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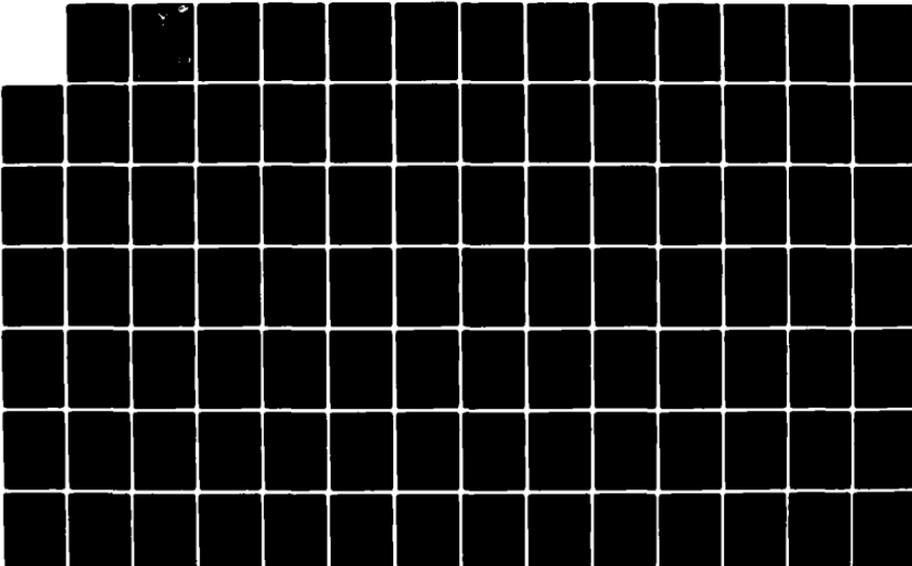
APPLICATION OF TECHNOLOGY MODERNIZATION TO THE
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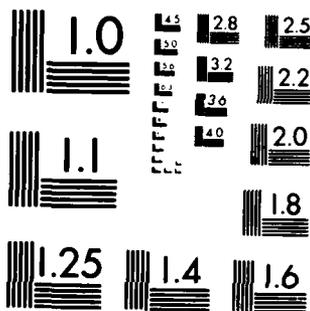
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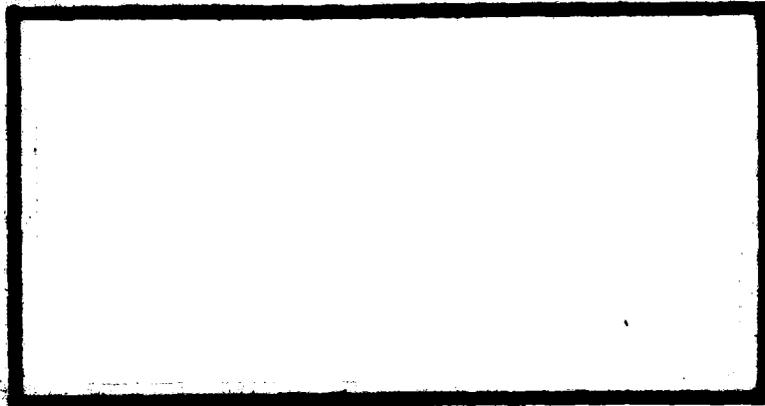
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APPLICATION OF TECHNOLOGY MODERNIZA-
TION TO THE SUBCONTRACTOR TIER:
AN ANALYSIS OF CONTRACTING
APPROACHES

Michael Szczepanek, GS-12
William M. Thompson, GS-12

LSSR 53-82

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Successful implementation of Technology Modernization at the Air Force subcontractor level offers the potential for significantly lower unit costs, quality enhancement, reduced lead times, and other positive results. Tech Mod has been applied to a very few prime contractors to date, and even fewer subcontractors. After researching the three available contracting strategies for implementing Tech Mod at the subcontractor tier, the authors conclude that contracting through the prime contractor is more advantageous than contracting through an independent third-party or contracting directly with the subcontractors. Other considerations and cautions, peculiar to subcontractor Tech Mod programs and Tech Mod in general are discussed, and several recommendations, including recommendations for further research, are presented. ↑

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TO THE SUBCONTRACTOR TIER: AN
ANALYSIS OF CONTRACTING
APPROACHES

A 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 Logistics Management

By

Michael Szczepanek, BA
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September 1982

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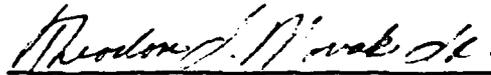
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fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 29 September 1982



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CHAPTER 1

RESEARCH PROBLEM

Introduction

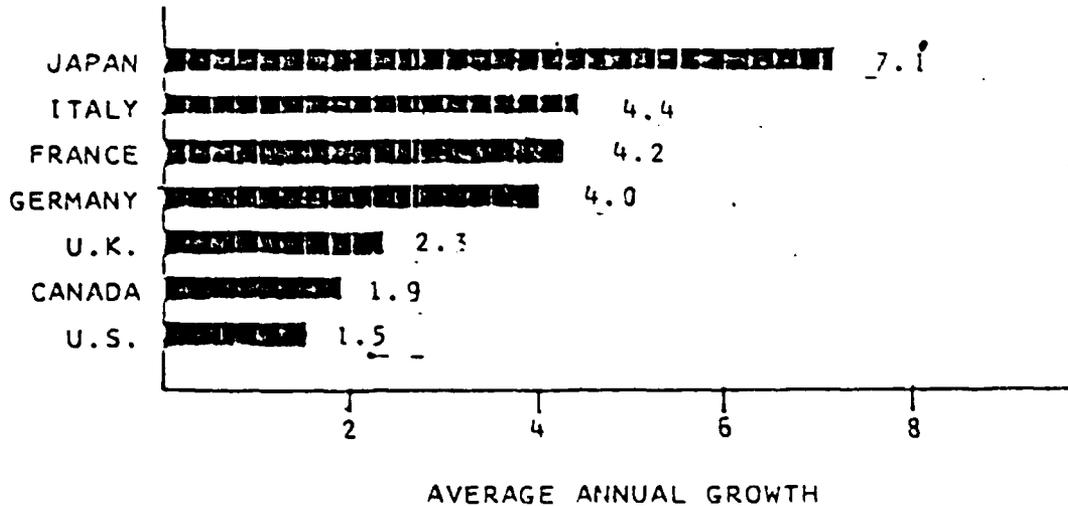
United States industry's loss of competitiveness in the world market over the past two decades has been nothing short of an economic disaster. The underpinnings of what amounts to a productivity crisis have been well documented, and are receiving even greater attention with the latest wave of lay offs and plant closings. The story told by the often quoted statistics is gloomy indeed.

In 1972 the United States standard of living was the highest in the world; today it ranks fifth (2:57). In 1979, for the first time in history, the inflation rate for the United States was higher than the average of all industrial nations. Overall economic growth as measured by the Gross National Product dropped to approximately 2.9 percent per year in the 1970's from 4.1 percent in the 1960's (2:57). In terms of industrial productivity, the U.S. realized only a 1.5 percent increase per year from 1960 to 1979 as compared with 4 percent for Germany and 7.1 percent for Japan (4:3). In 1979 U.S. productivity growth actually declined by .3 percent (4:3).

As productivity growth has declined, prices for U.S. goods have risen, and this increase in prices has made

FIGURE 1-1

INTERNATIONAL PRODUCTIVITY RANKING: 1960-1979 TOTAL ECONOMY



SOURCE: BUREAU OF LABOR STATISTICS (BLS)

United States industry largely noncompetitive in the world market. The reduced market share has led inevitably to reduced corporate income and, in turn, to a reduction in the capital so desperately needed for plant and tooling modernization to regain the market share lost. A vicious circle emerges.

Researchers and industry analysts have often focused on two primary factors affecting productivity growth: technology and capital investment. These two, taken together, are believed to account for over 80 percent of past productivity growth (4:5). Because the level of private

investment in American industry has continued to decline, it is not difficult to comprehend our present predicament.

Investment in United States industry presently stands at 10 percent of our Gross National Product, compared with 15 percent in Germany and 20 percent in Japan (2:57). Even more ominous, with respect to our subject, is the rate of investment by United States aerospace industries as compared with other firms. Over the past decade the average rate of investment in new capital plant or equipment for all U.S. industries was approximately 8 percent of sales. Manufacturing firms averaged slightly more than 4 percent. Aerospace firms' investment hovered at a dismal 2 percent. This lack of investment has led to a situation where over 60 percent of the metalworking equipment employed on United States defense contracts is over 20 years old (4:6).

The U.S. steel industry was one of the first victims of the capitalization drought and it presents a depressing prediction of the defense industry's future if changes are not made. In the late 1950's United States steel producers were still putting up cheap open-hearth furnaces. The Japanese, on the other hand, were building modern basic oxygen-process steel plants that allowed them to produce better steel with greater speed for less money. Ironically, the basic oxygen-process was a purely American invention. Only quota protection has permitted the United States steel industry to maintain its 85 percent share of the domestic market.

As we have already suggested, the plight of defense manufacturers and producers seems even more severe than their counterparts in United States industry. The ramifications of this problem have not been lost on the Department of Defense, which has witnessed the cost of its sophisticated weapons systems, aircraft in particular, skyrocket since the end of World War II.

A number of studies have asked why defense contractors are even more reluctant to invest in plant modernization than the rest of American industry. The two major answers that keep coming back relate to the way the government does business. Those two answers are "uncertainty" and "low profits".

The uncertainty of the defense business can be traced primarily to the government's practice of annual fiscal year buys. Annual funding prevents firms from making efficient production plans based on larger (though unfunded and not authorized) quantities which the Department of Defense indicates it intends to purchase. The annual quantities, which are funded and authorized, are seldom sufficient to justify major cost reducing capital expenditures. Then too, defense contractors are in no position to control future sales involving new hardware. These future sales are totally dependent upon the requirements of the Department of Defense and the mood of Congress. The ability to efficiently and effectively produce major weapons systems, such as

aircraft, certainly does not guarantee a defense firm new business. Such new buy decisions, as we have seen in the past, are often based primarily on political considerations. It is not difficult to see why long range planning in the United States defense industry is difficult if not impossible.

The second principal answer to our earlier question asking the reasons for defense firms' unwillingness to invest is "low profits". The fact is that, generally, commercial sales tend to be more profitable than defense sales, about twice as profitable according to one study (1:6). Low profits, coupled with the risk and uncertainty of the defense business, has lead to a very cautious approach to capital investment and plant modernization. Contractors also realize that the DoD will continue to purchase weapons systems regardless of whether they improve productivity.

The Department of Defense is taking aggressive action to turn declining defense productivity around. Multi-year procurement policy should go a long way in reducing contractor uncertainty and increased use of award fees should improve the defense business profit picture. One of the most innovative and exciting of the techniques for encouraging capitalization and plant modernization currently being used by the Air Force is the Technology Modernization Program, or as it is commonly known, Tech Mod.

Tech Mod is usually described as a cooperative effort between Air Force and contractor directed at systematically

bringing new and existing manufacturing technologies, and the capital necessary to implement them, onto the production floor. The program uses dynamic contractual tools to encourage contractor investment in manufacturing state-of-the-art and advanced technology. The net result is that both parties, Air Force and contractor, mutually benefit.

To date the Tech Mod program has been applied to several prime contractors. However, as the Defense Industrial Base Panel of the Committee on Armed Services, House of Representatives, discovered in their investigations in 1980, many of the productivity problems in the defense industry can be traced to the subcontractor tier (5:11).

Problem Statement

In producing today's highly sophisticated, very expensive defense hardware, subcontractors play a critical role. In most major defense systems, production subcontractors account for the majority of the work and for the majority of the cost. This is especially true in the Air Force. Over 60 percent of the costs of the F-16 fighter and over 60 percent of the costs of the new B-1B bomber are attributable to subcontractors on those programs. Over 50 percent of the expenditures on jet engines go to subcontractor firms (3:102). It is not surprising, then, that subcontractors have traditionally been the "bottlenecks" and principal cost drivers in defense production efforts.

The Defense Industrial Base Panel reported in their findings dated December 31, 1980, that "the defense industrial base is unbalanced; while excess production capacity generally exists at the prime contractor level, there are serious deficiencies at the subcontractor levels [5:11]." The Congressional task force also found evidence that the industrial base of the defense business was diminishing. In one of the programs examined, the number of suppliers involved in the effort dropped from 6,000 to 1,500 in a single year. On another program, the number of bids received declined by 40 percent from one year to the next. During the hearings, Mr. Harry Gray, Chairman and Chief Executive Officer, United Technologies Corporation, testified that since 1967 the number of companies involved in aerospace manufacturing had declined by 40 percent. While in 1967 there were approximately 6,000 firms in the industry, by the end of 1981 there were fewer than 3,500. In addition, there had been a turnover of some 1,500 of the 3,500 firms in the previous two years, Gray noted (5:12).

Productivity inefficiencies can certainly be blamed on at least some of the fatalities among aerospace and other defense industries. Productivity problems can also be held accountable for at least some of the rapidly escalating lead times among subcontractors. Delivery time for aluminum forgings exploded from 20 to 120 weeks between 1976 and 1980. In 1977 the Air Force could expect delivery of

aircraft landing gears within 52 weeks. By 1980 the wait for this critical component had more than doubled to 120 weeks. Delivery of integrated circuits went from 25 to 62 weeks in the last two years. The Air Force could expect to get a military jet engine about 19 months after ordering it in 1978; by 1981 delivery could be promised within 41 months after receipt of the necessary paperwork (5:13).

Getting down to the subcontractor and vendor tiers to improve productivity has not been an easy task in the past. The government normally deals with elements of the subcontractor base by going through a prime contractor. This lack of privity of contract has often precluded the access necessary to proper implementation of productivity enhancing programs. Early Air Force guidance on the application of the Tech Mod program even suggested that subcontractor participation in the program could be handled through a prime contractor. Recent developments in Tech Mod coupled with the ever increasing need to fix the productivity problems with subcontractors has lead to a reevaluation of the best way to apply the program to the subcontract tier. That overall question is the one we will address in this paper.

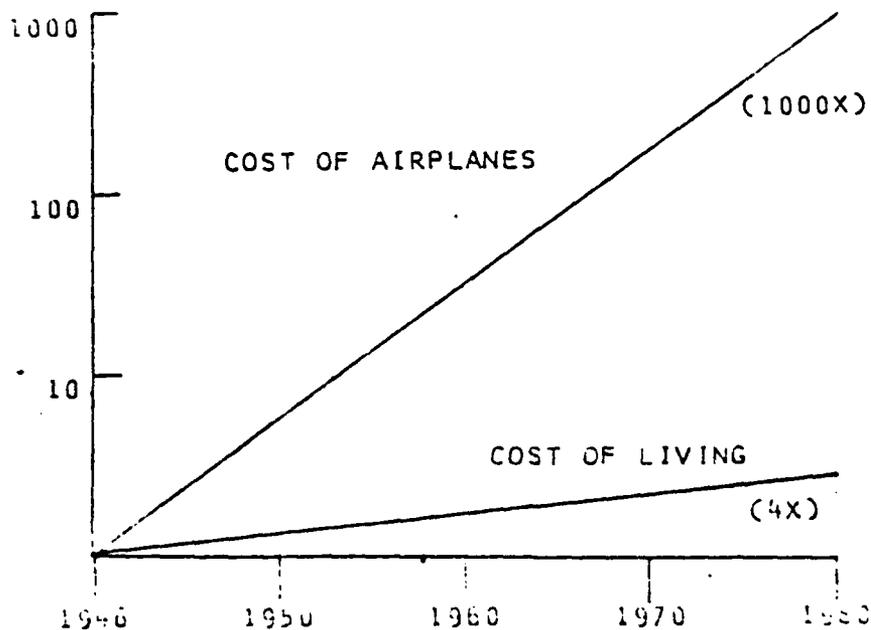
Background

The Air Force has been a leader in searching out ways to improve the productivity and responsiveness of its contractors. In a sense, the Air Force has had little

choice. Aircraft and airborne weapons systems are among the most complex and expensive in the United States arsenal and every indication is that they will continue to increase in cost and complexity. Since the end of World War II, the cost of aircraft has increased at a remarkable rate. (See Figure 1-2.)

Earlier approaches to encouraging contractors to invest in plant and tooling modernization dealt with changes to the Cost Accounting Standards and the Weighted Guidelines profit analysis. Air Force contracting officers were enabled to partially compensate contractors in Weighted

FIGURE 1-2
COST OF LIVING VS. COST OF AIRPLANES (1:2)



Guideline profit analysis for capital investments through cost of money allowances.

The Value Engineering program is another example of efforts to improve contractor productivity and reduce hardware costs. Under Value Engineering, or VE, a contractor was encouraged to look for ways to improve the product, streamline the production process, and cut costs. Under VE the contractor would be rewarded for any beneficial discoveries and would share to some extent in any savings the Air Force might realize on the current systems buy. There have been some problems encountered in applying the VE program. Contractors are often unwilling to dedicate their best individuals to the task and, as a result, the gains are often negligible. Then too there is the old contractor refrain of too much complicating government paperwork. Finally, many contractors do not believe that the potential reward justifies the effort. Any reduction in costs on the current program for a contractor may well be a reduction in profits on the next, and the VE system of rewards has not been perceived as offsetting those future losses.

The Manufacturing Technology, or MANTECH, program was initiated more than twenty years ago. MANTECH is oriented to closing the gap between advances in the state-of-the-art of manufacturing processes and implementation of these advances into full scale production. Under MANTECH,

the Department of Defense provides the seed money for the initial application of more productive manufacturing technology onto a factory floor. By so doing, both technical and financial risks to the contractor are substantially reduced. Wide implementation of successful projects by the private sector are then encouraged. An innovation within the MANTECH program has been the Air Force Integrated Computer Aided Manufacturing program, or ICAM. ICAM attempts to increase productivity and thereby reduce production costs by applying computer technology to aerospace production operations.

One criticism sometimes voiced about MANTECH is that many successfully demonstrated technologies never make it off the shelf and into widespread use by industry, largely because contractors have no assurance of an adequate return on what is generally a substantial capital investment.

Not very long ago, the Air Force introduced the Technology Modernization or Tech Mod program, which places contractors and the Air Force in a partnership aimed at bringing new and state-of-the-art production processes into the contractor's plant and onto Air Force systems assembly lines. "Tech Mod" was first used to describe the productivity enhancement approach on the F-16 program. General Dynamics, the prime contractor on the F-16, developed a comprehensive plan for advanced technology/plant

modernization in the mid '70s and submitted it to the Air Force which, in turn, accepted the program in 1977. The plan called for a cooperative Air Force/General Dynamics venture to systematically work towards improving productivity and reducing acquisition costs for the F-16 aircraft.

Though there have been a number of subtle changes in the Tech Mod program since its inception and subsequent application to several prime contractors, and recognizing that the program is quite flexible, it is still possible to say that Tech Mod is generally accomplished in a three phase effort:

-- Phase I is a "top down" factory analysis. This analysis serves to reflect the "as is" situation in the contractor's facility, an absolutely essential element if planning for the "to be" is going to be successful. Under Phase I, candidate technologies which may be applicable to the contractor's product line are also identified. The net result of this factory analysis and technology identification is an ordered list of Tech Mod candidate projects which reflects estimated costs of implementation and projected savings.

At the end of Phase I, the Air Force and the contractor negotiate a "business deal" to address the benefit sharing arrangements, contractor incentives, available technologies, returns-on-investments, guarantees, commitments, and other related items which become, in effect, the ground

rules for the next two phases. This business deal is the key to successful Tech Mod efforts. Consistent with the concept of Tech Mod itself, the business deal must be crafted in such a way that the final results will be beneficial to both parties.

-- Under Phase II, enabling technologies, i.e., the technology that will permit the contractor to actually set-up the new production system on the floor of the plant, and plant redesign are explored. This phase is often referred to as the "laboratory validation" phase because the contractor attempts to prove the feasibility of the advanced technologies under laboratory conditions. Phase II also produces implementation plans and specifies hardware/software requirements.

-- Phase III is the actual implementation of the Tech Mod. In Phase III the contractor actually invests in the new capital equipment to implement those final Tech Mod projects selected in Phase II based upon the highest potential payback.

"Technology transfer" is an integral part of any Technology Modernization effort. The Air Force believes that technology advances and innovative applications of state-of-the-art manufacturing processes should receive the widest possible exposure so that other firms in the United States industrial base might benefit. Where Air Force funds are used in a Tech Mod project, technology

transfer becomes a contract requirement. Following Phase III implementation, the participating firm distributes the results of their Tech Mod projects. All relevant data is provided to any interested firm including, of course, competitors of the Tech Mod participant. An "open house" may also be scheduled to show and explain the Tech Mod effort operations and results. In this manner the new technology and learning is transferred or shared with all other interested parties.

Funding for a Tech Mod further reflects the partnership arrangement between Air Force and contractor. Normally the Air Force will provide at least a portion of the funding required for Phases I and II. The contractor provides the great majority of the funding required under Tech Mod when, in Phase III, he purchases and installs the new equipment and tooling.

Again, success of the entire effort is dependent upon the negotiated business deal which details the payback for both parties. For the contractor this means a sufficient return on his capital investment to justify the expenditure. For the Air Force, payback takes the form of reduced system acquisition costs over the entire production life of the hardware. Of course additional savings may be realized on other defense production programs in the contractor plant which may be affected by the modernization efforts, and it is conceivable that other armed service

branches could share in these savings. Calculation of the Air Force/contractor payback can be very complex, and if the business deal is the key to success in a Tech Mod effort it is also its greatest hurdle.

It should be cautioned at this point that there is no one way to approach a Tech Mod program. Tech Mod has as perhaps its most valuable asset great flexibility. It is conceivable, for instance, that the Air Force could fund all three phases or that the contractor could carry the entire burden. It all depends upon the contractor and system involved and the parties willingness to participate.

Justification for Research

Research into the problem of applying Tech Mod at the subcontractor tier is justified by the following:

-- The Committee on Armed Services' Defense Industrial Base Panel in their December 31, 1980 report to the Ninety-sixth Congress identified the critical part played in the defense industry by subcontractors and heard testimony that "very serious deficiencies at the first, second, third and so on and so forth, tiers of subcontractors down to the vendor levels who are vrending components into the team."

-- The Air Force has responded to the overall productivity problem by forming within the Air Force Systems Command an Aerospace Industrial Modernization (AIM) office. AIM has been directed to develop Air Force industrial base

strategies and be responsible for synthesizing the contractual and technical efforts for aerospace industrial modernization.

-- Major General Jasper A. Welch, Jr., Assistant DCS for Research, Development, and Acquisition, in his 9 February 1982 letter to both AFSC and AFLC requested "AFSC, with AFLC participation, propose an Air Force policy approach for systematically addressing the implementation of MANTECH and Tech Mod efforts directed at the subtier industry levels."

Purpose of Research

The purpose of our research will be to review various contract procedural options and to analyze the option characteristics to enable selection of the most effective and efficient strategy for application of Tech Mod to subcontractors under given conditions. This will be accomplished by interviewing Tech Mod "experts" on the advantages and disadvantages of the various strategies and analyzing the results of our discussions.

Scope of Research

In considering, evaluating, and recommending contract strategies for implementation of Tech Mod at the subcontractor level, we will assume a single Air Force scenario leading up to the decision to consider a subtier Tech Mod effort.

In our scenario one or more subcontractors under a major Air Force weapons system program are identified as

being in need of a fix because of production bottlenecks or high costs for components or because the subcontracted items are considered critical to the major program. It is irrelevant to our paper as to whether the prime contractor, the subcontractor, or the Air Force discover the problem. The relevant point is that the Air Force has determined that Tech Mod may provide the solutions to the problem.

Three contracting strategies have been developed for application of Tech Mod at the subcontractor level. These three are:

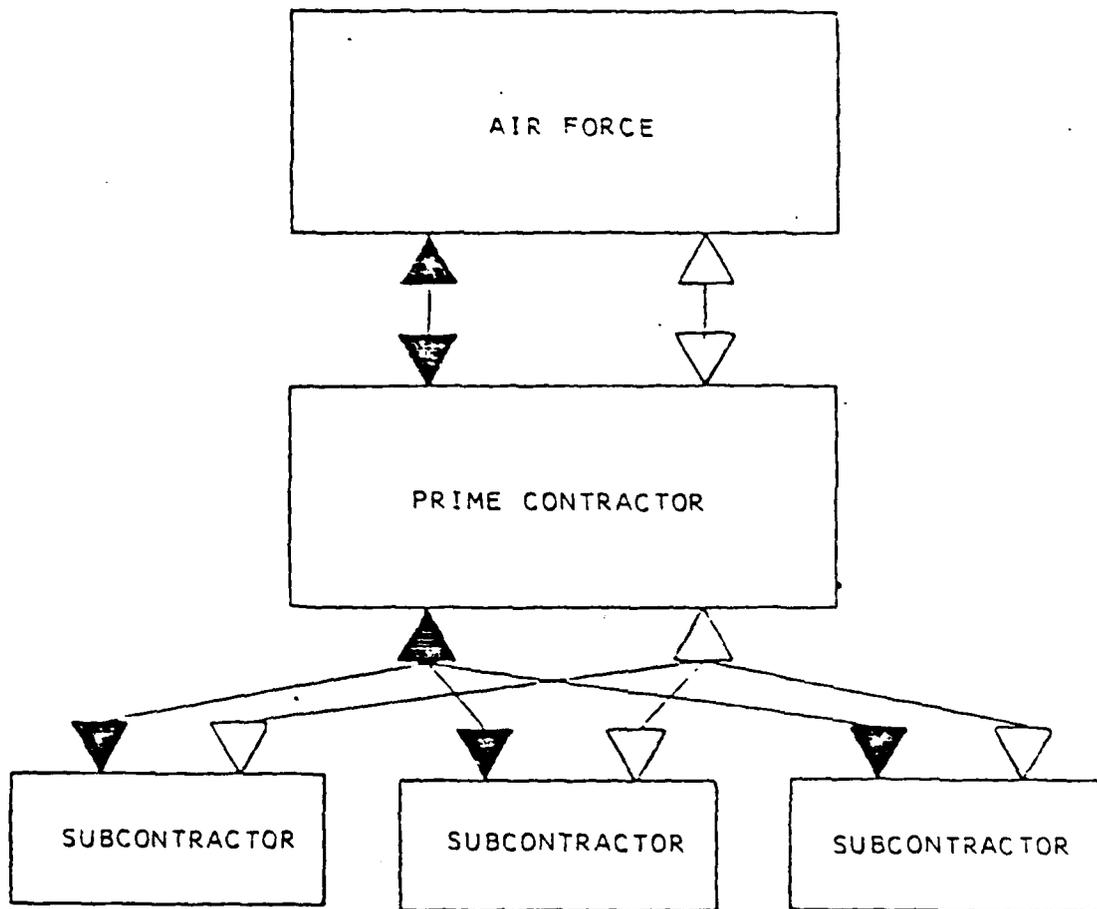
Strategy # 1 -- "Vertical". In the vertical strategy the prime contractor is used by the Air Force to take Tech Mod down to the subtiers. (See Figure 1-3).

Strategy # 2 -- "Direct". The Air Force would deal directly with the subcontractor(s) to the prime under the direct strategy (See Figure 1-4).

Strategy # 3 -- "Horizontal". A third-party contractor would be employed by the Air Force under the horizontal strategy to take the Tech Mod effort to the prime contractor's subcontractors (See Figure 1-5).

In our research we will consider only the Air Force, though the strategies and our research may be applicable to any agency considering a Tech Mod type of program.

FIGURE 1-3
VERTICAL STRATEGY

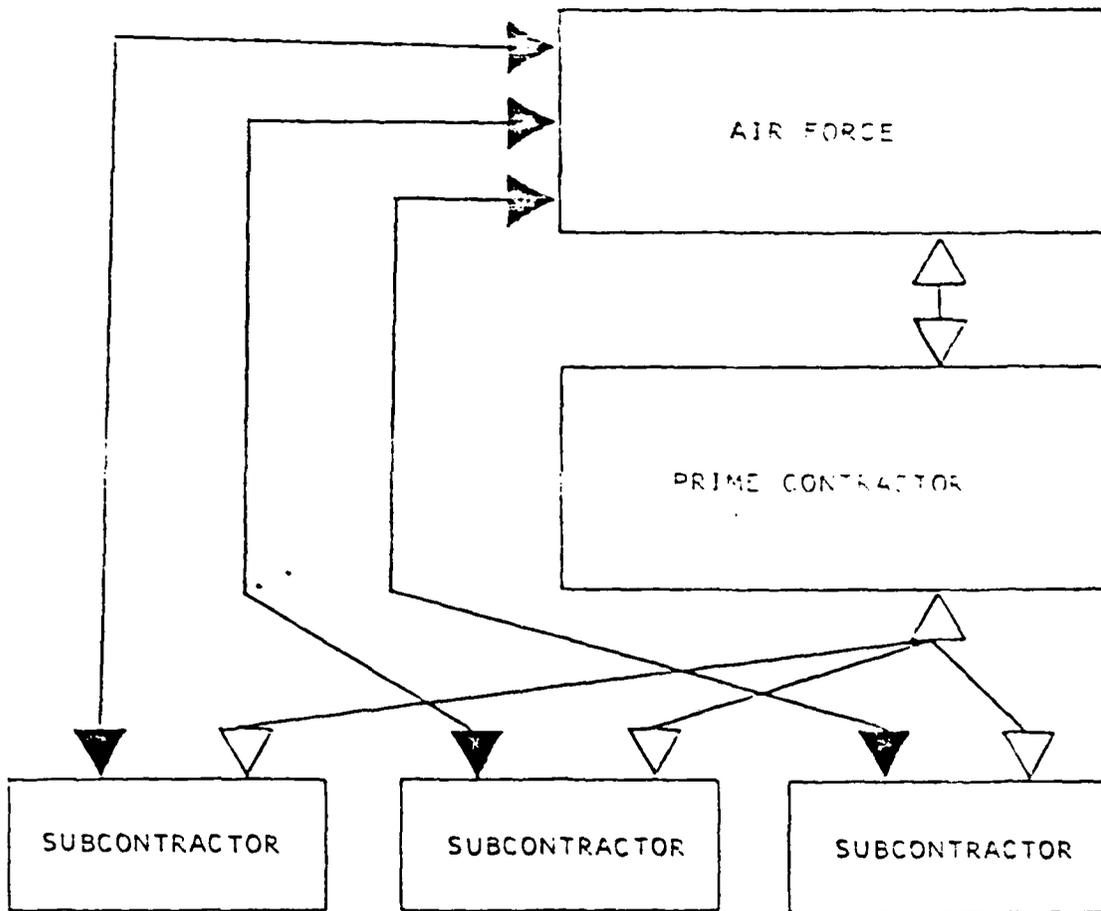


RESPONSIBILITY FLOW CHANNELS:



FIGURE 1-4

DIRECT STRATEGY



RESPONSIBILITY FLOW CHANNELS:

PRODUCTION CONTRACT

TECH MOD CONTRACT

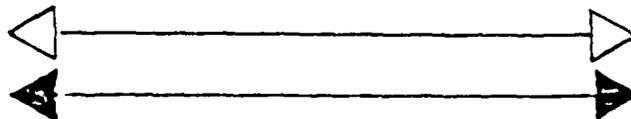
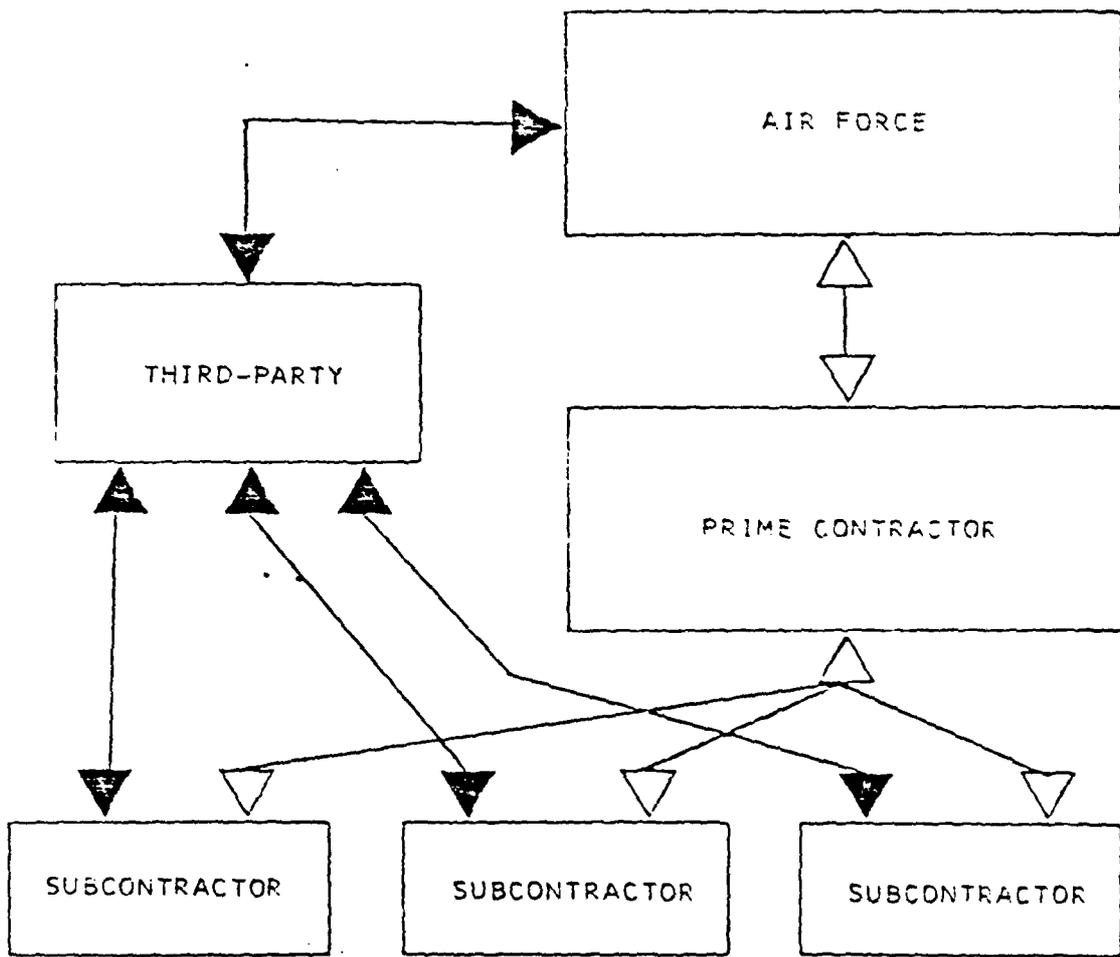


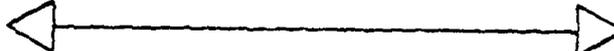
FIGURE 1-3

HORIZONTAL STRATEGY

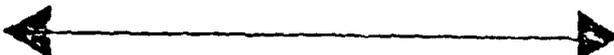


RESPONSIBILITY FLOW CHANNELS:

PRODUCTION CONTRACT



TECH MOD CONTRACT



CHAPTER 2

RESEARCH METHODOLOGY

Selection of Approach

Chapter 1 provided the general background and justification for research on the subject of contracting approaches for application of the Technology Modernization program at the subcontract tier. Under the assumed scenario identified in Chapter 1, three possible contracting strategies are recognized for implementing a Tech Mod project with a subcontractor.

The contracting process involves the application of regulations, policies, precedent, and perhaps most important, professional judgment, often within an ambiguous and dynamic environment. Because the contracting process is not an exact science, investigation of the various strategies for applying Tech Mod to the subcontract tier is more amenable to subjective evaluation than an objective or quantitative approach. Further, introduction of the Tech Mod program is so recent that historical data that might lend itself to an after-the-fact quantitative analysis of the alternate contracting strategies does not presently exist.

Our initial introduction to the concept of Tech Mod was obtained through extensive discussions with the individuals located at Wright-Patterson Air Force Base, OH.,

who are directly involved in the Air Force Industrial Modernization Incentive Program, which includes Tech Mod. These individuals are assigned to the Air Force System Command Aerospace Industrial Modernization Office (ASD/AI) and the Aeronautical Systems Division Directorate of Manufacturing (ASD/PMD). None of the individuals contacted were aware of any prior research on our specific topic. Our own search of the literature through library and available computer bank sources also provided no evidence of prior research in this area.

Therefore, because there is no useful historical data, no prior research has been done on this subject, and time and resource constraints preclude actual application and comparison of the alternate strategies under similar conditions, we determined that integration and analysis of expert opinion was the only appropriate methodology for our research.

Data Collection

In order to obtain a balanced perspective regarding the advantages and disadvantages of the alternate strategies, diversity of expert opinion was an essential element of the research design. This diversity was assured, in part, by including in the spectrum of interviewees both government and industry representatives. The industry representatives included individuals who worked for prime contractors, individuals employed by firms which normally operate as

subcontractors in the defense industry, and individuals employed by firms that either have expressed an interest or are known to have the general capabilities required to fill the "independent third party" role associated with Strategy 3.

Additional diversity was obtained by including as interviewees a balanced selection of government and industry sources with expertise in one or more of the four broad disciplines normally involved to a significant extent in any contracting effort. These broad disciplines are legal, technical, pricing, and administrative. Considering the issues from the perspective of each discipline is important because each offers a unique and a critical contribution to the contracting process, and, because all contracting related activities can be categorized within one of these four broad disciplines.

For the purpose of our research, "expert" status required the following qualifications:

1. Direct exposure to, or experience in, application of Tech Mod in a contract situation; or, a minimum of five years experience as an active participant in one or more of the four broad disciplines.
2. Adequate time available to participate in an initial interview, and follow-up interviews as necessary.
3. An expressed willingness and interest to participate as an interviewee in the project.

These experts were located principally by referrals from other known experts. The sources originally contacted during our Tech Mod familiarization stage provided many initial contacts. Each interview subject was also asked to refer us to other possible interview candidates. (It should be noted that our referrals to experts went full circle; ultimately all references had either been interviewed or at least considered for interview. No new names surfaced. For this reason, we believe that virtually all experts in the Tech Mod arena were a part of our research pool).

Each prospective interviewee was initially contacted by telephone to determine their qualifications. If they met the established experience criteria, we then determined whether they had the time available and the willingness and interest to participate in the project. Next, interview appointments were scheduled with each qualified expert and a preliminary letter of introduction was forwarded (See Appendix A). This letter also served to briefly introduce the interview candidate to the subject and the specific focus of our research. The interviews were conducted either in person or by telephone. To preclude any potential bias, all interviewees were guaranteed anonymity of their responses. This anonymity, which we considered essential, was twofold in purpose. First, the interviewee was assured that he or she could speak freely about Tech Mod without later seeing their name associated with any specific opinions or comments in

this document. Secondly, anonymity of remarks precluded undue influence of the opinions of one or more respondents on the opinions of other respondents.

An interview response worksheet and a logging/coding system internal to the project were developed to assist in cataloging of the interviews for the synthesis and analysis stages of the project.

The initial interview with each participant included a description of the scenario assumed for this project, a review of the three basic contracting strategies available for implementing a Tech Mod project at the subcontractor tier, and a thorough discussion of the advantages and disadvantages of each of the strategies from the perspective of the interviewee. We asked questions which served to focus the discussion on our subject, but interview subjects were given latitude to set their own priorities for discussion. This technique encouraged the introduction of new considerations by the interviewees. We assured that all issues were at least introduced for consideration by each interviewee. In addition, each interviewee was invited to submit by phone or mail any other ideas he or she might conceive after completion of the initial interview. Each interviewee also was requested to provide referrals as already discussed.

Upon completion of the initial interviews, the collected observations and opinions were synthesized. Our emphasis was on finding a broad consensus by all respondents.

We were also interested in finding any within-discipline or across-discipline concerns present.

In selected cases, interviewees were recontacted for clarification of initial responses or for a reaction to a particular point raised subsequent to the interview with that individual. At this point data collection was considered complete.

Method of Analysis and Presentation

In analyzing our data we used a matrix like that in Figure 2-1. The four broad disciplines we've identified were placed on the vertical axis and the government (or Air Force) and industry sources were on the horizontal axis. Our analysis in the next chapter will be guided by this matrix structure.

After all of our interviews were completed, we reviewed and discussed the comments of each interview subject on the advantages and disadvantages of each of the three strategies. We had prepared for our own use a separate matrix for each strategy, and on these we recorded, in very brief notes in the appropriate blocks, the positive and negative aspects suggested by our interviewees. For example, if an Air Force administrator had indicated in his or her interview that the traditional nature of Strategy #1 was an important "plus" for considering use of that procedure to apply Tech Mod to the subcontractor tier we would have

FIGURE 2-1
ANALYSIS MATRIX

	AIR FORCE	PRIME CONTRACTOR	SUB-CONTRACTOR	THIRD PARTY
ADMINISTRATION				
TECHNICAL				
PRICING				
LEGAL				

entered a comment to that effect on the Strategy #1 matrix in the administration row under the Air Force column. The additional blocks at the end of each row and column were used to record majority opinions within each discipline and source group.

These matrices, when completed, provided us with an important tool in our research. Through study of these grids we were able to perceive the advantages and disadvantages of each strategy as well as the sources of support for each strategy within our interview groups.

From these working matrices we were able to prepare the more general support charts and issue summaries which appear in Chapter 3. These are intended to serve to summarize in concise fashion the advantages and disadvantages and the sources of support for each of the contracting strategies.

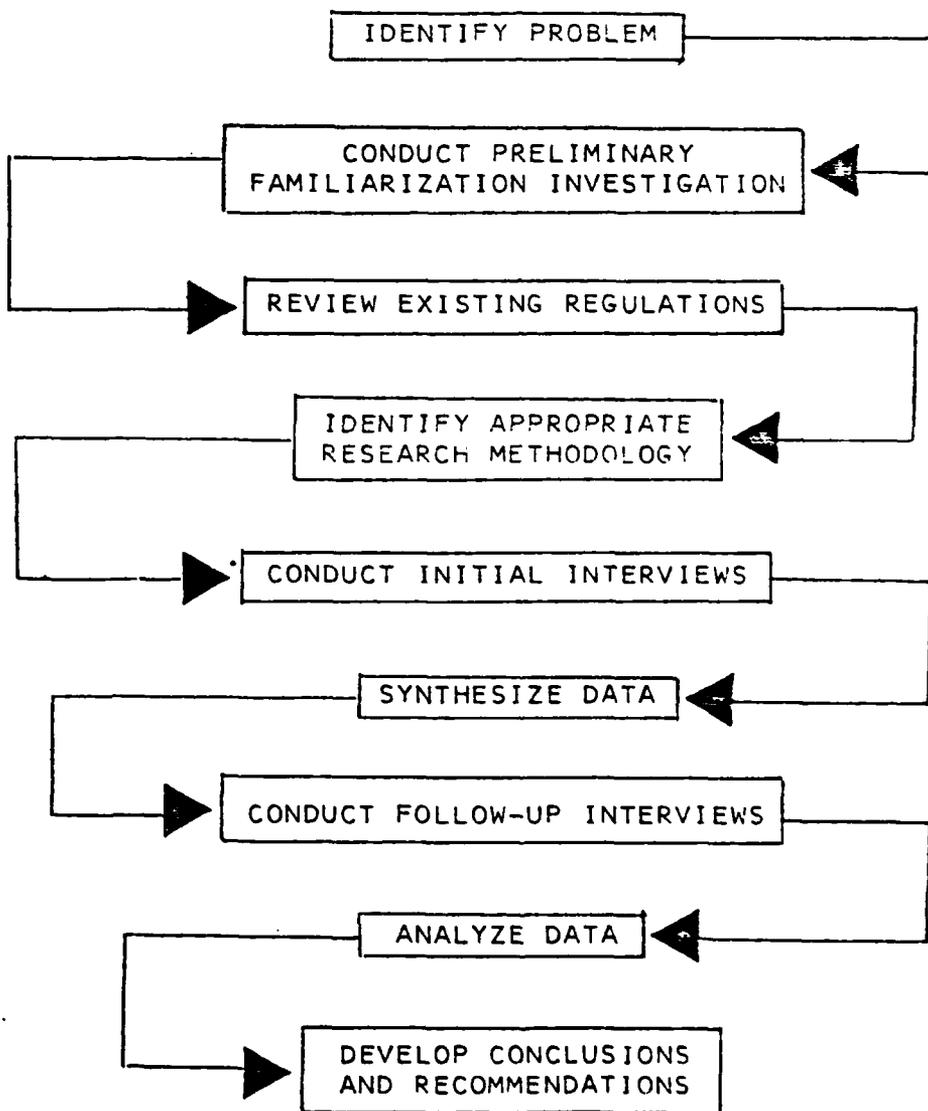
In Chapter 3 we will follow this advantage/disadvantage-support format in presenting our findings. For each of the strategies we will present:

1. a summary of those advantages and disadvantages raised most frequently by our interviewees
2. a discussion of these advantages and disadvantages with analysis
3. a discussion and analysis of the sources of support for each strategy.

Based upon our analysis, recommendations and conclusions were developed. These appear in the final chapter of this paper.

The research methodology applied in this project is summarized in Figure 2-2.

FIGURE 2-9
RESEARCH METHODOLOGY



CHAPTER 3

FINDINGS AND ANALYSIS

During the course of approximately forty-four interviews, several important considerations regarding the implementation of Tech Mod, though not directly concerning the focus of this paper, were raised. In Chapter 3, only the findings and analyses pertaining directly to the three contracting strategies for applying Tech Mod to the subcontractor tier under the conditions described in Chapter 1 will be detailed. These other considerations will be briefly considered in the succeeding chapter.

Our interviews were conducted over a period of seven weeks in June-July, 1982. The longest session lasted almost four hours; the shortest ended in about forty-five minutes. Several of the interviewees were contacted more than once, for clarification or elaboration of a previous response, or for a reaction to a point brought up in another interview. We were able to discuss the Tech Mod/subcontractor contracting strategies with a wide cross section of qualified sources representing both government and industry (prime contractors, subcontractors, and third party contractors) in each of the disciplines. All of our sources were either actively engaged or were anticipating active participation

in a Tech Mod program. Each of our subjects expected to become involved in some capacity in future efforts to apply Tech Mod to subcontractors. Based upon their experience and other qualifications, some of our interviewees were considered experts in more than one discipline. Figure 3-1 illustrates the cross-section composition of our pool of experts.

Discipline	Air Force	Prime Contractor	Sub-Contractor	Third Party Contractor
Administrative	16	3	4	3
Technical	5	2	3	3
Pricing	3	3	3	2
Legal	5	1	1	1
Total*	29	9	11	9

* Note that certain experts' qualifications placed them in more than a single discipline (See Appendix B and Appendix C).

Figure 3-1

Interviewees by Discipline

More than once during the course of our interviews we were reminded to some extent of the story of the seven blind men who came across an elephant. As you may remember, each of the blind men came in contact with a different

portion of the beast's anatomy, and, based on that limited contact, each perceived the entire animal very differently. The men who touched the leg believed the animal was very much like a tree, the man who found the tail decided an elephant resembled a rope, and so on. So it seems with Tech Mod. Possibly because development of the program is so recent and there is an overall absence, at this point, of regulations, guidance, and precedent, many of our interviewees perceptions of Tech Mod in general and application of Tech Mod to subcontractors in particular may have extended no further than their own contact with the program. In some of these cases, we felt, our questions and discussions had, for the first time, prompted the participant to consider issues, ideas, and implications beyond their limited experience. In several cases, however, our experts were unable to escape the influence of their current or former Tech Mod involvement. Most often in these few situations the consideration of advantages and disadvantages of the strategies became in reality a "sales pitch" for a particular approach. This problem was considered and allowance made in our analysis.

Presentation Format

In the following pages we will discuss in detail each of the contracting strategies under consideration. The method of presentation for this information was outlined in

Chapter 2. As indicated, each strategy discussion will be divided into two distinct though complementary sections. In the first section we will consider the issues connected with the use of the particular contracting strategy from an advantage/disadvantage perspective. Each of the initial sections for each strategy will be preceded by a summary of the advantages and disadvantages raised most frequently by our interviewees. The narratives that follow these introductory summaries flow from and elaborate upon them.

The second section within each strategy will focus on the sources of support and/or lack of support for the use of the strategy among our respondents. We have provided diagrams which summarize the support for each strategy at the beginning of each of these segments. The charts are provided to afford our readers a quick, easy overview only and we caution against interpreting the diagrams too literally. For example, a designation of "strong support" in one block of the matrix may not carry the same weight as the same designation in another block. This is because we have made no effort to assign any "quality" weights to the various experts we interviewed nor do we give any consideration to the number of experts interviewed in any particular discipline or source area.

It is also possible that the degree of support registered in one discipline under one source group may appear to contradict another designation for the same experts

under another strategy. This may indicate that the same interviewees supported the two different strategies to approximately the same degree but for different reasons. These cases will be apparent in the narrative explanations of the sources of support.

Strategy #1: Advantage/
Disadvantage Summary

Advantages Cited Most Frequently

1. Tradition. There is a long established precedent for dealing with the subcontractor tier by going through the prime contractor.
2. The report and data flow networks needed for Tech Mod efforts are already well established between subcontractors and primes.
3. Relatively few additional Air Force resources would be required.

Disadvantages Cited Most Frequently

1. Possible unwillingness on the part of some subcontractors to release sensitive data to their prime contractor customers.
2. Lack of incentives for the prime contractor to aid a subcontractor in reducing the cost base on which the prime contractor's profits are calculated.
3. The potential for "bonding" between prime and subcontractor; the creation of an unnatural alliance between the two entities fostered by Air Force Tech Mod funds.

Strategy #1: Discussion of
Issues

Under Strategy #1, the Air Force would implement Tech Mod at the subcontractor tier by going through a prime contractor. The anticipated relationship of the Air Force and prime contractor in this contracting strategy was probably best described by interviewee 17 AVFF, an Air Force policy expert, who saw the prime "administering" the program under Air Force overall "management".

In administering the program the prime would be expected to assist the subcontractor with the Phase I effort either in some direct capacity or by offering advice in securing the necessary outside technical assistance. The prime would review and analyze the candidate technologies/tasks to determine the most cost effective in terms of savings versus investment. Most of our respondents assumed that the ranked list would then be provided to Air Force managers for a final selection decision.

It is conceivable that the all important business deal could be negotiated by the prime with the final approval of the Air Force or negotiations could be directly between subcontractor and Air Force. In either event the real program savings for the Air Force will have to be addressed with the prime following the prime/subcontractor price negotiations.

For these administrative efforts the prime would probably receive a management fee and/or be permitted a

General and Administrative burden on those Tech Mod dollars passed through from the Air Force to the subcontractor(s).

The wide appeal of Strategy #1 can probably be attributed to the long-standing prime/subcontractor relationship which could accept Tech Mod as simply another element. In theory at least, the prime contractor is accustomed to managing the subcontractors and the subcontractors to being managed. The networks for flow of data and decisions between the parties exist and Tech Mod would simply require some additional information from the subcontractor, a bit more review and administration by the prime, and some concluding documents to bind the parties and involve the Air Force in the appropriate capacity.

On the surface the existant prime/subcontractor relationship is a definite "plus" for Strategy #1. Many of our respondents, however, questioned the willingness of some subcontractors to engage in a Tech Mod program with their prime. The focus of this concern was the great depth of detail necessary in the subcontractor data submissions. We were repeatedly reminded of how intimate a look into the subcontractor's operation was necessary to properly assure implementation of a successful Tech Mod program. Long-range plans, business goals, and strategies often have to be divulged for analysis.

Our respondents often pointed out that whenever a subcontractor was, or could be a competitor to the prime in

another arena or on some other program, the subcontractor would be extremely reluctant or absolutely unwilling to provide the necessary data, and most certainly not in the detail required. Similarly, one subcontractor, said he couldn't imagine providing the prime additional data, beyond what was already required under the original contract, which could be used by the prime as ammunition in any future negotiations.

Based on the responses to our interviews, Strategy #1 can presently boast an apparent success story of sorts in the General Dynamics F-16 experience. General Dynamics handling of their subcontractor's Tech Mod efforts has evidently been quite diligent and extensive. General Dynamics of course is the prime contractor in the very first application of the Air Force Technology Modernization concept. This fact prompted several respondents who were either connected with or familiar with the General Dynamics situation to indicate that Strategy #1 could only be effectively handled by a prime who had first-hand Tech Mod experience in its own facilities. These interviewees considered the experience gained as a participant in Tech Mod essential to the efficient application of the program to the subcontractor tier. Without this "good experience" they pointed out it may be difficult to offset in the prime's view, the anticipated reduction in the cost base and hence overall profit. The complexities of Tech Mod at this stage in its history

would make exceptionally difficult the effective and efficient administration of a subcontractor Tech Mod program by any prime contractor that does not have a Tech Mod program of its own.

In the same vein, a small number of our experts wondered what rewards would be required to insure the wholehearted support and involvement of a prime contractor under Strategy #1. At the minimum, they suggested it would be necessary to cover the actual costs which would be incurred by the prime contractor administering the Tech Mod program. Beyond that however, some sort of arrangement which would enable the prime to share in the savings, and which, as an offset to lost profits, would provide necessary incentives, appeared to be a good idea. Although this appeared to be an essential selling point in subcontractor Tech Mods involving substantial cost reductions, very few respondents addressed the issue and none of them were regarded as prime contractors.

Many of our interview subjects were convinced that it was just naturally to the advantage of prime contractors to strengthen their supplier base. These interviewees believed that a strong prime/subcontractor "team" helped assure a stable program. Lower costs, reduced delivery times and increased responsiveness to changes in production makes continuation and expansion of the program more likely, and possibly provides a competitive advantage for future

programs. Though this may in fact be the case many of our experts were concerned that the Air Force Tech Mod dollars in Strategy #1 would ultimately help the prime go somewhat beyond "strengthening" the team to actually creating a bond between the prime and subcontractor to the disadvantage of any of the sub's other customers. The subcontractor, they predicted, would be most responsive to whomever was holding the dollars and in Strategy #1 the Air Force would be helping a single prime exert additional control and influence over the subs.

We found this concern was greatest among those government experts furthest from any direct, hands-on Tech Mod experience. Those Air Force experts close to an operating Tech Mod program, particularly those individuals close to the F-16 Fighter program, believed that the prime's influence over subcontractors was already so great that the impact of the Tech Mod program would be negligible. Experts from the prime contractor community also believed the effect would be negligible but for an entirely different reason. They tended to believe that the diversity of most subcontractor's business was so great that no one prime contractor had sufficient leverage to "control" a sub. The independence of the subcontractors could not be affected by a Tech Mod effort.

It is a simple fact of business life that a firm responds differently to its better customers and a special relationship develops. Tech Mod dollars, particularly if a

major Tech Mod effort was involved, could certainly encourage this relationship. Given the nature of government contracting it seems unlikely that a particular prime contractor could realize a price advantage over the subcontractor's other customers because of this relationship. It could become a factor, however, in determining delivery priorities and perhaps in other more subtle ways. In a limited source situation where more than one aircraft system was dependent on the same subcontractor for critical components, one prime contractor could enjoy priority handling of his order. The implications are obvious. In situations where the delivery schedule of several major programs are tight, priority treatment by a critical subcontractor could salvage one program at the expense of the other.

Virtually all Air Force experts considered Strategy #1 a distinct advantage in limiting the use of government personnel resources required to operate a Tech Mod program for subcontractors. While agreeing that the Air Force pays substantially in some cases, they pointed out that it was inevitably easier to find the funds for a Strategy #1 approach than to have personnel dedicated to a Tech Mod effort by a program office or other concerned organization.

But more than one interviewee questioned exactly how much effort could really be avoided by the Air Force under Strategy #1. These respondents pointed out that the government would expect to make the final selection of projects, would want to review the projected costs versus anticipated

savings computations, and would want to be intimately involved in the ultimate negotiated business deal. In addition, in situations where a subcontractor would be reluctant to submit particularly sensitive data to the prime, this data may have to be provided directly to the government for evaluation. Considering that the Air Force would also want to monitor the general progress of the Tech Mod projects and would have to dedicate some resources to do these things, these respondents believe that the use of resource avoidance by the Air Force under Strategy #1 may be overplayed. Strategy #2 which calls for direct Air Force involvement will give additional consideration to this issue in upcoming portions of this chapter.

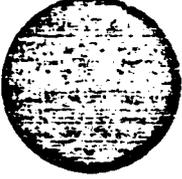
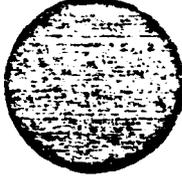
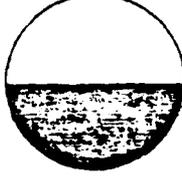
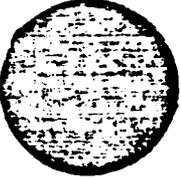
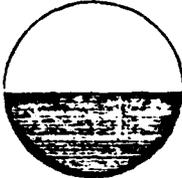
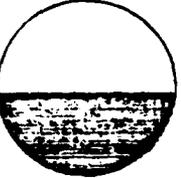
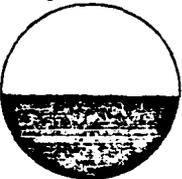
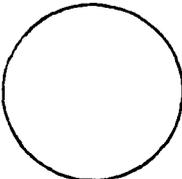
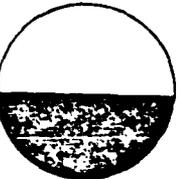
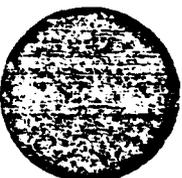
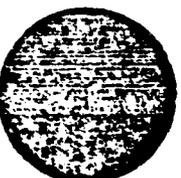
Strategy #1: Analysis of Support

Strategy #1 received broad support from our interviewees. Most Air Force sources, with the exception of several pricing experts, and most prime contractor sources believed Strategy #1 would be the preferred approach to applying Tech Mod to the subcontractor tier. (See Figure 3-2).

Air Force. Perhaps the greatest argument that can be cited for the generally favorable attitude of our Air Force interviewees for Strategy #1 is "tradition". The government's long standing access to subcontractors is via the prime contractors. Thus, Strategy #1 is familiar and comfortable. Approaching Tech Mod in the same fashion just "seems right".

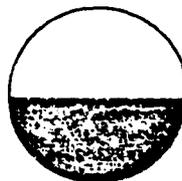
FIGURE 3-2

STRATEGY #1: SUMMARY OF SUPPORT

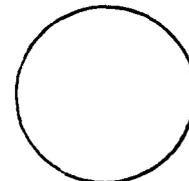
	AIR FORCE	PRIME CONTRACTOR	SUP-CONTRACTOR	THIRD PARTY
ADMINISTRATION				
TECHNICAL				
PRICING				
LEGAL				



STRONG
SUPPORT



MODERATE
SUPPORT



LIMITED
SUPPORT

Tied to that argument are two corollaries; Strategy #2 would require additional resources not easily obtainable and Strategy #3 would break new ground, perhaps with difficulty. Strategy #1 was seen as requiring no new resources since the "prime contractor would be carrying most of the work load." With the introduction of the third-party, and the resultant contractual paperwork, there would be an increased drain on Air Force resources though perhaps not as great a drain as with Strategy #2.

Those respondents from the Air Force administrative discipline also pointed to the prime contractor's "clout" with the subcontractors as a definite advantage under the first strategy. They believed the subcontractors are most responsive to their prime contractor customer and would be less so towards the Air Force as a third party.

Our Air Force technical discipline interviewees unanimously agreed that the prime contractor would be in a better position to gauge a subcontractor's proposed Tech Mod changes especially in regard to the impact those changes may have on the subcontractors item's form, fit, and function, than either the Air Force or a third-party.

In the Air Force legal discipline, respondents were most concerned about the potential for charges of Air Force "interference" in the subcontractor tier under Strategy #2 and #3. They opted almost unanimously for Strategy #1.

Air Force pricing people, as a group, cast the strongest dissenting votes against Strategy #1. They pointed

out that the government would have to pay the prime to provide the Tech Mod service and with the prime contractor's profits calculated on the cost base there would be little incentive on the part of the prime to reduce subcontractor costs. Then, too, our government pricing experts did not believe the Air Force would get as good a look at the subcontractor's finances, filtered through a prime, as by going directly to the subcontractor through Strategy #2. It is also interesting to note that our pricing respondents seldom raised the issue of the additional resources that would be required if Strategy #2 or even Strategy #3 were employed. We believe this was because the pricing people expected to be doing about the same degree of analysis and review regardless of the Tech Mod strategy employed. This would explain also why their prime concern was the quality of data received.

Prime Contractors. Most of our prime contractor respondents in all disciplines echoed the refrain of maintaining the traditional prime/sub relationship in any future Tech Mod efforts. They stressed the importance of fostering the "team attitude" that they believe is essential to the success of any major program. These interviewees also argued that the prime contractor is being paid by the Air Force to control and manage both the subcontractors and the program and it would not be reasonable to selectively transfer some control elsewhere and still expect the prime to properly manage the overall effort.

There were few dissenting opinions in any discipline of prime contractor respondents with a single exception. Recognizing that most, if not all, of our prime contractor interviewees were heavily influenced by the apparent success of the General Dynamics F-16 subcontractor Tech Mod program, a large majority of our respondents believed it was "very important" if not "essential" that any prime contractor involved in a Strategy #1 effort have already participated in their own Tech Mod with the Air Force. In the absence of such participation, some believed, some arguments could be made for a closer look at Strategy #2 or Strategy #3.

Subcontractors. Our subcontractors were less enthusiastic, across all disciplines about Strategy #1 than either the Air Force or prime contractor respondents. Virtually all recognized the traditional prime/subcontractor relationship and acknowledged, albeit somewhat reluctantly, that they could live with a Strategy #1 Tech Mod. But nearly all pointed out problems which could effect a successful Strategy #1 effort.

Respondents in all four subcontractor disciplines disliked releasing the data necessary for a Tech Mod to the prime contractor. In some cases this was because the subcontractor felt he was, or someday would be in competition with the prime contractor and release of this data would place them at a disadvantage. In other cases the subcontractor respondents suggested that they had spent many months,

sometimes years, establishing their cost lines with their prime contractor customer, and much of the data which would be forwarded under Tech Mod requirements could, at the least, provide new ammunition for the prime contractor to use in future negotiations with the subcontractor.

When we suggested, as a possible solution to this complaint, routing sensitive data directly to the Air Force, avoiding the prime entirely, most of our subcontractor objections seemed eased. Still, many thought such a system would be cumbersome and wondered just what role the prime contractor would play in such a situation that would justify a fee.

Several of our subcontractor administrative discipline interviewees also questioned what kind of guarantees of return on their investment they could expect from the prime under Strategy #1. Similarly they had little confidence that they would get a fair portion of shared savings through the prime contractor. Both of these thoughts tie in closely with a theme we heard from subcontractor respondents in all disciplines time after time, the "harshness" of a prime contractor's treatment of subcontractors. We generally interpreted these comments to mean they believed that a prime contractor was harder on subcontractors than the Air Force would be under similar conditions. It was not too surprising then when our subcontractor interviewees expressed only moderate support for Strategy #1.

Finally, there was one interesting idea from interviews with subcontractor technical discipline respondents. They were largely unenthusiastic about Strategy #1 when they put themselves in the role of a competitor to another subcontractor which had been a Strategy #1 Tech Mod participant. In such a situation they doubted the value of any technology transfer which might take place at project completion. Technology transfer, it should be remembered, is a requirement of all Tech Mod contracts where Air Force funding has been used in any of the phases. In technology transfer, the Tech Mod participant is expected to reveal through an open house and appropriate document distribution all the details of his modernization effort. The Air Force belief is that all other competing firms in that particular industry will be able to take the technology transfer information and apply it to their own operation. In theory, then, the actual Tech Mod participant's advantage over his competition would be one of time only. Most of the Air Force interviewees we spoke with placed substantial faith and confidence in the technology transfer process. However, few, if any, of the respondents from industry felt technology transfer, as it is presently set up, is worth much in helping a non-Tech Mod firm modernize. Just being told what changes were implemented is seldom sufficient, they pointed out, in helping a firm analyze and decide where they might be applied to his own facility. There is no substitute, they concluded, for being the actual participating firm in a Tech Mod effort.

Considering our subcontractor respondents' attitude about technology transfer in general, it is not difficult to understand how they rank the three strategies on this issue. As nonparticipants in a Tech Mod program, they believe their best chance at getting the necessary technical information from a participant will be if the Air Force is directly involved as in Strategy #2. Under Strategy #1 these interviewees did not think the prime contractor would be sufficiently incentivized to make the appropriate data available or to compel the subcontractor Tech Mod participant to provide the data. Requesting clarification or expansion of technology data through the Air Force under Strategy #1 would probably not be very fruitful, they feared, because the subcontractor involved would be insulated to some extent by the prime contractor. Then the Air Force would also have to go through the prime contractor for the requested information. Under Strategy #2, however the Air Force would be directly involved and our interviewees believed they would have a better chance of getting all the data they would need to take advantage of the new technology provided by the Tech Mod participant.

Third-Party Contractors. Our third-party or consultant interviewees generally supported Strategy #1 and maintenance of the prime contractor/subcontractor "team". To some extent their attitude towards Strategy #2 was almost equally favorable. Either Strategy was preferable over

Strategy #3, as we shall discuss later in greater detail. These respondents, it must be remembered, recognize they may still participate in either Strategy #1 or #2 Tech Mods in either Phase I or Phase II segments. Their interests are not particularly served better by either strategy and they were, not surprisingly, ambivalent about which approach might be better. The principal focus of the consultant interviewees we spoke with was in doing their jobs well. In order to do so they felt they would need the trust and confidence of the firm(s) they were attempting to service. Most respondents were sure they could build the necessary trusting relationships with subcontractor Tech Mod firms under Strategy #1 or #2 so long as they, the consultants, were contractually bound to the subcontractor/client only. Under such an arrangement, our consultant interviewees believed, subcontractors would be more willing to provide the data and other support needed to launch a Tech Mod effort. The consultant firm would be answerable only to the subcontractor client and all data analysis and recommendations would go directly back to the source. This same reasoning, as we shall see later, accounts for the overwhelming rejection of Strategy #3 by third-party consultant respondents.

Strategy #2: Advantage/Dis-
advantage Summary

Advantages Cited Most Frequently

1. Increased control over subcontractor Tech Mod program by Air Force.

2. Greater willingness by many subcontractors to release sensitive data to the government than to the prime contractor or a third party.

3. No need to pay the prime or a third party to administer the Tech Mod effort.

Disadvantages Cited Most Frequently

1. Legal liability which may result from Air Force "interference" with the prime contractor's subcontractors.

2. Inability of the Air Force to provide guarantees to subcontractors.

3. Increased demands on limited Air Force resources.

4. Need to involve the prime in any negotiations in order to realize savings on the production contract.

5. Lack of existing working relationship between the government and subcontractor network.

6. Subcontractors may use Tech Mod contract with the government to surface problems with the prime contractor on the product contract.

Strategy #2: Discussion of Issues

To implement a Tech Mod at the subcontractor tier under Strategy #2, the government would contract directly with subcontractors to the prime. This strategy, of course, requires that the government have the quantity and quality of administrative and technical resources to implement and operate Tech Mod projects. Under this strategy, the

government is directly responsible for solicitation and evaluation of proposals, final project selection, negotiation of the business deal, and all subsequent decision and approval requirements for each Tech Mod effort. The role of the prime contractor in this instance is one of coordination on facets of the subcontractor Tech Mod projects that might impact product configuration, price, or schedule, and, where possible, prime contract renegotiation.

Our research indicates that the most significant advantage perceived for Strategy #2 is the measure of control over the Tech Mod effort that the government would retain. Most interviewees felt that without either the prime or a third party involved, there was reduced chance of undesirable bias affecting the numerous decisions that are a part of all Tech Mod projects.

The most serious Strategy #2 deficiency raised by our respondents is over the issue of liability for the final product on the prime contract. The anticipated risk is that the government, by directly involving itself with the subcontractor(s) via Strategy #2, could be seen as "interfering" in the prime/sub relationship on the product contract. Under these circumstances, it is possible that the prime contractor, legitimately or not, may attempt to disavow liability as a result of government interference. None of the interviewees proposed a solution to this serious liability problem. Beyond the basic final product liability issue, there

are other possible consequences of Air Force interference at the subcontract tier. A modernization effort could involve brief plant shutdown which could, in turn, affect the prime contractor's delivery of the end item. It may be difficult, without some compensation, to convince a prime contractor to order and stock additional units from the subcontractor in anticipation of an "Air Force inspired" shutdown at the subcontractor's facility. The prime may not have available the storage facilities necessary to hold additional units, or to control and schedule them, and may be unwilling to alter his cash flow pattern by buying items before they are needed.

Even if the Air Force/subcontractor Tech Mod effort produced no noticeable delays or problems in production or delivery to the prime, several Air Force legal experts believed a prime contractor could relieve himself of some responsibility by simply arguing that he would not have selected that particular subcontractor had he known that the product was going to be manufactured in that fashion. This could effectively transfer ultimate responsibility for failure of the subcontractor product, or failure of the end system which might be attributable to the subcontractor product, to the Air Force. This is another very strong argument for heavy prime contractor involvement in any subcontractor Tech Mods through Strategy #2.

Many experts in both Air Force and industry wondered how Tech Mod through Strategy #2 could really succeed given

that the Air Force would be in no position to assure the subcontractor the future business necessary to justify the capital expenditures. When the Air Force develops a Tech Mod program with a prime contractor, the Air Force is able to say that, given necessary funding, purchases of the prime's product will continue. This is critical in calculations which go towards justifying the considerable investment necessary for Phase III implementation. But the Air Force can make no such promises to a subcontractor because the sub is dependent upon the prime contractor for business. The prime makes the decision on how much, if any, is to be purchased and from whom. The prime could decide to make a product in-house and end outside purchase completely if it were to his advantage on a particular program.

Once again the need to invoke the prime in a subcontractor Tech Mod under Strategy #2 appears obvious.

One possible solution to the potential problems of government interference would be to make the subcontractor product government furnished equipment. Certainly additional government resources would be required but the advantages, especially in the case of critical subsystems affecting several major programs, could easily outweigh the costs. Almost unanimously, our sources felt that the government does not currently have the personnel resources to implement and conduct subcontractor Tech Mod programs directly, either on a large scale by a single organization, or by any

of the existing program offices on an individual case basis. Many of the respondents completely dismissed Strategy #2 as a feasible approach for that reason. Our sources generally believed that the government could redirect and staff its contracting and technical organizations to the necessary levels if the rewards justified the costs. A sizeable number of our sources felt, though, that it would be unrealistic at this time to expect such redirection, given the many competing demands for the same limited resources. Disregarding whether or not adequate personnel resources are presently available, and whether or not they would be made available, Strategy #2 was seen to have definite advantages in a couple of areas over the other strategies. As mentioned above, the direct control over the projects retained by the government was seen as a positive factor. With this control the government could perhaps better balance overall plant modernization with anticipated instant program savings in realizing the stated objectives of the Tech Mod program. Another point of near unanimous agreement was on the issue of subcontractor release of sensitive data, such as that relating to long-range investment plans and technical processes. Tech Mod would require a sub to permit review of this type of information. The broad concensus was that subcontractors would be much less reluctant to divulge sensitive data to the government than to either a prime contractor or a third party contractor. The

subcontractor's potential reluctance to divulge this data to the prime has already been discussed. Most interviewees, particularly those experts on the industry side, believed the government has developed a reasonably good reputation of safeguarding proprietary data even in light of the Freedom of Information Act requirements. This reputation, most believed, would sufficiently alleviate the fears of subcontractors. Those few dissenters on this issue suggested that the Air Force may be unable to recognize the critical elements of the data, because of seldom having handled this sort of information in the past, and inadvertently release just enough of it to compromise the subcontractors competitive position.

Although it was acknowledged that in-house expenses would rise with the use of Strategy #2, our respondents considered the fact that a contractor management fee would not be paid an advantage of the Direct approach.

Beyond the apparent disadvantage of the present lack of personnel to carry out a Strategy #2 approach, there appear to be other potential difficulties with this contracting approach. For one thing, the government would still have to involve the prime contractor to a significant degree. The effect on program costs of improvements in subcontractors' efficiency could not be determined without discussions with the prime. Indeed, any savings the Air Force might realize on the instant contract could occur

only through negotiations, or renegotiations with the prime contractor. Most of our government respondents thought it highly unlikely that subcontractor savings dollar for dollar, would flow directly through the prime to the Air Force without notable reduction, especially in the absence of any contract clauses requiring savings flow-through. This could of course seriously hamper the Air Force/subcontractor analysis of modernization costs versus program savings and negotiation of a satisfactory business deal. The implied solution is that the prime contractor would have to be very involved in the subcontractor's Tech Mod program.

A number of our respondents, especially on the Air Force side, cited as a Strategy #2 disadvantage the fact that the government has no existing relationship, in most cases, with the subcontractor/vendor network likely to be targeted for Tech Mod projects. Certainly any relationship the Air Force does have at that level is not nearly as well developed as that of prime contractors. Thus, we might project a certain lack of clout on the part of the government under Strategy #2.

Another point raised in the course of our interviews was that subcontractors may attempt to surface problems from their production contract with the prime contractor directly with the government via the Tech Mod contract. Normally, of course, a subcontractor has no direct avenue of recourse to the government on problems involving its contract

with the prime. That subcontractor must resolve those problems directly with the prime contractor. Most respondents acknowledged that this might be a problem, but generally all felt that this could be handled relatively easily by the government administrator by properly divorcing product issues from Tech Mod issues.

Strategy #2: Analysis of Support

Strategy #2 was supported as an approach primarily by some Air Force and subcontractor interviewees (See Figure 3-3).

Air Force. Our Air Force administrative, technical and pricing respondents liked the direct approach because they felt that the government was in a better position to control the direction and the impact of Tech Mod projects if they were managed and administered by the government without the direct participation of the prime contractor or a third party contractor. Given that the Tech Mod program does have formal objectives -- to increase productivity, reduce costs, improve quality, improve reliability, conserve materials, and so on -- government respondents felt that by handling implementation of the subcontractor Tech Mods directly, the chances of straying from the course of the formal objectives or of emphasizing program savings, for instance, at the expense of other objectives would be minimized. Air Force pricing experts preferred Strategy #2 over the others because they felt they could do a better job of cost

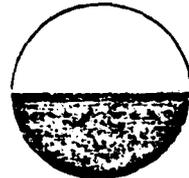
FIGURE 3-7

STRATEGY #2: SUMMARY OF SUPPORT

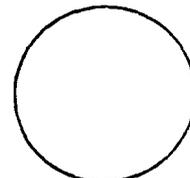
	AIR FORCE	PRIME CONTRACTOR	SUB-CONTRACTOR	THIRD PARTY
ADMINISTRATION				
TECHNICAL				
PRICING				
LEGAL				



STRONG SUPPORT



MODERATE SUPPORT



LIMITED SUPPORT

analysis by having direct access to the subcontractors' books, rather than having to rely on a prime or third-party type contractor for indirect access.

Legal experts for the Air Force as well as from the prime contractors, subcontractors, and third party contractors all agreed that direct government involvement with a subcontractor, as prescribed by Strategy #2, created the probability of liability questions arising on production contracts. That is, it could be expected that in situations where the government proceeds with Strategy #2, prime contractors may attempt to disavow liability for the end product based on government interference with their subcontractors. By adopting a Strategy #2 approach, according to these legal experts, the government may be assuming liability for the acceptability of the component delivered to the prime, or even of the end product of the prime contract. This same concern, as will be discussed later in this chapter, applies also to Strategy #3.

Prime Contractors. Prime contractor sources disliked Strategy #2 primarily because of the lost control such an arrangement implies. Some prime contractor respondents, administrative and legal, felt that additional effort might be required to monitor the results and analyze the implications of the contract(s) between the government and their subcontractors. They were certain that even though they weren't directly involved in the modernization effort of the sub's facility, they would undoubtedly be called on to at

least discuss the implications of the Tech Mod on the major system contract. Prime contractor legal opinions regarding the liability resulting from government "interference" has already been discussed above.

Subcontractors. The subcontractor interviewees, across all disciplines, were much stronger proponents of Strategy #2. The primary concern on the part of the subcontractors was over the issue of release of sensitive data to another contractor. As mentioned elsewhere, all subcontractor respondents preferred submitting data of this nature directly to the government. They felt that notwithstanding the possible impact of the Freedom of Information Act requirements, the government had established a solid reputation for safeguarding sensitive or proprietary data submitted by contractors.

In addition to the issue of data release, subcontractor interviewees preferred Strategy #2 over the others because under Strategy #2 they would have direct access to the government, and would not have to operate through a middle man. In this vein, several interviewees were able to relate unsatisfactory personal experiences of having to work on requirements inspired directly by the government, but without direct access to the government. As discussed above, subcontractors also felt the opportunity for the most fruitful transfer of technology would exist under Strategy #2. Cautions from the subcontractor legal respondents regarding

government interference with subcontractors has already been discussed.

Third Party Contractors. The third party contractors did not express a strong like or dislike for Strategy #2, but merely acknowledged some of the more obvious relevant considerations. The one exception was the universal legal opinion that government interference at the subcontractor tier portended liability problems on the prime contract.

Our respondents cited several disadvantages for Strategy #2. Overall, however, it was clear that the most serious concern was over the issue of the liability of the prime contractor when the government contracts directly with subcontractors for Tech Mod projects. All sources and all disciplines from both Air Force and industry felt that the government did not currently possess adequate resources to handle implementation of Tech Mod projects at the subtier directly. Air Force and subcontractor administrative and legal experts also pointed out the difficulty involved in guaranteeing a subcontractor a return on his investment, given that prime contractor source selection and purchases were largely beyond the control of the government.

Strategy #3: Advantage/Disadvantage
Summary

Advantages Cited Most Frequently

1. Relatively few additional Air Force resources would be required.

2. Availability of administrative and technical expertise which the Air Force could not otherwise furnish.

3. The prime contractor is denied the additional "leverage" on his subcontractors that the Tech Mod dollars might permit.

4. Subcontractors would be more forthcoming with sensitive data to third party contractors than to primes.

Disadvantages Cited Most Frequently

1. Legal liability which may result from Air Force-inspired third party interference with the prime contractor's subcontractors.

2. Inability of the third party contractor to provide guarantees to subcontractors.

3. Third party contractors lack the established relationship with the subcontractor network and therefore may lack standing necessary to elicit strong subcontractor dedication to the Tech Mod effort.

4. The Air Force and the prime contractor must still become involved in review of data and savings negotiations.

5. Strategy #3 awards would be difficult to compete.

6. Potential cost of employing third-party may be quite high.

Strategy #3: Discussion of Issues

To employ Strategy #3 the government would contract with an independent, third-party to implement and administer Tech Mod projects/contracts with subcontractors to government prime contractors. "Independent" in this context

suggests that the third-party contractor has no direct or indirect affiliation with the product contract. The third-party contractor would need to possess administrative, management, and technical capabilities consistent with the requirements of the Tech Mod contracts the government wishes to implement. During our original familiarization with Tech Mod we found that the role most often projected for a third-party contractor was as administrator on a Tech Mod program intended to impact an entire targeted industry or large segment of an industry. In our scenario, however, the role of the third-party contractor under Strategy #3 is one of implementing and managing all Tech Mod projects undertaken with subcontractors to a single prime on a major program. Under Strategy #3, the role of the prime contractor would be nearly identical to the role played in Strategy #2, except that in this case an additional participant, namely the third-party contractor, is introduced. The role of the government would be identical to the role played under Strategy #1, meaning the government would "manage" the project by retaining many of the essential approval and decision making functions, while the third-party contractor would basically "administer" the project(s).

The primary argument for employing Strategy #3 is the government's perceived lack of adequate administrative and technical resources to employ Strategy #2. Thus, it is not surprising that nearly all of the respondents saw

conserving government personnel resources as the major advantage of using Strategy #3. Beyond the idea of merely conserving government personnel resources, though, some interviewees saw Strategy #3 as an opportunity to introduce special expertise into the process of applying Tech Mod at the subcontractor tier. Not only would the government be contracting for the basic resources to do the job, but they would conceivably also obtain resources with capabilities beyond those of the government personnel or prime contractor personnel who might otherwise be doing the job.

The majority of our respondents agreed that by using Strategy #3, the Air Force would avoid any potential problems associated with allowing a prime contractor undue leverage or influence over subcontractors such as could occur in applying Tech Mod under Strategy #1. Another observation shared by most of those interviewed is that subcontractors, although more reluctant to release sensitive data to a third-party contractor than to the government, would still be more willing to bring sensitive data to an independent third-party than to a prime contractor, particularly in cases where the prime contractor and subcontractor are competitors.

The most serious deficiency with Strategy #3, it would appear as a result of our research, is that the issue of liability could be as serious a problem as it appears to be with Strategy #2. Again, our experts, and particularly

the legal experts, warn that prime contractors may attempt to disavow liability because of interference with their subcontractors instigated by the government.

Another problem with Strategy #3, as it similarly was for Strategy #2, is that the third-party contractor is not in a position to guarantee the subcontractor the future business necessary to justify significant capital expenditures. Because the subcontractor is entirely dependent for sales on regular customers, such as the prime contractors, and not on the third party or on the Air Force, Strategy #3 is seen by many as having a serious drawback with regard to the all-important business deal.

Another problem seen by many of the interviewees is that a third-party may have no established relationships with the subcontractors/vendors, nor do they have the influence that comes with being a major customer. As a result the third-party contractor may have difficulty getting "the attention of the subcontractor management". It is interesting to note that the clout of the prime in its relationship with its subcontractors is seen as both a positive and a negative factor.

By going through a third-party instead of going through the prime contractor, our sources generally believed, an important chance, to create or improve a working "team attitude" between the prime and sub would be bypassed.

Another drawback our interviewees associated with Strategy #3 is that both the prime contractor and the

government must still be heavily involved. The involvement of the government, as in the case of Strategy #1, would basically be to make final evaluations and decisions. This involvement obviously offsets some of the principal reasons for going to Strategy #3 in the first place, and in the minds of some of the respondents was a strong argument in favor of Strategy #2. One issue raised with all of the interviewees (none of them brought it up) was the potential problem of violation of Defense Acquisition Regulations prohibiting the contracting out of a government function - in this case, contracting. None of the sources felt this was a serious problem with Strategy #3 either because "it is always gotten around," or perhaps more legitimately because statements of work can be written to require more from the third-party contractor than the contracting (or subcontracting) function. These additional requirements, according to the interviewees, would be in the areas of special management performance and documentation, and technical consultation and evaluation skills.

Finally, two other negative considerations were surfaced in our interviews. First, many of the respondents felt that awards for Strategy #3 contracts may be difficult to compete, in that requiring organizations (the major program offices, presumably) may either have a tendency, or be forced by limited sources, to essentially tailor contract requirements for a Strategy #3 award to fit the profile of a

specific potential offeror. Secondly, our sources were generally of the opinion that using Strategy #3 would be very much more expensive because the third-party's incentive would be profit on the immediate contract, as opposed to the more general, long-term motivations of the prime contractor under Strategy #1.

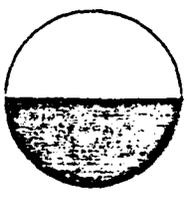
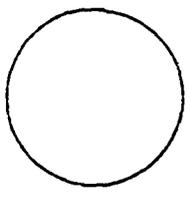
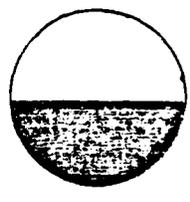
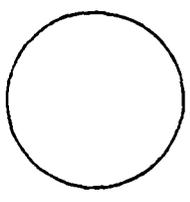
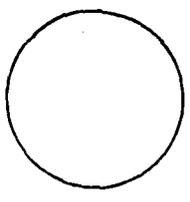
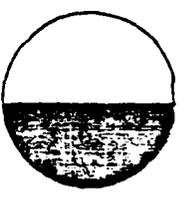
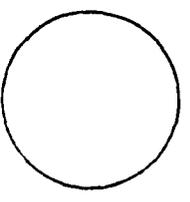
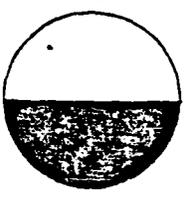
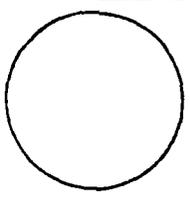
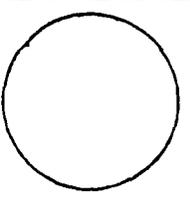
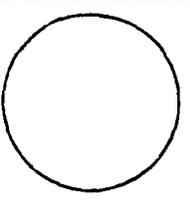
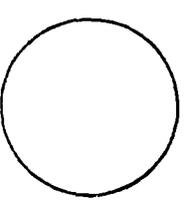
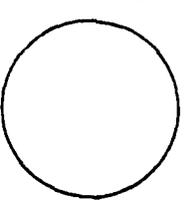
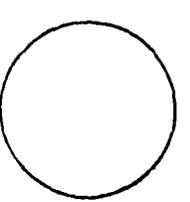
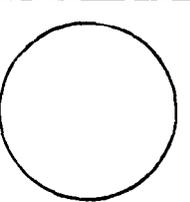
Strategy #3: Analysis of Support

Very little support was evidenced for Strategy #3 during the course of our research (See Figure 3-4). The majority of our interviewees, particularly the third-party contractors themselves that would presumably be involved, saw Strategy #3 as the least favorable alternative of the three strategies.

Air Force. Broadly speaking, the Air Force respondents were the only group to exhibit even moderate support for this approach. For these respondents, Strategy #3 was attractive for three reasons and all three had approximately the same weight. First Strategy #3 spared the Air Force the need to come up with the additional resources that a Strategy #2 would require. Secondly, the Air Force respondents felt that the third-party consultant firms they imagined as being Strategy #3 contractors would bring a higher level of expertise in both the Tech Mod program and production technology modernization in general than could be obtained in either Strategy #1 or #2. Finally, these interviewees looked to Strategy #3 as the best solution to the potential

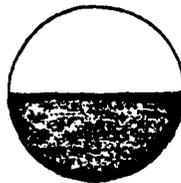
FIGURE 3-4

STRATEGY #3: SUMMARY OF SUPPORT

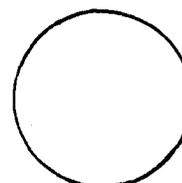
	AIR FORCE	PRIME CONTRACTOR	SUB-CONTRACTOR	THIRD PARTY
ADMINISTRATION				
TECHNICAL				
PRICING				
LEGAL				



STRONG SUPPORT



MODERATE SUPPORT



LIMITED SUPPORT

prime/subcontractor "bonding" problem which might occur under Strategy #1 and as the best way to apply Tech Mod to an entire industry simultaneously without a single participating prime contractor.

Some Air Force respondents disliked Strategy #3 primarily because of the cost which they perceived would be higher than might be paid to the prime contractor under Strategy #1. These interviewees were largely unsure how such a requirement could be properly competed and in the absence of competition felt that costs could be high. Air Force sources also saw the continued need to deal with the prime contractor as another factor limiting the success of Strategy #3. Regardless of how well a third-party may administer a Tech Mod program, the prime contractor participation may still be required if inspection or configuration changes are possible, and will certainly be required if program savings are going to be calculated and negotiated. All our interviewees expected some costs to be connected with the prime's involvement which would tend to increase the overall price of Strategy #3 even more.

Prime Contractors. Prime contractors contacted showed, perhaps not surprisingly, no support whatsoever for Strategy #3. The prime sources from all disciplines most often cited the notion that third-party types would not have the kind of clout with subcontractor management necessary to guarantee expeditious subcontractor response to Tech Mod requirements.

Subcontractors. Our subcontractor interviewees from the administrative and technical disciplines did see Strategy #3 in a somewhat more favorable light than Strategy #1 from a data release point of view for the reasons already discussed elsewhere. They also felt that the Strategy #3 contractor might be able to provide some special expertise to Tech Mod projects and that this was a positive factor.

One reason cited by administrative, pricing, and technical experts of the subcontractors for disliking Strategy #3 was that double sets of data and documentation might be required. Much of the material already submitted to the prime contractor would have to be updated and resubmitted to the third party for Tech Mod purposes such as calculation of savings on the business deal negotiations.

Third-Party Contractors. Somewhat surprisingly, none of the third-party type contractors we spoke to were very interested at all in filling that role as projected in Strategy #3. This was surprising in light of the fact that these sources were referred to us as potential "third-party" type contractors who had expressed some direct interest in participating in Air Force Tech Mod projects. Nevertheless, in each case the interviewees practically closed the door on their involvement as the prime contractor on a horizontal approach to implementing Tech Mod with subcontractors to government contracts. One reason cited was the preference to avoid the "headaches" of being a government prime contractor, meaning the extensive paperwork and contract requirements.

The third-party contractors we interviewed believed that they would be more effective in the role of advisor or consultant to the subcontractors, inasmuch as they were not customers, much less major customers of the subcontractor, meant that they would have little leverage in extracting data from a sub if they were in the role of the prime contractor in Strategy #3. As they described it, the subs would not be as willing or as fast to respond to them with proposals, data submittals, etc., as they would be to someone who was a major customer. Overall, however, the general opinion expressed by all third-party interviewees was that in the arena of Tech Mod they simply preferred the role of consultant to the party whose facility was to be modernized.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

Overview

In this chapter we will review briefly the methodology employed in our research, discuss our conclusions and make recommendations pertaining specifically to our research topic, and present some more general findings regarding Tech Mod as it currently exists with comments on possible future directions. We will conclude the chapter with our recommendations for future research in the Tech Mod and productivity arenas.

The most notable findings of our research are summarized in Figure 4-1.

Methodology

Our expert interview technique was adopted principally because we could find no other method or process for gathering data about the application of Tech Mod to the subcontractor tier. The dynamics of the contracting process and the relatively recent emergence of the productivity enhancement ideas in the Air Force all precluded a strict quantifiable technique. At no time during our study did any other research technique which could have been applied to our topic

- Strategy #1 is the overall best choice.
 - Potential legal problems with Strategies #2 and #3.
 - Prospective Third-Party contractors not interested in Strategy #3 role.
 - Significant government resources still required under Strategies #1 and #3.
 - Guarantees to subcontractors are a problem in any strategy, although less in Strategy #1.
- (See discussion for details)

Figure 4-1

Major Research Findings

emerge. If anything, we became more confident in the appropriateness of our approach as our research proceeded.

Of course our study and technique are subject to the same limitations as any other interview process. Some of our interviewees were very good; they were able to project possible future applications of Tech Mod by the three various strategies from their own experience. They came into our interviews with solid backgrounds in the contracting process and a good working knowledge of the Tech Mod program and its current form. These interviewees were able to imagine the advantages and disadvantages that might develop when one or another of the strategies is used.

Some of our interview subjects were less valuable to us. Probably the greatest failing we discovered in this regard was the inability of the interviewee to step beyond whatever Tech Mod experience he or she might have had to that point. In some cases these interview sessions consisted primarily of our attempting to get the interview subject to use their experience as a springboard towards conceptualizing the results of use of one or another of the strategies. Thus, some of our interviews were very valuable and others were not. Obviously it is possible that the better spokesmen were able to present more convincing arguments for or against a particular strategy and those arguments might have weighed more heavily in our final conclusions.

This possibility was offset to some extent by the sheer number of expert interviews conducted. As has been pointed out before, we either interviewed or considered for interview nearly everyone on the leading edge of the Tech Mod movement. Each of our interviewees was asked to provide other expert references and by the time we had conducted our last interview no new names were being suggested. Every likely candidate mentioned was already on our list.

Beyond the implications of our interview technique on the validity of our research, we believe that we were able to provide a real service in disseminating ideas throughout the Tech Mod community. In nearly all of our interviews we were able to introduce Tech Mod ideas and considerations

raised in other discussions that our interviewee had never thought about before. During one of these interviews we raised a critical point that had been suggested to us by a previous expert subject in passing. The implications for that particular expert were not very great, but when raised again by us in the later interview our interview subject was quite surprised. Conversation stopped while he considered the ramifications of the idea, and in the end that point became the major consideration in his selection of a particular strategy. This interviewee strongly recommended that some form of informative checklist regarding contracting for Tech Mod concerns, not presently available, was needed to assist contracting officers in its implementation.

Our guarantee of anonymity served its purpose well. In several cases respondents aggressively disagreed with other interviewees who in fact happened to be their supervisors. Likewise, field personnel were sometimes at odds with staff personnel and vice versa. This freedom of position might not have been possible in any other sort of environment. There were several instances where members of an organization whom we intended to interview wanted to have a round-table meeting on the subject of Tech Mod. We avoided such situations firmly. We believed that such a forum would provide one single Tech Mod position and inhibit, along the way, the free exchange of ideas.

If there is one aspect of our research and research methodology that is open to criticism it may well be the

backgrounds and personal experiences that we brought into the study. Both of us have extensive contracting and acquisition backgrounds and as a result tended to see each of the advantages and disadvantages of the three strategies in terms of contracting. We tried to avoid this slant as much as possible by interviewing many non-contracting personnel and attempting, whenever we could, to put ourselves in the position of someone from another discipline during our discussions. At the same time it cannot be denied that contracting is a very important consideration in Tech Mod applications and it is possible that our backgrounds actually helped our research effort rather than hindered it. That will be for our readers to decide.

Research Conclusions and Recommendations

As a result of our research, we are disposed support use of Strategy #1 in applying Tech Mod to the sub-contractor tier. This is not the result we anticipated when we began our research, but the weight of evidence and the preponderance of advantages to Strategy #1 noted by our respondents makes selection of Strategy #1 as "best" overall unavoidable.

In Chapter 3 we covered extensively the advantages and disadvantages of Strategy #1 and perhaps a review of these considerations as they apply to our selection of this particular strategy as "best" (or better than the other strategies) is in order.

It is impossible to ignore the importance of the traditional prime contractor/subcontractor relationship. The fundamental idea that one of the prime contractor's principal responsibilities is control and management of his subcontractors has guided government contracting for a long time. Though the Tech Mod and productivity enhancement programs are vital to the defense of the country, they are no less vital than the many production contracts currently in existence and hardly reason to alter this long standing relationship.

Subcontractor firms recognize the prime contractors to the Air Force as their true customers and are more likely to respond to a Tech Mod program administered by a valued customer than by the Air Force itself (as in Strategy #2) or by another third party (Strategy #3). Mere participation in the program is not sufficient to assure success. The Tech Mod targeted firm must aggressively pursue the effort and assign priority attention, and the best personnel available, to the modernization attempt. We believe that the prime contractor customer is in the best possible position to encourage the subcontractor Tech Mod participant to make the effort necessary.

Then there is the problem of realizing the savings from the subcontractor Tech Mod effort. Given the current funding procedures for Tech Mod where a program office will use its own funds to cover Phase I and portions of Phase II,

and the dim prospects for the Department of Defense to adopt a more liberal funding and candidate selection process (see our comments in the section on Other Considerations), it will continue to be extremely important to estimate savings which will accrue on current production contracts. If the production contract is fixed price with no reopeners of course there will be no reductions on that production effort, but in any event savings can only be negotiated with the prime contractor. Thus, it makes little sense to us to exclude the prime contractor from the subcontractor Tech Mod programs at their inception only to have to open negotiations with the prime later in the cycle.

We do offer some caveats in our support of Strategy #1 for application of Tech Mod to the subcontractor tier. First, we were not completely convinced by some of our respondents that subcontractors were sufficiently independent of their prime contractor customers that additional dollars from government Tech Mod programs would not or could not prompt some exceptional treatment by a sub towards a particular prime and vice versa. This idea of "bonding" which we have already discussed in greater detail in the previous chapter is troubling to us. We can visualize a situation where those subcontractors involved with a Tech Mod effort administered through a prime contractor develop a stronger alliance than they might have otherwise known. This might work to the exclusion of other competing subcontractors who

suddenly find that they have not only missed participating in the current production contract but are in effect frozen out of future contracts because of the relationship that now exists between their competitor and the prime, because they are not as efficient or effective as their modernized competitor, and because the prime contractor may have had to assure the competitor of a certain level of future business in order to permit the subcontractor a satisfactory return on his Tech Mod investment.

The potential harm from "bonding" requires that the Air Force closely monitor Tech Mod efforts handled through Strategy #1 to insure that the industry modernization effort does not end up putting the Air Force at a disadvantage in future contracting programs, and this may well be the result if the competitive base in some industries is lost.

Our second caveat concerns Air Force resources. There will be a strong temptation whenever Strategy #1 is employed for the Air Force to sit back and let the contractor do it all. The program office involved may look only at the expenditure of Air Force funds in Phase I and/or Phase II in deciding what level of staffing is necessary. Generally the Tech Mod effort will appear, under these circumstances, to be a very small part of the entire program and, as a result, could get little attention.

But it is the potential overall attainment of Tech Mod objectives that should really determine resource allocation and we believe that realizing these objectives will be

directly related to the effort expended by both prime contractor and Air Force in pursuing the program. The Air Force must not hesitate to apply whatever resources are necessary in order to assure success.

Many of the disadvantages of Strategy #1 discussed earlier can be corrected by judicious administration of the Tech Mod program by the Air Force. The Air Force may have to become directly involved in early data analysis if the subcontractors involved are reluctant to divulge this sensitive information to the prime contractor. Air Force participation is going to be required anyway in reviewing the projects identified for modernization efforts, and early involvement in data transfer and analysis will speed the reluctant subcontractors in providing the data and give the Air Force personnel involved a chance for a "head start" on their review process coming later.

The Air Force team will be involved again in negotiating or assisting the prime contractor in negotiating the all important business deal. Recognizing that this business deal is the lynchpin of the entire Tech Mod program, it is apparent that the Air Force must assign the necessary personnel resources to do a good job. In addition, it may be necessary at some point for the Air Force to participate in some fashion in making good the guarantee on return on investment that will compel the subcontractor to make the Phase III capital expenditures.

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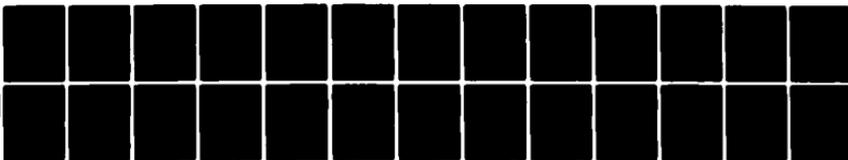
APPLICATION OF TECHNOLOGY MODERNIZATION TO THE
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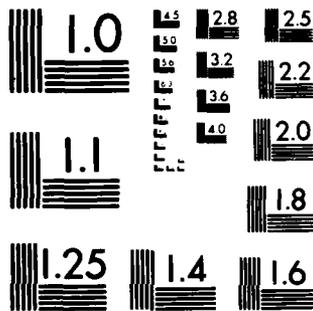
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The Air Force will also have to be on the alert for the possible "bonding" already discussed. This will require coordination with some organization assigned macro analysis of the defense industry. (See our recommendations in Other Considerations in this chapter.) The various program offices will also have to coordinate their efforts to insure that the competitive base of some industries is not being reduced as a result of strong Tech Mod bonds between certain prime contractors and certain subcontractors.

Effective operation of the Tech Mod program will clearly require not only the diligent efforts of the prime contractor but the close assistance of the Air Force team and that team should be afforded whatever resources are required to do the job.

And, finally, this warning about the application of Strategy #1 to subcontractor Tech Mod programs. We do think it preferable that the prime contractor involved already have administered a Tech Mod program of his own. With a successful program of his own already behind him, the prime will be in a much better position to appreciate the potential returns from Tech Mod and much more likely, it seems to us, to pursue a program with his subcontractors diligently. Many of the potential Tech Mod returns are long term and these may be difficult for a prime contractor who has not been a Tech Mod participant to visualize.

If the Air Force is compelled to pursue Strategy #1 with a prime contractor who has not been a Tech Mod

participant, it will require even closer scrutiny by the Air Force office. In such a situation, without the long term view, the prime contractor may see reductions in the cost of subcontractor items as nothing more than a reduction in his own cost base. Since Air Force contracts are usually negotiated in such a way that profit is calculated as a percentage of cost, a reduction in a subcontractor cost is going to be seen as a reduction in profit by the prime contractor not aware or fully cognizant of the long term benefits. Thus the Air Force will have to be even more diligent to insure that the prime contractor is administering the program properly and applying the necessary effort to assure success.

There are several ways around such a problem. If it is absolutely necessary to involve a prime contractor who is not a former Tech Mod participant, the Air Force may have to consider including the prime in the sharing of cost savings realized at the subcontract tier. In this way the prime may be incentivized to make additional efforts on the program with the subcontractors. A second possible solution to the problem would be to remove the critical Tech Mod subcontractor from the prime contractor's cost base completely by making the subcontractor items involved GFE. The prime contractor could still be employed to administer a Tech Mod effort with the subcontractor and in such circumstances a management fee would probably suffice to incentivize the prime contractor.

Strategies Not Selected

It is impossible to talk about Strategy #1 and why we selected it as best without talking about the other two possible strategies that were considered.

We did not select Strategy #2 even though some of our interviewees, particularly in Air Force/pricing, made it sound very attractive. The additional Air Force resources that would be required did not play a very big role in shaping our decision. We agreed with those interviewees who said that if the Air Force considered Tech Mod vital enough or important enough they would come up with the necessary resources.

We did not select Strategy #2 because of our fears of "interference" by the Air Force in the prime contractors' subcontractor tier. Every involvement by the government in a prime contractor's operations reduces to some extent the prime's responsibilities in pursuing the contract. While many of our interviewees, particularly those in the legal disciplines, saw interference in terms of potential court battles when delivery or quality or any one of several other factors began to slip and the prime contractor implicated the Air Force, we also saw something much more subtle.

Government involvement in prime contractor operations has increased steadily over the years. That involvement, we suspect, has tended to lessen the motivation of our

prime contractors. Every time the government steps in to hold the contractor's hand, the contractor's incentive to do without government involvement is reduced. Strategy #2 would involve the Air Force in the prime contractor's subcontractor operations and management and with the Air Force presence, failures, and the responsibility for those failures in the subcontractor/prime contractor interface would be that much harder to pinpoint. Even if the problems never ended up in the court room, the responsibilities we assign to the prime contractor in any government contract will have been diminished, and the strength and stand-alone ability of the industry reduced.

We did not select Strategy #3 for a more simple reason; many of the firms which were being touted as Strategy #3 third party participants wanted nothing to do with it. They did, of course, want to be involved in Tech Mod efforts, but the structure envisioned by Strategy # 3 did not interest them. We think that there may have been some miscommunication between the Air Force and the interested third parties as to exactly what role the third party firms might play in Tech Mod.

If it were to become necessary for the Air Force to modernize an entire industry segment, say the forging industry, it would be best if the Air Force assumed the role of the third party in Strategy #3 (if prime contractors capable of doing the job could not be found) and hired, or

had the subcontractors involved hire the third party firms for consultation and help in setting up the Tech Mod efforts. Close attention would have to be paid to the client relationship so many of the third party interviewees saw as critical to the success of their function and described by us in Chapter 3.

Other Considerations

As mentioned previously, several important considerations regarding the implementation of Tech Mod, though not directly concerning the focus of this paper, were raised during the course of our research. We will briefly address them here.

Long Run Impacts. The most serious of these considerations concerns the current methods for selection and funding of Tech Mod program participants. Because of the way these activities are presently handled there is a strong possibility that unintended and undesirable consequences may result from implementation of Tech Mods. A reduction to the competitive base of an industry and the introduction of additional capacity into an industry where there is already excess capacity are two of these undesirable effects.

There are several reasons for which a contractor may become a Tech Mod candidate. The government may be attempting to increase the productivity of a particular industrial sector, to reduce component lead-time, or to lower unit costs, among other possible reasons. However, without adequate

macro analysis and planning on the part of the government, a somewhat haphazard application of Tech Mod or application without due regard to the competition and excess capacity implications, can certainly be counterproductive, particularly in the long-run. This particular issue may very well be one of attaining short-run, obvious objectives, such as instant program savings, at the expense of incurring long-run negative consequences such as the decline of competition. It should be noted that with program offices currently providing much of the Phase I funding for Tech Mods and also managing the Tech Mod contracts, there appear to be strong incentives for that organization to opt for short-run objectives, perhaps at the expense of the Tech Mod program's long-run goals.

The threat to the competitiveness of an industry can be seen clearly. First of all, the government's documentation and demonstration requirements for technology transfer from a Tech Mod participant to other interested parties including the firm's competitors, although viewed by most as being of some definite value, is also seen as not being the equivalent of actually doing the Tech Mod and cannot be expected to place the non Tech Mod contractors on equal footing with the Tech Mod participant. Secondly, even if the technology transfer did significantly advance the know-how of the nonparticipating competitor contractors, there is no assurance that these contractors will be willing or able to make the required capital investments in the absence of a

guaranteed or probable return on investment or of other government incentives. There is also no assurance that competitive forces alone will be sufficient to motivate these contractors to keep pace, in terms of factory modernization, with the Tech Mod contractor. As a result, in future contract award situations--government and commercial--contractors who have modernized, either as a Tech Mod participant or on their own, will be at a distinct competitive advantage and more likely to receive the contract awards. Firms that fail to modernize may ultimately go out of business and competitive base of that industry will have been reduced. Conceivably, the reduction could lead ultimately to the Air Force having to deal on a sole source basis with the Tech Mod contractor alone and an elimination of the all advantageous pressures of competition.

Excess capacity in the defense industry has traditionally been accepted as a necessary evil, required to assure the capability of industry to rapidly respond to the increased demands of wartime. While the merits of this notion can be argued at length, there is clearly a point beyond which additional capacity could be counterproductive. One of the primary results of a factory modernization is often increased capacity. Again, without careful prior analysis of the overall impacts to an industry, and of the implications for the Department of Defense, there is a real danger of causing lingering damage, in the form of

lower productivity and higher costs, if the Tech Mod program is implemented.

Because of the possibility that counterproductive consequences may result from inadequately planned application of Tech Mod, we support the proposition that the Department of Defense take steps to assure that a comprehensive strategy for modernization of its industrial base be developed to address all possible implications of government assisted industrial modernization programs. We also believe that an impact statement should be required for each planned Tech Mod program. Only with this strategic approach and precautionary attitude can it be assured that unwanted and unforeseen final results will not be the end products of good intentions.

Guarantee Problems. Another important consideration raised during the course of our interviews concerned the subject of guarantees made to contractors as part of the Tech Mod business deal. Serious questions existed in the minds of several of our interviewees regarding just how solid of a guarantee the government was capable of making given the annual funding that most programs must live with. Guaranteeing to purchase a number of units, or protecting the contractor through a contingent liability guarantee is often seen as a violation of the Anti-deficiency Act. The act of providing the guarantee, even with the "contingent" description is seen as creating an actual obligation of

the government and this obligation is often unfunded. Notwithstanding proposed directives requiring that procuring activities plan cancellations and terminations to assure availability of adequate funds to cover liabilities created by the business deal, we tend to agree with those who see an anti-deficiency problem. Steps should be taken to address this problem. For instance, it might be advisable to provide multiyear funding for all programs that make or need such guarantees.

Also with respect to guarantees, it appears it will be necessary for the government to find a way to provide direct guarantees on Tech Mod business deals to subcontractors, because it is almost certain that adequate guarantees cannot be made by the prime contractors. One possible solution is to buy all components from Tech Mod subcontractors directly, to get into a position to provide a guarantee, and provide the component to the prime as government furnished equipment.

Savings Clause. A mandatory Tech Mod savings clause is another issue that merits some attention. An important return on the investments the government makes in funding Tech Mod efforts is the eventual lower unit costs achieved, not only on future contracts, but on the instant contract and on other current contracts as well. Whether these are savings to be realized on any current contracts of course depends on the required return on the Tech Mod contractor's

capital investment. With the possibility of more and more application of Tech Mods, it seems that the government ought to be in a position to reap as much return on its investment as possible. The Truth in Negotiations requirements provide an adequate assurance that savings on future contracts will be realized. However, in the absence of a reopener provision related to Tech Mod savings on current contracts, it is probable that significant savings owing to the Tech Mod investments might never be realized. To address this situation, we suggest that a clause requiring the pass thru of all savings resulting from implementation of a Tech Mod, save for those foregone as a part of the Tech Mod business deal, be passed back to the government. This clause, we would expect, would provide the authority for reopening of negotiations on existing contracts to achieve cost and price reductions owing to successful Tech Mods.

Regulations. The issue of regulations, directives, and policy guidelines concerning Tech Mod is quite interesting. Overwhelmingly, the people we talked to said that the current absence of Tech Mod regulations provided Tech Mod with its greatest asset -- flexibility. It was pointed out that the fact that there were so few established rules and procedures on the subject permitted and even encouraged the innovativeness and creativity so critical to working out a complicated Tech Mod program and particularly the business deal. On the other hand, opinions were expressed that the compensation

of a government contracting officer does not encourage or justify the "risk taking" that often goes hand-in-hand with being innovative. These sources felt that contracting officers and negotiators would only feel comfortable in working out Tech Mod arrangements if there were institutionalized procedures to fall back on. It was also pointed out that eventually contractors might insist on a rigid set of Tech Mod regulations, so that they would "know the rules of the game". We tend to agree that flexibility is critical to successful application of Tech Mod. Experience to date seems to indicate that government contracting officers will be innovative and creative in fashioning workable Tech Mod arrangements. Accordingly, to maintain the desirable flexibility, and permit the latitude, judgment, and discretion a contracting officer needs in a complicated situation, while at the same time providing some form and structure to the contracting aspects of Tech Mod, we suggest the following. A generally non-mandatory set of guidelines should be prepared and distributed which would provide an important frame of reference for those involved in Tech Mods, but would not bind them to a rigid set of rules and would not stifle, but would encourage innovativeness. Of course, it might be necessary that some Tech Mod aspects be strictly regulated, but we believe that the complexities inherent in making a program of this nature workable makes it important that strict regulations be held to the minimum.

Focal Point. Several of our interviewees, both in the Air Force and in industry, strongly recommended that a focal point for Tech Mod be established. The role most often envisioned for this focal point was to be the single point of contact within the Air Force capable of answering any and all questions, general and specific and from any source, relating to Technology Modernization. Aside from being the information clearinghouse for Tech Mod, many thought that this organization might also serve as the corporate Tech Mod headquarters for the Air Force, developing policy, analyzing alternative approaches to implementing Tech Mod, providing program offices with consultant-type assistance, and so forth. The newly created Aerospace Industrial Modernization (AIM) office, a part of the Air Force Systems Command and located at Wright-Patterson Air Force Base, OH, might be the organization to assume these functions and responsibilities.

Candidate Selection. One final consideration, which may seem to be a quite radical departure from the Tech Mod status quo, is worth mentioning. Given the fact that there are no unlimited funds available to modernize the entire industrial base of the Department of Defense, the funds that are available must certainly be spent in the way that best assures the desired results. Ideally, the Department of Defense should approach the issue of modernization of its industrial base at a macro level, rather than on an

industrial sector or program basis. Because a relative few contractors actually account for the most significant proportion of all of the Defense Department dollars awarded, and of all of the serious capacity and production problems, it can be logically argued that the Department of Defense should undertake a massive effort to modernize only those contractors in that category. Of course there would be considerable political difficulty and regulatory obstacles involved if this type of an approach were to be taken. However, if there really are serious negative national security implications linked directly and unmistakably to the decline in the productivity and general readiness of this industrial base, this strategically selective approach appears both sensible and justified. As sensible and justified as this approach may appear to be, undoubtedly it would be most controversial, because of its impact to contractors left out as well as several other reasons. Nevertheless, the importance of maintaining a healthy defense industrial base compels that this type of approach be given serious consideration by a research body fully qualified to analyze all of the implications and to report on the benefits and the costs that could be anticipated.

Recommendations for Further Research

Almost any new government program, and particularly one as complicated as the Technology Modernization program

appears to be, will pass through a period of trial and error before settling into an institutionalized pattern of format and procedure. The Tech Mod program is currently in that experimentation phase, and of course several questions have arisen that warrant in depth investigation. Our conversations with the individuals most knowledgeable in the area of Tech Mod lead us to recommend that the following issues be addressed in future research:

Long-Run Tech Mod Impacts. Analysis should be undertaken to determine the long-run impacts of Tech Mod to both competition and to capacity in the affected defense industries. This research is essential to enable the government to make fully informed decisions relative to the future selection and extent of individual Tech Mods.

Guarantees and Commitments. We recommend that the questions regarding the legality and the adequacy of government guarantees in Tech Mod business deals be thoroughly examined to provide definitive clarification of these issues. Also, analysis of a contractor's commitment to proceed with capital investments to implement the enabling technologies that were at least partially funded by the government should be considered as a part of this avenue of research.

Approach to Candidate Selection. Today, selection of candidates for Tech Mod participation is most often on a "by-program" basis, with instant program savings often the driving criterion for selection. Given that the primary

objective of the Tech Mod program is modernization of the industrial base, and not instant program savings, other candidate selection procedures need to be more fully explored. The implications of embarking on a strategy to modernize only those contractors who are a significant part of the Department of Defense business base, and those who are especially critical as a Defense contractor for one reason or another, should be examined. This research should attempt to determine both the monetary and the nonmonetary costs and benefits of this approach, and should also make an assessment of the feasibility of proceeding with such a program.

Training. The training needs of the personnel who are delegated the responsibility for implementing Tech Mod need to be determined. The exact methods for best fulfilling these training requirements should also be examined.

APPENDICES

APPENDIX A
INTRODUCTORY LETTER



DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (ATIC)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

REPLY TO
ATTN OF

M. Szczepanek/W. M. Thompson, (513) 836-1346

SUBJECT

Study of Application of Technology Modernization at Subcontract
Tier

TO

1. In connection with the Air Force Institute of Technology graduate logistics program, we are conducting research concerning contracting strategies for application of the Air Force Technology Modernization program (Tech Mod) at the subcontractor tier. As part of our research effort we are interviewing individuals whose background, experience, or current position may provide insights into potential contracting problems and possible solutions. We appreciate your willingness to participate in our study.

2. We are limiting our investigation to a hypothetical situation which involves a single major Air Force weapons system program in which there is a possibility of substantial savings through application of Tech Mod to the subcontractor level. We have identified three possible strategies to accomplish this. They are:

Strategy #1 ("Vertical"): The Government contracts with the program prime contractor who is responsible for implementing Tech Mod with subcontractors.

Strategy #2 ("Direct"): The Government contracts directly with the subcontractors to the prime.

Strategy #3 ("Horizontal"): The Government contracts with an independent third party who in turn is responsible for implementing Tech Mod with subcontractors to the prime.

3. Our interview will follow from these broad questions:

(a) Are you familiar with the Tech Mod program as it currently exists?

(b) Have you considered the problems which may be unique to application of the Tech Mod program at the subcontract tier?

(c) For the purposes of this study we have identified four broad disciplines or areas of expertise which would be involved in contracting for Tech Mod. They are legal, pricing, technical, and administrative. Which discipline(s) would your experience enable you to address in the interview?

(d) From your perspective, what are the advantages and disadvantages of each of the three contracting strategies?

(e) Are there other considerations which would, in your opinion, recommend one of the strategies over another?

4. For the purposes of our research it is important that we meet with you privately, if possible. We would appreciate referral to any additional sources you feel are qualified to contribute to this effort. We look forward to meeting you in the near future to discuss all the ramifications of the three strategies.

Sincerely,

MICHAEL SZCZEPANEK

W. M. THOMPSON

APPENDIX B
INTERVIEWEE CURRENT POSITION CHART

This chart shows the current position for each of our interviewees and whether they are employed by the Air Force or by an Air Force contractor.

<u>INTERVIEWEE (CODE NUMBER)</u>	<u>ORGANIZATION/CURRENT POSITION</u>
02 WRHE	Contractor Executive Officer
06 WADE	Contractor Contracts Manager
06 WAFE	Contractor Senior Engineer
06 ATGF	Air Force Program Manager
07 GACA	Contractor Contract Negotiator
07 MWKM	Contractor Attorney
13 ADPF	Air Force Administrator
13 AWIF	Air Force Administrative Staff
14 ABFF	Air Force Contracting Officer
14 ACDF	Air Force Acquisition Analyst
14 AGWF	Air Force Price Analyst
15 ARNF	Air Force Administrator
15 MABM	Contractor Contracts Manager
15 MBDM	Contractor Price Analyst
15 MGXM	Contractor Project Engineer
16 AMNF	Air Force Attorney
16 ARBF	Air Force Administrative Staff
16 CLTF	Contractor Executive Officer
17 ASBF	Air Force Contracting Officer
17 AVFF	Air Force Administrator
21 AGIF	Air Force Engineer
21 AJBF	Air Force Contracting Officer
22 ADXF	Air Force Contract Administrator
22 GPID	Contractor Program Manager
23 ACIF	Air Force Price Analyst
23 AMNF	Air Force Attorney
23 GFMD	Contractor Chief Negotiator
24 ADQF	Air Force Program Manager
24 AKFF	Air Force Administrator

INTERVIEWEE (CODE NUMBER)ORGANIZATION/CURRENT POSITION

24 ARNF	Air Force Attorney
25 ARLF	Air Force Contract Administrator
28 BWIA	Contractor Attorney
29 ADPF	Air Force Acquisition Analyst
29 AGTF	Air Force Acquisition Analyst
29 AJCF	Air Force Attorney
29 AMNF	Air Force Attorney
29 ASIF	Air Force Administrative Staff
29 TJHA	Contractor Executive Officer
29 TTXA	Contractor Chief Engineer
30 AMZL	Contractor Price Analyst
30 ARSF	Air Force Contracting Officer
30 CMAF	Contractor Senior Engineer
30 HMYA	Contractor Attorney
30 MMBM	Contractor Price Analyst

APPENDIX C
INTERVIEWEE DISCIPLINE CLASSIFICATION
CHART

This chart shows how the experts interviewed were classed by discipline and whether they were employed by the Air Force or by an Air Force contractor. Note that certain experts' qualifications placed them in more than a single discipline.

	AIR FORCE	PRIME CONTRACTOR	SUBCONTRACTOR	THIRD PARTY CONTRACTOR
Administrative	06 ATGF	15 MABM	02 WRHE	16 CLTF
	13 ADPF	23 GPID	06 WADE	28 BWIA
	13 AWIF	23 GTMD	06 WAFE	29 TJHA
	14 ACDF		07 GACA	
	14 ABFF			
	15 ARNF			
	16 ARBF			
	17 ASBF			
	21 AJBF			
	22 ADXF			
	24 AKFF			
	25 ARLF			
	29 ADPF			
	29 AGFT			
	29 ASIF			
	30 ARSF			
Technical	06 ATGF	15 MGXM	02 WRHE	16 CLTF
	13 ADPF	22 GPID	06 WAFE	29 TTXA
	17 AVFF		30 CMAF	29 TJHA
	21 AGIF			
	24 AOQF			

	AIR FORCE	PRIME CONTRACTOR	SUBCONTRACTOR	THIRD PARTY CONTRACTOR
Pricing	13 AWIF	15 MABM	07 GACA	16 CLTF
	14 AGWF	15 MBDM	30 AMZL	29 TJHA
	23 AMNF	22 GPID	30 MMBM	
Legal	16 AMNF	07 MWKM	30 HMYA	28 BWIA
	23 AMNF			
	24 ARNF			
	29 AMNF			
	29 AJCF			

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