to do business with them. At the same time, the government must always remember to make it easy to do business with itself. Trilling outlined the best way to ensure this occurs:

> It should be clear that if there is to be a commercial ELV industry, we must make it easy for firms to deal with the government. Once assured that national security, foreign policy, environmental concerns and public safety are protected (and these must always be the concerns of the federal government), then the next objective is to make sure the industry's economic ability to develop is not hindered by needless regulation. One aspect of this will be to provide certainty and predictability in the licensing process. (33:211)

Thus, the government must make every effort to allow the Commercial Space Launch Act to provide the incentives that it was designed to provide. The Act should not become

another means for regulating an industry. It should be the way to foster the industry.

There are many obstacles involved with trying to incentivize the commercial space launch industry:

> Removing legal, regulatory and operational barriers to accessing space will both shorten the time and cost of commercial operations and will also help develop professional relationships between people as they seek to work together. (26:51)

As the barriers to space come down, it would seem that the administrative costs involved in getting into space will decrease as long as the government takes conscientious steps towards allowing easier access to orbit.

Trilling offered that there are some traditionally government space efforts that could be turned over to the private sector:

> There now appears to be a number of opportunities for commercial space ventures that can be fully managed and operated by the private sector. Most of these are derived from work sponsored by NASA, which has spawned these developments by encouraging and conducting scientific and high technology experiments, and making their findings readily available for spin-off into commercial ventures. This reflects long standing patterns of government-sponsored research and development and subsequent private sector commercialization in many fields. In turn, technological innovations and productivity improvements have led to increased economic growth and a higher standard of living for our country. (33:206)

These types of efforts would help provide a stabilizing demand for commercial launch services.

Marcia S. Smith in an article entitled "Civilian Space Applications: The Privatization Battleground" pointed out

that some people would like the fact that the government was both creating and incentivizing the commercial space launch industry, "some would argue that such guarantees would be a subsidy, although others would point out that it would be money the government would have to spend in any case" (29:116). There is nothing wrong with private ventures taking over a certain technological advancement after the government has discovered it (1:269). The government would have to spend the necessary money for the service or technology no matter if it was a government employee or a private company performing the necessary acts. The use of a private company would allow greater market expansion opportunities when compared to alternative of the government continuing to monopolize the effort.

Smith, however, saw some problems with the easy transition of government technology to the private sector:

> Another important point is that government responsibility for a technology or a system should not end at some arbitrary pronouncement of "operational" status. While every effort should be made to encourage privatization of systems, the ultimate need for the systems should not be lost in the cacophony of arguments over who should be in charge of what. Subsidizing interested private sector parties, at least through the initial rough years and perhaps longer if necessary, may be a reasonable alternative. (29:112)

The transfer of technology to the private sector is a very uncertain business. It should be carefully watched by the government to ensure that the effort is given every chance

for commercial success while maintaining, at the same time, the technology for government use whenever necessary.

Allowing for all other arguments and discussions, perspective should not be lost as to the true worth and value of launch services:

> Space launch vehicles serve no useful purpose in and of themselves; they are a means to achieve other objectives. The only useful function of a space launch vehicle is to place a useful payload in a productive environment; i.e., to convert kinetic into potential energy. (16:115)

The basic task of getting into orbit is the essence of the launch industry. Launch service by itself has little value, but similarly a satellite sitting in a factory also has very little value.

A way to build faith and reduce overall risk in the launch industry would be to increase launch resiliency:

> Simply stated, resiliency is the ability of a launch fleet to maintain schedules despite failures. The resiliency of existing launch fleets was called into question by the ELV and Shuttle launch failures in 1986. In order to increase space transportation resiliency, the Nation could develop new, more reliable launch systems. Alternatively, it could make existing vehicles more reliable, reduce the period of inactivity after failures, or increase the ability to "surge" by buying extra vehicles and payloads to launch at high rates following failure. (19:21)

Increasing resiliency increases the flexibility of the launch service industry. This will correspondingly result in reducing the risk inherent in the industry. Anything which decreases risk will lower insurance premiums, decrease launch service costs, and strengthen the industry.

The flexibility of the space launch business has increased as more companies became involved in these commercial ventures. Goldman detailed what the commercial space launch industry has already done:

> The array of rockets and services and the increasing variation in satellite and applications has transformed the old one-stop shopping for the satellite or the rocket. Now satellite owners and users can shop for the service that best fits their needs. (13:39-40)

As time goes on, this flexibility and variety could only be expected to increase. Companies would be expected to become better able to meet the exact needs of the customer no matter what those needs, sizes, or time schedule, might be. The same view was seen in the deregulated airline industry where the available variety of flight options to the consumer has become almost limitless. This issue closely relates to the area of market segmentation and specialization which was discussed earlier.

Trilling provided the final comment summarizing the commercial market as it applies to the launch service industry:

> Expendable launch vehicles can be dedicated to a single mission, placing the payload desired into the particular orbit desired at the precise time desired. For many applications expendable vehicles are inherently the most economical way to launch. They don't require the safety features of manned flight nor is there an opportunity cost for the time of payload integration. Competition provided by an ongoing, efficient private ELV industry could foster new technological developments in space transportation. It has been the government's experience that competition inevitably spawns innovation, creativity and efficiency. (33:207)

The Commercial Space Launch Industry

Introduction. The future of any commercial space venture depends upon its ability to economically reach space through the use of companies engaged in the commercial space launch industry:

> Key space technologies are interdependent, technically and economically. Thus, designing a cheap satellite may not be helpful if launch costs or costs of other government provided infrastructure prevent overall venture costs from being competitive. (31:147)

The launch industry must be able to provide its service at a reasonable price.

This examination of the industry focused on expendable launch vehicles as they are the key to the Commercial Space Launch Act. It should not be forgotten, however, that the space transportation system, commonly referred to as the space shuttle, could easily compete with the expendable launch vehicle industry economically. The space shuttle offers potential customers many advantages that present expendable launch vehicles cannot especially with regard to manned flight and payload size and weight (14:29). Although currently still in development, the same could be said about the National Aerospace Plane (NASP) (4:82).

As the launch industry grows and matures it will face many challenges which the industry may not be prepared for:

> Under commercialization, the market will dictate different sets of incentives and rewards than have been traditional in the space business. Companies will have their own money (or their financier's) at risk. They

> will have to establish new marketing networks. They must not only concern themselves with competing with the Shuttle and its impressive capabilities, but also with international competition from the Europeans' Ariane, Soviet Proton and Japanese launch vehicles. With payloads valued in the millions, reliability of the launch vehicle will remain as the most important criterion. Being commercial ventures, however, business will go to firms who can reduce their costs and/or supply a broad range of launching services, minimizing the headaches confronting their clients. (33:212)

The commercial space launch industry was analyzed by investigating (1) the industry leaders, (2) the foreign launch competition, and (3) the second tier American launch companies.

The Industry Leaders. Historically, the production of expendable launch vehicles was dominated by three firms: McDonnell Douglas, General Dynamics, and Martin Marietta. When the use of the shuttle for commercial launches was curtailed a large market was immediately created:

> Then, when Challenger was lost in January 1986 and the United States suddenly remembered who has been doing the work when the shuttle was just a gleam in some engineer's eye, General Dynamics' assembly line was shut down, McDonnell Douglas had been turned off for two years and only Martin Marietta had anything resembling an active factory. The bell rang, and there was no one home to answer the door. (12:12)

The industry leaders were faced with retooling and reinvesting to try and grab a share of the emerging market.

McDonnell Douglas produces the Delta launch system. This system was first developed in 1955 as the Thor missile and it has been NASA's most frequent choice for space launch (16:117). Delta can count the Pioneer, Intelsat, Tiros and

TelStar programs as successful launches (12:13). The Delta can be outfitted in several different configurations and can lift between 8,000 and 11,000 pounds to a low Earth orbit (19:29). The Delta 2 configuration carries a price tag of approximately $50 million and McDonnell Douglas has current orders for at least four launches (15:7). At peak production McDonnell Douglas can expect to produce 12 Delta launch vehicles a year and can launch, including vehicles in inventory, 18 each year (19:31).

General Dynamics produces the Atlas Centaur combination as its entry into the commercial space launch industry.

> The Atlas began life in the late 1950s as a 1 1/2 stage ICBM. Atlas hit the big time when a modified Atlas ICBM lifted John Glenn's Friendship 7 into orbit on February 20, 1962. (12:13)

The Centaur was developed to team with the Atlas in order to produce heavy lift and to allow for geosynchronous payloads to be launched (16:120). The Centaur upper stage has proven to be reliable in over 66 missions (25:17). Centaur was used for the Voyager launches and its capabilities make it especially useful for interplanetary missions (25:31). General Dynamics charges about $59 million for an Atlas Centaur launch and they have been contracted for about six launches (15:7). The Atlas Centaur will lift about 13,000 pounds into a low Earth orbit or 5,000 pounds into a geosynchronous orbit (19:30). Currently, General Dynamics

can manufacture 5 Atlas Centaur launch vehicles per year and launch up to 4 in any year (19:81).

Martin Marietta produces the Titan family of expendable launch vehicles. The Titan was developed in 1959 to be an ICBM and was used to launch the Gemini space vehicles (12:13). Martin Marietta currently builds three different models of the Titan: the Titan II, lifting 5,500 pounds into low Earth orbit, the Titan III, lifting 27,600 pounds into low Earth orbit, and the Titan IV, lifting 48,000 pounds into low Earth orbit (19:31). Martin Marietta's "existing manufacturing facilities can produce 20 Titan cores per year, [but] only 10 payload fairings can be produced per year with existing facilities" (19:30). Martin Marietta charges about $120 million for the Titan IV with its huge capability and charges for the smaller Titans are proportionally less (15:7). Martin Marietta has agreements to launch about thirty satellites of varied sizes and shapes (15:7). A launch rate of approximately 20 Titans a year can currently be achieved by Martin Marietta (19:31).

The Foreign Launch Competition. As can be seen in almost every industry in the country, foreign competition exists in the commercial space launch industry:

> [Foreign competition is] characterized as follows by Mr. Beggs, a former NASA Administrator: "The launch vehicle business seems to be the 1980's equivalent of the steel mills back in the 1950's when every country of any size had a steel capacity." These days it appears that every

> country that wants to be in the forefront wants to have a launch vehicle capability. (38:3)

The best descriptive word for this competition would be fierce. A country wants to have a launch vehicle capability as much for national prestige as for the versatility the capability offers a country.

The four countries with the most aggressive space launch industries are Canada, France, the Federal Republic of Germany (West Germany) ard Japan (30:3). The list of countries that are trying to get involved in commercial space launch activities seems to grow almost daily. It includes: China, India, Pakistan, South Korea, Brazil, and Argentina (38:3-15). A large player in the commercial industry is the European Space Agency and Arianespace, which is a consortium of European countries and companies, which are dedicated to pursuing and dominating the commercial space launch industry (38:15).

There is, however, a difference between countries with a space program and countries involved in efforts to pursue the commercial space launch industry. Many countries have some kind of space program but only certain countries have taken steps to enter the commercial space launch market; these steps may include the country itself seeking the commercial business, as is the case in the Soviet Union or China, or the country subsidizes companies operating within their borders who are pursuing the business (24:179). The

nine countries which have taken the most steps in either of these areas are Brazil, France, India, Japan, China, the Soviet Union, the United Kingdom, West Germany, and, of course, the United States (39:68). There is some reluctance on the part of world satellite and payload producers in using the Soviet Union and China for commercial launching because of the problems of technology transfer and export control to places which are not allowed to possess such technology for whatever reason.

The Second Tier American Launch Companies. The Vought Corporation has been producing the Scout rocket since the early 1950s and the Scout is the smallest of the established expendable launch vehicle inventory (16:118). The Scout can place 570 pounds into low Earth orbit (19:31). Vought can currently produce 12 Scouts per year and launch 18 a year, when stockpiled inventory is used (19:31).

Space Services Incorporated manufactures the Conestoga II. The Conestoga II can lift 11,000 pounds into low Earth orbit and was developed solely for the commercial launch market (24:179). The Conestoga II was built to compete with the Scout for low weight payloads seeking a cost efficient and reliable launch option (24:205).

Other companies have undertaken efforts to enter the commercial space launch market with various vehicles either in serious development or in limited initial production.

Loftus, Reid, and Bristow provide a list of some of these companies:

> Aerojet Technical Systems Company -- Liquid Propulsion Module (LPM); Orbital Sciences Corporation -- Apogee and Maneuver Stage (AMS); American Rocket Company -- Industrial Launch Vehicle (ILV-1); RCA Astronautics -- Shuttle Compatible Orbit Transfer Stage (SCOTS); and, Ford Aerospace and Aerojet -- High Performance Propulsion Module (HPPM). (15:114-133)

Each of these launch vehicles has its own unique characteristics but they are the same to the degree that they are all being manufactured to capture the space launch market. Other companies have expressed an interest in exploring ways in which they can become involved in commercial space activities. Goldman identified the following major aerospace firms as having an interest in being involved in commercial space launch activities:

> Ball Aerospace Textron; Boeing Aerospace Company; Chrysler; Fairchild Space and Electronics; Litton Industries; Lockheed Missile and Space; United Technologies; Rockwell International; Thiokol Corporation; and, Westinghouse. (13:112-113)

The extent to which each of these corporations has actually become involved is hard to determine but it is easy to say that interest in the commercial space launch industry is increasing.

The Commercial Space Launch Outlook

Introduction. Being traditionally controlled and financed by the government, it is very difficult to determine with any certainty the outlook for the commercial

space launch industry. Various experts disagree as to where the total volume of the space launch marketplace will eventually be settle. As alluded to earlier, it is very simple to conclude that as providers of launch services increase the forces of competition on the marketplace will decrease costs and increase the variety of services provided (13:36).

But, can the situation be this simple? Struthers in his article maintained that it is:

> The U.S. private sector has an awesome reputation for innovation and making markets grow, and may do so in space if given proper motivation to become involved, just as it did with aviation. One could expect lower costs and increased capacity for space goods and services. If development of a commercial space industry were to evolve like other successful industries, one could also expect new uses as capacity increases and costs go down, and as access to space and related support services become routine and reliable. (31:148)

This model assumed that demand would increase to some degree as time progressed. Goldman supported Struthers and offered the following insight:

> If the cost of launches is reduced, for example, the cost of the space applications will also go down. Obviously, the reduction in cost then makes the space-based industries more competitive with its Earth-based alternatives. This logic should dictate a larger space segment, which in turn should precipitate more and cheaper launch facilities. Hence, the space economy requires an integrated and interactive model to understand space commerce in total and in its parts. (13:33-34)

The existence of more launch facilities may become a main constraining factor on the commercial space launch industry,

as the capacity of airports has constrained the aviation business. Only four or five potential launch sites have been identified within the continental United States due to the chance of harm to the environment and the added dangers inherent in launching close to a population center (19:11).

The commercial space launch outlook was scrutinized in two broad areas (1) the future expendable launch vehicles and (2) the launch outlook numbers.

The Future Expendable Launch Vehicles. Most experts agree that current industry vehicles and production rates will support adequately a short period of small growth (19:5). It is beyond this short-term or above the small growth where many questions are unanswered or even unasked. Each company must rely on its own internal research and development program to find the necessary answers and the government can help by funding some research (29:111-112).

The need for brand new expendable launch vehicles is itself questionable. The ability to manufacture these vehicles certainly exists within the industry, however, any company that expends valuable resources to do so must be positive the demand for their vehicle will exist or their company most probably will cease to exist (4:73). This high priced question is addressed by Marcia S. Smith in her article when she says:

> Are the technologies mature enough that the private sector should take charge of developing more advanced

> systems? If the private sector refuses, should the country abandon those technologies; that is, should the future of space applications "sink or swim" on the private sector's willingness to take them over? Or do those technologies play a crucial role in the overall technological competitiveness of the country and therefore deserve taxpayer support? (29:105-106)

The United States may have to decide if a new expendable launch vehicle is necessary for the nation if the commercial industry finds that it is not economically feasible. If the country does decide to invest in a new vehicle choosing one company or consortium to develop and produce this new vehicle would give that company a significant competitive advantage in all future commercial space endeavors. In his article DalBello added the following:

> [I] argue that it is not prudent or necessary to develop new technologies simply because we can, nor is it prudent to support our large space institutions simply because they already exist. (4:80)

It could be seen that as the industry matures one or even two of the three industry leaders and several of the second tier companies could be pushed out of the space launch industry by virtue of the competition which will exist.

Others argue that all the money and efforts spent on some new expendable launch vehicle would be superfluous. These experts support a process of evolutionary improvement of current launch platforms:

> Many experts argue that significant cost savings could be achieved if time and money were spent on modernizing manufacturing facilities and on applying new technologies, some of which already exist in other industries. Yet, the application of these new

> technologies would increase the front-end cost, which would have to be recouped later in the program through reduced production and operations costs. One aerospace company has estimated that automation of certain tasks could provide a 30 percent to 50 percent savings over manual processes by reducing labor and hard tooling needs. For example, Variable Polarity Plasma Arc (VPPA) welding reportedly could yield up to 70 percent savings over conventional welding and possibly eliminate the need for x-ray inspection. Computer integrated manufacturing, paper-less management, modern inventory control systems, expert systems for checkout and preparation, and collocating manufacturing and launch facilities are all being investigated for their efficacy in reducing costs and improving efficiency. (19:47)

Any or all of these techniques could be applied to current launch vehicles to produce cost savings and reliability improvements. It could be assumed that companies currently involved in commercial space launch activities are investigating these types of improvements.

Another angle to approach is to incorporate new technology into the older launch platforms (DalBello:82). These actions produce the quick gains available from emerging technologies while improving or maintaining the current level of product reliability. There are many examples of moderate or evolutionary improvements which can be made in the current expendable launch vehicle fleet:

> Improved liquid rocket engine components; new ground processing technologies; advanced avionics and flight software; new high-strength, light-weight materials; and new launch pads and flight control facilities. (19:9)

Each of these enhancements would produce positive benefits almost immediately.

The last statement on this area of launch vehicle development and maturation goes to Loftus, Reid, and Bristow:

> Any substantial increase in space activity will require a new generation of vehicles that must have significant improvement over current systems. Among the more significant improvements required are significantly increased reliability, reduced unit cost, reduced lead time on production, and improved payload accommodations. Systems definition and technology efforts are in progress to define the manner in which these goals can be achieved. (16:115)

If large growth is experienced in the space launch industry it is reasonable to assume that it would strongly spur the development of new vehicles and the enhancement of the current fleet of launch vehicles.

The Launch Outlook Numbers. It is in the actual numbers of launches that can be found the clearest disparity between experts who foresee growth of some kind and those who forecast a very gloomy picture for the industry. "There is little doubt that space technology can lead to economic growth and overall development" (28:XVII). "It is very unclear what mission requirements will be beyond about a five-year future" (39:68). These two opinions summarize the general feelings of most experts.

The disappointing view for the industry is well documented in the following statement by Lance Frazer in an article entitled "Lead, Follow or Get Out of the Way":

> One of the results of the Challenger accident was a tremendous backlog of satellites -- commercial, defense

> and scientific. NASA has predicted as many as 75 Shuttle-equivalent flights backed up by 1992 (including 28 DOD payloads for 1992 above), and commercial satellite makers including Ford and Hughes Aircraft report soaring orders due to the fact that many orbiting satellites are nearing the end of their predicted lives. But after the backlog is cleared up, then what? . . . John Pike of the Federation of American Scientists sees no more than 20 launches per year to clear up the backlog into the 1990s, with a substantial drop-off after that. Otterman (the Center for Space Policy Analysis) goes much lower (eight to ten launches annually), and Arianespace (French) shoots slightly higher, with an estimate of 20-25 per year. Even taking the highest figure, 25 launches annually is not a plush figure to build an entire industry upon . . . . (12:14)

The commercial space launch industry could indeed develop as a cyclical industry based on the deterioration rate of the satellites which are placed into orbit.

V.H. Reis outlined the general position of the pessimistic camp when he said:

> I think that there is a real danger in overselling the economic returns from space commercialization, both in terms of absolute magnitude and (especially) in terms of how long it will take to get that return. Further, overselling the economic return is not necessary. (26:52)

The promise of space commercialization is, obviously, not readily seen by all space experts; in fact, some people have the opinion that there is very little promise at all.

Richard A. Rasmussen in "Conestoga II -- A Low Cost Commercial Space Transportation System" offered the following comments on the potential of the commercial space launch business:

> It is most difficult to "crystal ball" sales for any systems related to rapidly advancing technology. I

> suspect Henry Ford had similar difficulties in justifying sales projections for the Model T prior to its development. He may have erred on the low side. The world demand for space launches is not likely to disappear. If space transport costs can be significantly reduced, volume will increase. An important factor in cost is the inherent efficiency of a commercial operation as opposed to government operations. (24:201)

The fact that the government is out of the launch business should by itself increase the use of space and decrease the costs to launch by reducing the overall amount of bureaucracy associated with getting to orbit. Commercial enterprises with a historical reluctance to deal with the government, for whatever reason, could be enticed to place payloads into orbit because they could now work in space without having to directly deal with the government.

Independent expert analysis of the future of the space industry does exist:

> According to the American Institute of Aeronautics and Astronautics (AIAA), space is a $22-23 billion industry today, coming from the satellite communication, remote sensing, military and other governmental agencies. Satellite-communication revenues are growing at a rate of 20 percent a year. Therefore, the projection of annual revenue of $40-100 billion seems reasonable by the turn of the century. (28:XVI-XVII)

The percent of these monies which can be allocated to the space launch industry is uncertain but, never the less, it would seem that whatever the percentage it would still amount to a quite substantial figure. With the emergence of new and presently unknown technologies, these numbers can only be assumed to grow.

The final comments on the optimistic view come from a government report by the Office of Technology Assessment entitled Launch Options for the Future: Buyer's Guide. In this report the government offered its opinion of the potential number of launches per year for the commercial space launch industry:

> The mission models describe a range of possible demand levels from 1989 to 2010. Each model assumes that the United States will maintain a mix of piloted, and medium and heavy lift expendable vehicles: Low Growth -- 3 percent average annual growth in launch rate (41 launches per year by 2010). Growth -- 5 percent average annual growth in launch rate (55 launches per year by 2010). Expanded -- 7 percent average annual growth in launch rate (91 launches per year by 2010). . . . Although 91 launches per year may seem high relative to recent U.S. experience, it is important to note that in 1966 the United States did launch 73 vehicles. Also, the Soviet Union has averaged 94 launches per year since 1974. (19:3)

The government sees a fairly good chance for significant growth within the commercial space launch industry. Even matching the 1966 U.S. total of 73 launches through commercial exploitation of space would be a fairly substantial amount of launches on which to sustain the industry.

In general, the outlook for the industry can best be summarized as uncertain or chaotic. Various experts stated that the industry will include anywhere from 20 to 90 launches a year. This range is quite substantial and as such really becomes useless. The best that can be said is that as time progresses the projections for the future of

the commercial space launch industry can only become clearer.

III. Methodology

Overview

This chapter explains the process used to collect the data necessary to answer the investigative and research questions discussed in Chapter I.

Telephone Surveys

The basic methodology used in this study was that of questioning. The technique selected for questioning the study participants was the telephone interview. The telephone survey offered the greatest advantages to this study in terms of time and cost over the alternatives of personal interviews or mail surveys. The telephone survey is generally considered the best choice for a researcher whose time and money are limited (11:40). In this case, the use of a telephone survey was selected because the time frame for thesis completion was quite limited thereby hampering the use of a mail survey and the availability of travel money for personal interviewing was severely constrained.

Interview Instrument

The interview schedule of questions was developed through research and review of the Commercial Space Launch Act. The interview schedule of questions is found at Appendix A. Initial lists of potential questions were

reviewed by Dr. Rita Wells, thesis advisor, Professor of Contract Management and Lieutenant Colonel John Ballard, PhD, Associate Professor of Management and Organizational Behavior. Iterations of review occurred and produced the interview schedule as it appears today.

The schedule is divided into two sections. This division employed a technique of screening in which only those with a superior knowledge of the Act would be asked the second part of the questionnaire (11:59). In this way, guesses or gross misunderstandings of the interview questions on the part of the interviewees could be avoided (11:59). The top section contained questions of a general nature; these questions were asked of each interviewee. The bottom section was composed of questions of a specific nature. This part was asked only to those individuals who indicated that they were actively involved with the Commercial Space Launch Act at their location.

The interview schedule of questions was validated through review by individuals who are experts on the provisions of the Commercial Space Launch Act. The validators were Captain Mark Bergeron and Dr. Douglas Giest, both members of the AFIT faculty in the Department of Contract Management. These individuals were extremely familiar with the Commercial Space Launch Act and had conducted and published research in the area. Each

suggestion for improving or modifying the schedule of questions given by the validators was incorporated into the schedule of questions before it was used.

Population and Sample

The population sampled was composed of the commanders of DOD contract administration offices. These commanders are individuals of high government status. They are either military in the rank of lieutenant colonel (LTC) or colonel or civilians in the rank of GM-14 or GM-15. The elements of the sample were determined by using a complex random stratified design. The complete sampling frame was known and numbered one hundred and twenty-four. Certain organizations performing contract administration were eliminated from the population because either they were performing CAS outside of the United States or the CAS was performed exclusively on small research contracts. Neither of these exclused categories would have any interplay at all with the Commercial Space Launch Act.

The population was divided into two strata: (1) those elements which the literature review identified as having a potential for involvement in commercial space activities, and (2) all other elements. The first subpopulation was censused; this grouping was relatively small numbering eleven. The second was randomly sampled through the use of the formula found in "A Guide for the Development of the

Attitude and Opinion Survey" written by Headquarters USAF/ACM located at the Pentagon (7). Employing this formula at the 90% confidence level on the one hundred and thirteen remaining elements yielded a sample of forty-four members. Eleven population members had been previously removed from the population because they were chosen to be censused.

The representativeness of the random sample to the population was established by determining the percentage of each segment which were AFPROs, NAVPROs, ARPROs, DCASPROs, or DCASMAs. Table one depicts the composition of the population and the sample.

Table One

Organizational Composition

Organization	Population	Sample
AFPRO	20%	27%
NAVPRO	11%	18%
ARPRO	2%	0%
DCASPRO	37%	34%
DCASMA	30%	21%

When the population was divided into DPROs and DCMAOs, as will be done by DCMC, the break out was 70% DPROs and 30% DCMAOs. The sample composition was 79% DPROs and 21% DCMAOs. The deviation between the population and the sample was quite small. Any differences between the two segments were resolved to be immaterial for the purposes of this study.

Interview Procedures

The process followed in performing the telephone interviews on the sample was first suggested by the book Mail and Telephone Surveys The Total Design Method written by Don A. Dillman. Each sample element was contacted by telephone to arrange a convenient time for a formal telephone interview. This initial contact was followed by sending a letter to the commander documenting our conversation and reaffirming the time and date of the interview. Dillman commented on this general approach:

> Surprised by an unexpected telephone call and a request to be interviewed, respondents often react with suspicion. Some forthrightly state their belief that the call is some kind of joke. Others ask questions to satisfy their skepticism. Still others, and probably the majority, do not verbalize their concern, but reflect it by initially being extremely guarded in their responses. These reactions interfere with the respondent's ability to concentrate on questions and other information provided by the interviewer. It is reasonable to think that this element of surprise and uncertainty contributes both to refusals and the lowering of response quality. Sending an advance letter to notify potential respondents of the impending telephone call is a reasonable way to counter possible difficulties. (11:243,245)

For the above reasons, the methodology procedure was structured to include an initial contact. This telephone introduction was followed by a letter that stated the objective of the interview and contained a copy of the interview schedule of questions. The letter used for this purpose can be found in Appendix B. The interview schedule was enclosed with the confirmation letter so that the

interviewees could be prepared for the formal interview before the interview occurred. This was done in order to limit the inconvenience to the interviewee and to make the time necessary for performing the formal interview the shortest amount possible while stilling ensuring that the answers provided by the interviewees were of the highest quality possible.

The time frame for conducting the interview procedure was limited. The initial contacts of all respondents occurred in the end of May and the beginning of June 1990. The followup letter and interview instrument were mailed to the interviewee, at the latest, the day after the initial contact. The formal interview was scheduled to take place about seven to ten days after the initial contact, if suitable to the interviewee. All interviews occurred before the end of June 1990.

The formal interview was conducted using the provided schedule of interview questions. Any additional or followup questions flowed directly from the original questions. These secondary questions were limited to concentrating on information in direct connection with interviewee answers to the schedule questions and were used to understand or clarify the answers provided by the interviewee. No surprise areas or new questions were asked during the formal interview.

All participants in the study were given anonymity and no associations were made to the various contractors and organizations that are involved in the study. The interviewees were told that any questions they felt uncomfortable with answering would be skipped. No interviewee expressed such a discomfort and as a result no questions were skipped in any interview.

Interview Information Analysis

The information received through the interview process was analyzed in order to answer the investigative questions and problem statement posed in Chapter One of this document. The information was reviewed to determine the mean and the mode of the question answers when appropriate. Tables presenting the research information have been included when they add to the reader's understanding of the presented material. Extrapolations of the research findings to the entire DOD CAS community have been included when doing so added to the meaning of the presented material. No other statistical tests were employed due to the qualitative nonparametric nature of the information obtained.

IV. Findings

Overview

This chapter documents the informational findings resulting from following the research methodology outlined in the previous chapter. Each investigative question contained in Chapter I was answered by analyzing the information received from the telephone interviews. Other findings resulting from the interviews are presented and the problem statement was addressed.

The answers received from the fifty-five separate interviews have been compiled in order to address each of the investigative questions. As described in Chapter III, the methodology employed in this study was a complex stratified design which separated all CAS units within the DOD into two segments. The first segment contained those organizations which the literature review indicated had a strong possibility for involvement under the Commercial Space Launch Act. This group consisted of eleven plant representative offices. Of this group, five commanders indicated that they were very involved with the Act. This amounted to 45.5% of those in this category. The second group consisted of everyone else; this group numbered forty-four. Of this group, three units were found to have an involvement with the Act. This amounted to 6.8% of those individuals interviewed. Overall, the percent of

organizations who were involved under the Act out of the total number sampled was eight units or 14.5%. This percentage extrapolated to the entire population of one-hundred and twenty-four would mean that approximately eighteen plant representative offices throughout the DOD would be expected to have an involvement with the Commercial Space Launch Act.

Investigative Question Discussion

Question One. What types of items do contractors produce in support of commercial space launch activities? Of the total, eight interviewees were found to have cognizance over contractors which produce items of this type. There were three contractors who produced ELVs as the prime contractor. The other five contractors manufactured components as subcontractors to one of the three prime contractors. The following items were produced by the subcontractors: two contractors produced rocket engines, one made solid rocket fuel, one manufactured guidance systems, and another fabricated upper stage booster rockets.

Question Two. How often do government contract administrative organizations work in accordance with the Commercial Space Launch Act? A unit would be working in accordance with the Act by providing CAS support to the contractor. In the forty-seven interviews in which the commander said their unit was not involved under the Act,

the response was that the organization never was involved with working under the Act. Of the eight interviews with active involvement, six commanders answered that their organization worked under the Act on a daily basis, one unit worked with the Act three times a week, and another unit worked in accordance with the Act twice a week. Those organizations who were involved with the Act worked in accordance with the Act on a very frequent basis. The mode of the answers was daily and the average was 1.38 where one corresponded to working with the Act daily and two corresponded to working with the Act three times a week.

Question Three. What knowledge do individuals in government contract administration organizations have of the Commercial Space Launch Act? A purpose of this study was determining the general awareness of the Act within the DOD CAS community. This was done by determining the awareness or knowledge of the Commercial Space Launch Act in two categories: those involved with the Act and those not involved. Assessing the commander's knowledge of the Act was done by placing the individual in one of four general classifications. A commander could: have no knowledge of the Act, have a cursory knowledge of the Act's existence, be familiar with the provisions of the Act, and be very familiar with the Act provisions. A person has a familiarity with the Commercial Space Launch Act when they

have experienced working with the Act or they are knowledgeable about either the Act itself or the higher headquarters guidance covering the Act. A person was very familiar with the Act when they are knowledgeable of all aspects of the Act to include the Act itself, the guidance of the Act, and experience working with the Act.

Table two portrays the knowledge levels of all interview participants.

Table Two

Respondent Knowledge of the Act

Level of Knowledge	Number	Percentage
No Act Knowledge	26	47%
Knowledge of Act Existence	19	35%
Familiar with the Act	5	9%
Very Familiar with the Act	5	9%

The table shows that 82% of the sample population did not have the basic knowledge necessary to administer the Act. These individuals would require substantial training if a situation involving the Act presented itself at their location. The 82% would represent one hundred and two of the one hundred and twenty-four elements in the population.

Of the forty-seven interviews accomplished in the category where no involvement was expressed, the most common answer was that the interviewee knew nothing about the Act. Twenty-six commanders responded in this fashion or 55.3% of those in this category. The next most common response was that the interviewee knew that the Act existed but that was

the extent of the interviewee's knowledge. Of the remaining interviews, nineteen people answered in this way. This represented 40.4% of those interviewed. Of the two remaining respondents in this category, one interviewee was very familiar with the Act and its provisions and the other interviewee felt that he was familiar with the Act. Both of these individuals had acquired this knowledge through working with the Act in previous jobs.

In the second category of active involvement, the commanders were expected to be very familiar with the Act provisions. Of the eight interviewees falling into this category, four commanders expressed that they were very familiar with the Act. The other four said that they were familiar with the Act.

Each interviewee was asked where they heard about the Commercial Space Launch Act. Of the forty-seven commanders who were not actively involved with the Act, the twenty-six commanders who had previously indicated that they were not knowledgeable of the Act understandably had no answer for this question. The remaining twenty-one commanders heard about the Act in the following ways: sixteen received their knowledge from an article, normally in a trade journal like Aviation Week and Space Technology, Defense News, or The Federal Contracts Reporter, two found out through on the job exposure to the area, one heard about the Act from the

contractor, one became knowledgeable at a meeting of the local National Contract Management Association chapter, a professional association of contracting and procurement specialists, and another heard about the Act in training at the DLA Executive Seminar in Acquisition Management.

Of the eight respondents in the active involvement category, commanders normally responded that their knowledge came from more than one source. The most common way of becoming knowledgeable of the Act was at a meeting. This was chosen by four commanders. These meetings were of the following types: three were at meetings with their higher headquarters, which was AFCMD, and one did not specify the type of meeting. Of the remaining responses, four interviewees indicated that the contractor caused them to become knowledgeable of the Act. The answer of conference was chosen by three respondents; one of these conferences was a Joint Government Conference on Space Commercialization held at Cape Canaveral. The various DLA or CMD regulations or guidance was the way in which two commanders became knowledgeable about the Act. Lastly, one interviewee heard about the Act through exposure on the job.

It was interesting that the answer of article, which was mentioned most frequently by the nonactive interviewees, was not mentioned at all by those in the active category. This was most reasonably the case because of the higher level of

knowledge that the active interviewees needed, when compared to the units not involved. This higher knowledge cannot normally be obtained through the review of an article.

Question Four. What types of services do government contract administration organizations provide to contractors in support of commercial space launch items? This question involved only those organizations which were actively involved with the Act. The interviewees could and normally did respond with more than one service. The support to contractors was divided into the common areas of surveillance performed by the plant representative office on government contracts. Table three shows the manner in which commanders answered this question.

Table Three

CAS Support to Contractors

Provided Services	Number Responded
Quality Assurance	8
Government Property	7
Contract Administration	3
Production/Manufacturing	3
Subcontract Management	2
Engineering/Technical	1

The classification of other was offered to the interviewee as a choice; however, it was not selected in any interview. Quality assurance and government property administration were the two most frequently provided services. These two areas were the fields expected to be the most highly

provided support services. This statement was made as a result of the literature review in Chapter II. The provisions of the Act and the guidance on the Act indicate that property and quality are the two most anticipated support areas. In fact, the Act itself directly addressed the area of government property administration.

Question Five. How was the reimbursement of provided services handled between the contractor and the government? This question was not applicable to the forty-seven respondents who did not have an active involvement with activities under the Commercial Space Launch Act. Of the eight units actively involved with the Act, five commanders said that reimbursement was being received from the contractor for the support provide to them. Each of these plant representative offices handled the reimbursement in the same manner. The organization tracked their actual hours expended in support of contractor commercial space activities and forwarded these hours to their applicable headquarters. The headquarters would bill the contractor for an amount equal to the hours expended multiplied by the current NASA reimbursable rate. This method was the one required by the appropriate AFCMD or DLA regulation or guidance.

One respondent explained that CAS support was being provided to the contractor but no reimbursement was received

from the contractor. In accordance with the Commercial Space Launch Act, this contractor had not formally requested CAS support from the government and, therefore, even though CAS support was definitely being received, the contractor refused to reimburse the government. Another interviewee said that services were provided to the contractor but no reimbursement was being received because the plant representative office did not know how to pursue the reimbursement. The commander indicated that the reimbursement was perceived to be too hard of an issue to try to work out. This commander estimated that the effort expended amounted to at least one man year of effort per year. The final organization responded basically in the same way, that they did not know how to report the hours tracked in order to be reimbursed. This commander said that the office had stopped tracking the hours expended because of this reason. He had very little insight as to the amount of effort expended by his unit in support of contractor commercial space activities. This commander also indicated that he had never spoken to the contractor directly on the issue of reimbursement.

Question Six. Do aspects of the Commercial Space Launch Act cause problems or are unclear to government contract administration personnel? For the sample, seven interviewees said that there were areas of the Act which

were unclear or caused problems. Of these seven, six respondents were commanders who had an active involvement with the act. Thus, in the active category, six of the eight had some degree of trouble with the Act; this represents 75% of the actively involved interviewees. The most frequently mentioned problem area was the reimbursement of government provided support. This area was stated by five different respondents. The interviewees cited the actual process of billing the contractor as a problem and the implementation of reimbursement in general as being troublesome.

The definition of what was and what was not a commercial space launch vehicle was the cause of ambiguity at two locations. Of these commanders, one expressed a problem with what has been called a civil launch. A civil launch has been defined as a government launch performed solely by commercial contractors. The civil launch was not referred to by either the Act itself or the Act guidance. A problem in this area has developed as to whether a civil launch was subject to reimbursement when such reimbursement would be passed directly onto the government when it purchased the launch service.

The Act was found to be ambiguous by two commanders on the applicability and administration of the Act provisions to the subcontractors of the prime contractors. They were

unsure both to providing CAS support and receiving reimbursement for any support given to the subcontractors. The CAS support area was difficult because it was uncertain as to whom, the prime or the subcontractor, could request CAS support. Whether either one could do so or whether only the prime could request support was not delineated in the Act. A reimbursement problem surfaced in this area which stemmed from not knowing whom to bill for CAS support the prime or the subcontractor.

The borrow and payback of parts between government and commercial vehicles was mentioned as being troublesome by one respondent. This procedure was very hard to keep track of and harder still to charge correctly between the government and the commercial accounts. Another commander had a difficult time with the use by the contractor of government owned facilities. Such use was very hard to reimburse due to the direct cost definition included in the 1988 Act amendments. The problem resulted because the facilities would be engaged in government contract manufacturing no matter whether the contractor endeavors in commercial ventures or not.

At one location, the interviewee cited noncomformances as an area causing problems. When a contractor produces commercial and government launch vehicles in the same assembly line and does not distinguish between these

commercial and government vehicles until the end of production, it causes problems for the plant representative office in the area of noncomformances. As an aside, each of the eight respondents who were actively involved with the Act oversaw contractors that produced their items in this manner. As the government performs its normal quality inspection on contractor items, the inspector identifies each noncomformance the item has from the contract specifications. After this process, the government remedy was to withhold a percentage of the item contract price in order to ensure that the contractor corrects these deficiencies. When the item is sold as a commercial item, these noncomformances, either minor or major in nature, are left unaddressed; if the item is eventually secured for government use the resolution of these noncomformances are impossible to track.

The last problem specified was by a commander whose contractor had very recently stated a desire to become involved in the commercial space launch market. The actions of the plant representative office where somewhat unclear to the commander as to the diligence of surveillance necessary for the commercial items while not interfering with the office's primary job of performing CAS on government contracts. The commander wondered whether this commercial surveillance should or should not be to the same high degree

as provided on the government contracts or should it be of a more cursory nature that provides the minimal benefits of CAS on the commercial items.

Subcontractor Administration

In the current defense and government manufacturing environment, at least half, but normally more, of the final item is actually produced at a subcontractor facility. The prime contractor can be seen as much more of an integrator or systems engineering specialist than the actual manufacturer. In the area of expendable launch vehicle production, the manufacturing could be divided into the production of the rocket motor, the rocket motor fuel, the guidance system, the electrical system, the lower, middle, or upper stage of the vehicle, and the launch or system software. These are just examples and the total subcontractor breakout could be much greater. In fact, each of these divisions could be further divided into smaller segments or components.

In the entire interview process, only five organizations were found to be building subcontracted items for launch vehicle prime contractors who were also involved with the Commercial Space Launch Act. However, thirty other interviewees, not including the eight organizations actively involved with the Act, indicated that the contractor they worked with produced space related items or the contractor

had contracts with NASA. As a total picture, these thirty-eight contractors represent 69.1% of all organizations contacted and would amount to eighty-six of the one hundred and twenty-four CAS units. While it cannot be said that each of these contractors necessarily produce items for commercial space launch prime contractors, it does seem that the subcontractor involvement with the Commercial Space Launch Act has been significantly under reported.

One plausible explanation for some of this understatement would be that the subcontractor involved had segregated their commercial space items from their government items. One of the interviewees who was not involved with the Act said that their contractor produced satellites. This contractor totally segregated, through the use of separate facilities, their commercial satellite production from their government satellite production. But of the eight active involvees, none of them had taken this step and it is unlikely that very many other contractors have taken this step due to the high costs involved in such an undertaking. Another reason for the understatement could be attributed to a lack of knowledge of the Act on the part of the CAS office or because the subcontract has not been clearly identified as being in support of a commercial space effort on the part of the purchasing prime contractor.

The importance of this area is that the government has not received reimbursement from subcontractors which received the benefit of CAS support. It also means that the government may be, or is, improperly expending resources for which reimbursement should be received. In fact, one of the actively involved organizations said that the contractor produced guidance systems as a subcontractor and they were sold to be used in commercial vehicles. At this location, CAS support was provided but no reimbursement was received because the unit did not know whom to bill for the CAS hours expended.

Another interviewee, whose contractor had recently announced plans to become involved in commercial space endeavors as a subcontractor, expressed that the problem of reimbursement was the key element concerning the interviewee's dealings with the contractor. The contractor did not wish to violate the Act but did not want to hold up any business dealings while the reimbursement arrangement was worked out with the government plant representative office and the government was uncertain as to how to handle the reimbursement since the components are manufactured in one assembly line under a government contract specification. Only at the end of production was a commercial item identified and sold by the contractor. The commander could

find no guidance nor helpful insight into how to handle the reimbursement from any headquarters organization.

Reimbursement

As discussed with regard to investigative question five above, of the eight respondents who indicated an active involvement with the Commercial Space Launch Act, five units were receiving reimbursement and three units were not. Each of the five receiving organizations was processing the reimbursement in accordance with the applicable CMD or DLA regulations, as described previously. One interviewee reported that the total reimbursement received to date from the contractor amounted to about $150,000 over a stretch of approximately four years. That figure corresponds to $37,500 a year, this amount could be viewed as being equal to one position in the office which was reimbursed by the contractor each year. In essence, the commander could secure one extra person working in the office at no charge to the government and, thus, not appear in the unit manning numbers. AFCMD realized this early on and proceeded to authorize plant representative office commanders to open up new so called reimbursable positions within their organizations. These positions would be paid for through the recovery of the reimbursement due the government from the Commercial Space Launch Act. Recently, however, AFCMD eliminated these positions. Two commanders expressed

disbelief at these actions and said that no explanation for the elimination was given to them by AFCMD.

The changeover of the contract administration community from the separate services, as it exists today, to the newly formed unified command of the DCMC is currently going on throughout the DOD. None of the interviewees expressed any knowledge as to how the DCMC was going to handle the reimbursement of commercial space launch efforts. Two of the commanders said that they were pursuing an alternate method of direct billing the contractor for services instead of the normal procedure. All other respondents were taking a "wait and see" attitude to the transformation of the CAS world. Of the eight commanders actively involved with the Act, five expressed apprehension with regard to the coming changeover to the DCMC and its applicability to this area.

None of the respondents had experienced any instances where alternate methods of reimbursement, different from the one included in the appropriate regulations or guidance, were employed. The other methods presented to them were to charge a flat fee, to credit the overhead account charged by the contractor for the government plant representative office, or some other method. None of the eight active interviewees expressed any preference or made any comments on these alternative methods. One commander said he would follow whatever course of action was prescribed in the

regulation and that he would not ever deviate from that method. Another respondent said he felt the government should pursue a reimbursement methodology similar to the method employed in foreign military sales (FMS) contracts. In FMS contracts, the contract price is adjusted to reflect the cost of CAS support on the items being purchased. This same philosophy could be applied to commercial space launch activities by decreasing the contract price for government purchased launch vehicles to reflect the cost to the government of expending CAS resources in support of the contractor's commercial space launch ventures.

Administrative Guidance

Each interviewee was asked how they would like information on the Commercial Space Launch Act provided to them. The respondent was told that the information would be comprehensive in nature addressing the Act itself, the administration of the Act, the expected responsibilities of the plant representative office under the Act, and the reimbursement aspects of the Act. The commanders were asked to respond by choosing one or more categories. These categories corresponded to current types of documents provided throughout the DOD as guidance in various areas. Table four displays the answers given by the respondents in this area.

Table Four

Preferred Administration Guidance

Guidance	Number	Percentage
Pamphlet	24	27%
Booklet	16	18%
Instruction	14	16%
Regulation	11	13%
Guidebook	11	13%
Procedure	7	8%
Directive	4	5%

The category of other was not chosen by any of the interviewees and as such it has been ignored. Since the respondents could select more than one category the total number amounts to more than fifty-five. The mode of all the answers was the pamphlet, followed by a booklet, and an instruction. The top three answers of the eight actively involved respondents were a pamphlet, picked by four commanders, followed by a tie between a booklet, a procedure, and an instruction, each chosen by three commanders. The top three answers of the forty-seven uninvolved interviewees were a pamphlet, preferred by twenty commanders, followed by a booklet, elected by thirteen respondents, followed by an instruction, picked by eleven interviewees.

It was interesting that the choice of directive was last on the list of categories since this was the manner selected by the DOD for the main guidance on the Commercial Space Launch Act. The choice of pamphlet as the overall favorite,

indicating a more basic informational type of guidance, showed that the commanders in general felt they lacked some of the basic background and introductory details on the Commercial Space Launch Act.

In total, five of the commanders said that they preferred to be just given the Act itself with no further guidance. These five did offer their other category preferences. One of these commanders expressed his feeling that he could most effectively administer the Act without any additional guidance because he knew best how his organization and the contractor interacted. This was an idea which could generally be seen as unacceptable to any higher headquarters since public laws are routinely flowed into regulatory guidance, as the Truth in Negotiations Act (TINA) has been. Overall, the merit of the idea was hard to evaluate since no evidence of its occurrence could be found.

The mere existence of a copy of the Act in the hands of the plant representative office commander would be very useful for reference purposes. The copy would be especially useful in areas of ambiguity between the Act and the regulatory guidance on the Act. Each interviewee was asked whether or not they had a copy of the Commercial Space Launch Act in their possession. Table five documents the survey results in this area.

Table Five

Unit Copies of the Act

	Involved Units	Uninvolved Units
Had a Copy	6	9
No Copy	2	38
	8	47

Overall, fifteen interviewees had a copy of the Act and forty did not have a copy. It would seem that those commanders involved with the Act made the efforts necessary to obtain a copy of the law. One commander involved with the Act commented that he felt he could not do the best job he could administering the provisions of the Act if he did not have a copy of the Act to refer to whenever necessary. This seemed to be quite a reasonable and logical assertion.

V. Recommendations

Overview

This chapter was founded on the work done previously in this endeavor especially in Chapter II and Chapter IV. The recommendations are divided into two general categories: research based suggestions and areas of future study. The research based suggestions are conclusions which were reached through the analysis and study of the data obtained from the telephone interviews and the information uncovered of a background nature contained in the literature review, Chapter II. The areas of future study are matters related to the research that should and could be examined further with positive potential results.

Research Based Suggestions

Education. In Chapter IV, it was shown that 75% of all plant representative office commanders found provisions of the Commercial Space Launch Act to be unclear to them or to cause them problems. This issue must be addressed in order for the best administration of the Act to occur in the DOD CAS community. One way to solve the problem would be to provide training to the commanders and their staff on the Act. This training could be at a commanders' conference or in a formal training atmosphere. The commanders' conference could spend an hour on the general aspects of the Act for

all conference attendees. After this, a smaller session could be organized for all interested or involved commanders to provide more in depth information.

The formal training on the Commercial Space Launch Act would be provided to anyone participating in the class where the information was presented. This approach would be of a higher value overall to the DOD because more personnel would be exposed to the Act and, thereby, be better prepared to administer it if the situation ever presented itself. This training could be given at the Defense Systems Management College, the Air Force Institute of Technology (AFIT), the Army Logistics Management College, or some other DOD training location. The inclusion of the Act in training would seem to be most appropriate as an addition to currently offered courses instead of it being its own unique course, although those involved in the Act would probably appreciate such a course.

A basic introduction to the topic, at a very high level of summarization, should be included in the course work of the basic introductory course to contract administration. This course is currently called Management of Defense Acquisition Contracts. This preliminary insight will allow new personnel to be aware of the existence of the Act in case they have any involvement with the Act later in their administrative career. The Executive Course in Contract

Administration, currently offered at AFIT, would seem to be a very appropriate place to add information on the Act since the course is geared to senior contract administration personnel. The information on the Act presented in this course could be of a broader and more complex nature because the individuals present would be responsible for the administration of the Act at their location.

Education on the Commercial Space Launch Act would definitely aid the actions and the decision making of the plant representative office commander. This would be especially true in the task of effectively identifying all support services which are being provided to the contractor. The education would help to ensure that reimbursement is being received from the contractor and that the reimbursement being received is adequate to compensate for the resources expended in providing the support services.

Special Assistant. Another way to aid the commander with the administration of the Commercial Space Launch Act would be to create a position of special assistant to the commander for commercial space. This position would be created within each office that is involved with the Act. This position could be paid for through the process of Act reimbursement and thus not count against the current plant representative office manpower. The individual selected for this position would be required to receive special training

on the Act and also be expected to become an expert on how the Act operates and how it applies at the contractor location where the office is located. This person would be the commander's personal representative on all aspects of the Act both with the contractor and with higher headquarters. Another benefit of this individual would be that the commander would have a knowledgeable staff member with whom they could discuss or research any commercial space issues.

Written Guidance. A way to address the issue of the ambiguity inherent in the Act would be to change or rewrite the current guidance on the Act provided to the plant representative offices. The newly formed DCMC has a unique opportunity to correct this problem by starting out fresh in the DOD contract administration community. The DCMC should seek out experts on the Act who would be tasked to develop new guidance. This new guidance should be both flexible enough for use at all locations and definitive enough to be easily understood by all who read it.

Each of these actions, training and guidance, would help to increase the knowledge and the awareness of the Commercial Space Launch Act within the DOD CAS population. These gains would better enable CAS offices to identify and adequately administer the tenuous government contractor commercial space relationship.

Direct Reimbursement. The DCMC must also act quickly, in this period of transition of DOD CAS, to ensure that each involved plant representative office has clear guidance as to how to proceed with the process of reimbursement. DCMC should provide instructions for office commanders on whether to pursue direct reimbursement from the contractor or to arrange for a higher headquarters involvement with the reimbursement procedure. Direct reimbursement is when the plant representative office bills and receives the contractor's reimbursement directly without the involvement of anyone else. It is obvious that direct reimbursement is the easiest and most cost effective means for processing the reimbursement. The direct method is normally the best approach to all situations because each commander can personally oversee and organize both the contractor's and the office's actions in order to ensure the timely payment of the reimbursement. This decentralization would be more timely than headquarters involvement and cost less administratively while still allowing any higher headquarters insight necessary through the responsible commander.

Headquarters Focal Point. As the new unifying command, the DCMC should establish an office or division within its headquarters to oversee all Commercial Space Launch Act functioning within the command. Assuming the reimbursement

is received directly by the DCMC, this office would not cost the command anything because it could be funded through the reimbursement received from the contractors. The office would oversee all reimbursement under the Act to include: ensuring reimbursement is received when appropriate, managing manpower position authorizations in plant representative offices which would be paid for through the reimbursement process, and overseeing the various reimbursement alternatives employed at the plant representative offices.

This division could provide training to DCMC personnel on the Act, including the training to the aforementioned commercial space specialists. This training would be especially useful to those locations which encounter a new involvement with the Act. Another role of this office would be to ensure that adequate subcontractor commercial space reimbursement occurs. The establishment of such an office would address the problem of having no experts on the Act to contact when there are administration problems. One commander expressed that he felt that he was all alone without help in dealing with the Commercial Space Launch Act. This general feeling amongst commanders would be eliminated with the opening of a competent commercial space office within the DCMC.

Subcontractor Involvement. To address the area of subcontractor reimbursement, the responsible parties and offices should undertake a joint subcontractor and prime contractor plant representative office identification project. This project would, from the prime contractor downward, endeavor to find as many subcontractors as possible involved in commercial space launch production. After identification, each subcontractor plant representative office should be contacted and the subject of the Act must be introduced and thoroughly explained. It would be necessary to provide these newly identified offices with training so that they could implement a reimbursement policy, if and when CAS support was being provided. It would be expected that a significant number of subcontractors would be identified in this process. These actions would then greatly increase the total amount of reimbursement received from commercial space contractors and thereby pay for the establishment of the office mentioned previously.

Legislation. The last general area of suggestion is that of the Act itself. It was known, at the time of this study production, that there had been discussions in Congress on modifying the Commercial Space Launch Act. These talks centered on forcing the government to purchase launch services instead of launch vehicles at all times. A

change such as this would most probably both increase the demand for commercial services and increase the cost for those services due to the captive nature of the government.

From an administrative perspective, the Act could be changed to better define what types of services and costs should be reimbursed by the using contractor. This would be in addition to the definition of direct costs currently included in the Act or to modify the current definition. The changes should address the charging of government facility use and the general issue of how far to extend the provisions of the Act to commercial space contractors.

The issue of contractors requesting CAS support should be further addressed. Contractors who refuse or are unable to adequately segregate and identify commercial items should not be exempt from reimbursement solely because they did not formally request CAS support. The use of any government CAS support should be enough notice that such service is needed. Anytime the government expends resources for a contractor engaged in commercial ventures the contractor should be forced to reimburse the government for these services.

Areas of Future Study

Reimbursement. The areas of future study which surround the Commercial Space Launch Act center around the question of reimbursement. The reimbursement provisions of the Act

were found to be the most frequently misunderstood provision of the Act.

The area of alternatives to the normal reimbursement methods is the most obvious area for further study. The options of a flat fee, an overhead surcharge, or some other, previously discussed, method need to be evaluated to determine if any or all of these options are an equitable and a fair means for the government receiving reimbursement.

Aside from the provisions of the Act, the overall question of whether the processing and the administration of the reimbursement provisions of the Act by the plant representative office is productive needs to be discovered. In other words, the receiving of the reimbursement may be counterproductive to the actual performance of the CAS support. Whether or not the administrative costs associated with seeking the reimbursement exceeds the total reimbursement received from the contractor is the central consideration. The question remains as to whether the reimbursement is a material figure. If the reimbursement is immaterial then the monies affiliated with it are not worth collecting.

An interesting question needing further study in the area of reimbursement is the area of contractors who do not request CAS support but who receive it any way. The question of whether or not the Department of Transportation

should reimburse the DOD for the DOD CAS support expended should be determined. The reasoning for this assertion comes from the provision of the Act which directs the Secretary of Transportation to oversee contractor manufacturing facilities. As with the Postal Service charging other government departments for using the mail, the DOD may be able to charge the DOT for providing contract administration at contractor facilities.

The last area of further study associated with the reimbursement is the appropriateness of using the aforementioned NASA reimbursement rate for charging against commercial space hours. The composition and administration of the NASA rate could not be determined even though numerous attempts were made by the author to discover the answer at all levels of DOD procurement, from the Pentagon, to AFSC, to AFCMD, to Space Systems Division of AFSC. The amount of escalation included in the rate each year and the actual components of the rate are two of the major items about the NASA rate which need to be better understood before it can indiscriminately be used for charging contractors for reimbursement under the Act. If the makeup of the rate is inconsistent with the services provided to the contractor then some other composite rate for charging the reimbursement of commercial space support needs to be used. The new rate could be determined by ascertaining the

average hourly rate of all CAS support categories and then applying these rates proportionally to the levels of CAS support by category received by contractors which was discovered in this research. This new rate would assure both the contractor and the government that the reimbursement being billed is being charged at an equitable rate. A more complicated method for charging could be developed to take the category average rates and multiply them by the actual hours expended in each category and charge the contractors this amount. This procedure would require more extensive record keeping on the part of the plant representative office.

Government Property. One area of future study that is not associated with the issue of reimbursement deals with government property administration. The point that requires investigation centers on the situation when a need for government property at a certain defense contractor ceases to exist, due to contract termination or conclusion, and the government takes action to remove the government property. At the same time, the contractor wants the government property to remain because it is used for a commercial space venture. In the normal instance, the government property is removed from the plant if the government needs or intends to use the property in the future no matter if the contractor needs the government property or not. The provisions of the

Commercial Space Launch Act stipulate that contractors possessing government property which has been declared as surplus or excess by the government may purchase such property at some determined market price. If the government property is not declared excess or surplus, then the government may do as it deems correct with its own property. The instance of a contractor needing government property to perform a commercial space launch venture and the government taking away the contractor's means for performing this venture is not addressed by the Act and should be examined by competent agencies. In the current environment of a declining defense budget, the situation of shrinking numbers of contracts and the termination of contracts deemed unnecessary can only be seen to increase in the near future. This shows the importance of investigating this identified issue to find an equitable solution before a first occurrence of the situation happens.

Summary

This chapter has been provided to make recommendations for the better administration of the Commercial Space Launch Act at DOD CAS organizations. These recommendations were divided into research based suggestions and areas of future study. The suggestions were conclusions drawn from the material in Chapter II and Chapter IV. The areas of future

study were matters tangent to the research which could or should be analyzed further in this field.

Appendix A: Telephone Schedule of Questions

COMMERCIAL SPACE LAUNCH ACT
TELEPHONE SCHEDULE OF QUESTIONS

SECTION I WILL BE ASKED OF ALL INTERVIEWEES. SECTION II WILL BE ASKED TO THOSE INTERVIEWEES WHO HAVE AN ACTIVE INVOLVEMENT WITH THE COMMERCIAL SPACE LAUNCH ACT.

SECTION I -- GENERAL QUESTIONS

1 -- TO YOUR KNOWLEDGE, DOES THE CONTRACTOR UNDER YOUR COGNIZANCE PRODUCE ANYTHING IN SUPPORT OF COMMERCIAL SPACE LAUNCH ACTIVITIES, FOR EXAMPLE BOOSTER ROCKETS, EXPENDABLE LAUNCH VEHICLES OR HEAVY LIFT PLATFORMS?

A. PRIME

B. SUB

2 -- WHAT TYPES OF ITEMS OR SERVICES DO THEY MAKE OR PROVIDE?

A. PRIME

B. SUB

3 -- HOW OFTEN DOES YOUR ORGANIZATION WORK IN ACCORDANCE WITH THE COMMERCIAL SPACE LAUNCH ACT?

1 -- DAILY
2 -- THREE TIMES PER WEEK
3 -- TWICE A WEEK
4 -- WEEKLY
5 -- MONTHLY
6 -- ONCE EVERY TWO MONTHS
7 -- NEVER

4 -- WHAT HAVE YOU HEARD ABOUT THE ACT?

5 -- WHERE DID YOU HEAR ABOUT IT?

1 -- AT TRAINING
2 -- AT A MEETING
3 -- AT A CONFERENCE
4 -- IN AN ARTICLE
5 -- IN A REGULATION
6 -- FROM THE CONTRACTOR
7 -- OTHER (PLEASE EXPLAIN)
8 -- I HAVE NOT HEARD ABOUT THE ACT

6 -- WHAT PERCENT OF YOUR CONTRACTOR'S SALES ARE GOVERNMENT SALES?

1 -- 100 - 90 %
2 -- 89 - 80 %
3 -- 79 - 70 %
4 -- 69 - 60 %
5 -- 59 - 50 %
6 -- 49 - 40 %
7 -- 39 - 30 %
8 -- 29 - 20 %
9 -- 19 - 10 %
10 -- 9 - 0 %

7 -- ARE THERE ASPECTS OF THE COMMERCIAL SPACE LAUNCH ACT WHICH CAUSE YOU TROUBLE OR ARE UNCLEAR DURING THE PERFORMANCE OF YOUR JOB OR IN AN EFFORT TO COMPLY WITH THE LAW?

8 -- DO YOU HAVE A COPY OF THE PUBLIC LAW (98-575)?

1 -- YES
2 -- NO
3 -- OTHER (PLEASE EXPLAIN)

9 -- HOW WOULD YOU LIKE TO SEE INFORMATION ON THE COMMERCIAL SPACE LAUNCH ACT PROVIDED?

1 -- BOOKLET
2 -- PAMPHLET
3 -- PROCEDURE
4 -- REGULATION
5 -- GUIDEBOOK
6 -- DIRECTIVE
7 -- INSTRUCTION
8 -- OTHER (PLEASE EXPLAIN)

10 -- DO YOU KNOW OF ANY INFORMATION ON OR PEOPLE WHO ARE KNOWLEDGEABLE OF THE COMMERCIAL SPACE LAUNCH ACT?

SECTION II -- SPECIFIC INFORMATION QUESTIONS

11 -- WHAT TYPES OF CONTRACT ADMINISTRATIVE SERVICES DOES THE GOVERNMENT PROVIDE TO THE CONTRACTOR IN SUPPORT OF COMMERCIAL SPACE LAUNCH ITEMS?

1 -- CONTRACT ADMINISTRATION
2 -- PRODUCTION/MANUFACTURING
3 -- GOVERNMENT PROPERTY
4 -- QUALITY
5 -- ENGINEERING
6 -- SUBCONTRACT MANAGEMENT
7 -- OTHER
8 -- NO SERVICES ARE PROVIDED

12 -- IF THE CONTRACTOR DOES PRODUCE COMMERCIAL SPACE LAUNCH ITEMS AND DOES NOT RECEIVE ANY GOVERNMENT CAS -- HOW DOES THE CONTRACTOR SEGREGATE THE COMMERCIAL SPACE LAUNCH ITEMS?

1 -- SEPARATE FACTORY
2 -- SEPARATE PLANT FLOOR
3 -- SEPARATE ASSEMBLY LINE
4 -- NOTICE TO THE GOVERNMENT TO DISREGARD CERTAIN ITEMS
5 -- OTHER (PLEASE EXPLAIN)

13 -- IS THE GOVERNMENT RECEIVING REIMBURSEMENT FOR PROVIDING CAS SERVICES TO THE CONTRACTOR?

1 -- YES
2 -- NO
3 -- OTHER (PLEASE EXPLAIN)

14 -- HOW IS THE REIMBURSEMENT HANDLED? WHAT ARE THE PROCEDURES?

1 -- BY AGREEMENT (CAN A COPY BE SENT TO ME?)
2 -- BY APPLYING A RATE TO ACTUAL HOURS
3 -- BY CHARGING A FLAT FEE EACH PERIOD
4 -- BY CREDITING THE OVERHEAD
5 -- OTHER (PLEASE EXPLAIN)

15 -- IS A RATE USED?

1 -- YES
2 -- NO
3 -- OTHER (PLEASE EXPLAIN)

16 -- HOW IS THE RATE DETERMINED?

17 -- IS THE NASA REIMBURSABLE RATE USED AT ALL?

1 -- THE NASA RATE IS THE RATE USED
2 -- THE RATE IS A PERCENTAGE OF THE NASA RATE
3 -- THE NASA RATE IS CONSULTED OR USED FOR COMPARISON
4 -- THE NASA RATE IS NOT USED NOR LOOKED AT
5 -- I AM NOT AWARE OF THE NASA RATE
6 -- OTHER (PLEASE EXPLAIN)

18 -- IF THEY ARE RECEIVING GOVERNMENT CAS AND IF NO REIMBURSEMENT IS RECEIVED -- WHAT ARE THE REASONS BEHIND THERE BEING NO REIMBURSEMENT?

1 -- I WAS UNAWARE THAT REIMBURSEMENT SHOULD BE RECEIVED
2 -- THERE IS A SPECIAL AGREEMENT WITH THE CONTRACTOR
3 -- ANOTHER TYPE OF STYLE OF COMPENSATION IS RECEIVED
4 -- OTHER (PLEASE EXPLAIN)

Appendix B: Telephone Interview Appointment Letter

AFIT/LS (Michael M. Hale)

Thesis Telephone Interview

Interviewee
Address

Thank you for agreeing to participate in my study of the Commercial Space Launch Act. I am trying to determine the effect of the act on Department of Defense contract administration services. The information will be used for my masters thesis in contract management at the Air Force Institute of Technology.

I will telephone you, as previously agreed on, 1990 at hours (local time). The responses which are obtained will remain anonymous in the study. I would ask you to review the attached list of questions before the telephone interview. Please feel free not to answer any questions in the interview which for whatever reason you do not wish to answer.

Thank you for your time and your cooperation. Your participation will hopefully provide a better understanding of the interplay between DoD contract administration and the Commercial Space Launch Act. If requested, a copy of your compiled answers and a summary of the study findings will be provided to you.

If for any reason you need to contact me, please call me at home at (513) 237-8393.

Sincerely,

Michael M. Hale, Cpt, USAF
AFIT Masters Student

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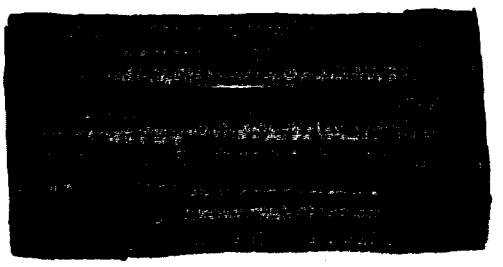
Vita

Captain Michael Martin Hale [redacted] graduated from Holy Cross High School in Flushing, New York in 1986. He attended the United States Air Force Academy and received a Bachelor of Science degree majoring in financial management upon graduation in 1986. After graduation, he was commissioned in the United States Air Force and was assigned to the Air Force Plant Representative Office situated at Eaton Corporation AIL Division in Deer Park, Long Island, New York. From June 1986 to May 1989, he held the positions of price analyst, overhead specialist, and administrative contracting officer. While stationed at the AFPRO, he was named the 1988 recipient of the AFCMD Outstanding Contributor to Contracting, Manufacturing, or Quality Assurance. In May 1989, he was assigned to the Air Force Institute of Technology in pursuit of a Master of Science degree in contracting management graduating in September 1990. He has received the Air Force Achievement Medal and the Air Force Commendation Medal.



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13. ABSTRACT *(Maximum 200 words)*

This study anlayzes the Commercial Space Launch Act and the effect of the Act on Department of Defense contract administration. The Act is the way for the United States to encourage corporate involvement in the commercial space launch industry. The literature review provides a comprehensive overview of the Act, the current environment of space commercialization, and the future of the space launch industry. The method of acquiring the necessary data used in the study was the telephone interview. Commanders of Department of Defense contract administration units were surveyed to determine their knowledge and awareness of the Act. The study found that the Act was being administered adequately at those locations which reported involvement; however, there were serious problems in the administrative guidance on the Act and the process of reimbursement for government provided contract administrative services. The study makes numerous recommendations for improvement to include: rewriting the current Act guidance and forming a focal point for commercial space within the newly formed Defense Contract Management Command. Keywords: Contract administration, Department of Defense, Space launched, Commerce, Theses. (RWJ)

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