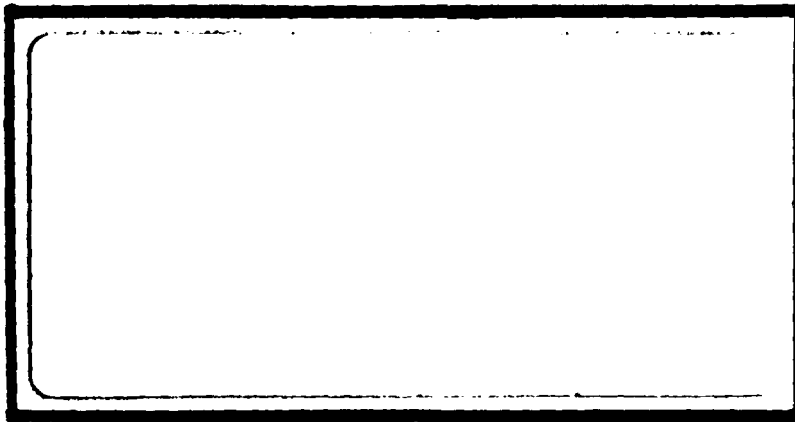


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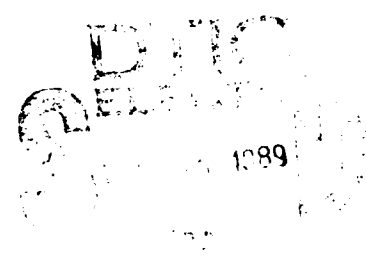
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INITIATION, ADOPTION, AND
IMPLEMENTATION OF ADMINISTRATIVE
INNOVATION IN THE AIR FORCE:
A CASE STUDY

THESIS

David E. Jacobs
GS-9, USAF

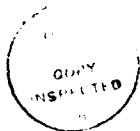
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AFIT/GLM/LSR/88S-38

INITIATION, ADOPTION, AND IMPLEMENTATION
OF
ADMINISTRATIVE INNOVATION IN THE AIR FORCE:
A CASE STUDY

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

David E. Jacobs, M.H.R.M.

GS-9, USAF

August 1988

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ABSTRACT

Department of Defense maintenance (DOD) budgets are expected to decline, while maintenance requirements are expected to rise. Innovation is one means of achieving the increased quality and productivity, necessary to meet DOD maintenance requirements in a decreased funding environment.

This research is a study of a recent Air Force innovation, QP4 - Quality for People, Process, Product and Performance. A case study approach was chosen.

QP4 was judged to be a successful innovation. QP4's success was due in part to the way that AFLC nurtures innovation. Factors that were found to be important to innovation within the Air Force setting include: the balance between administrative and technical innovation, the presence of boundary spanning activities, the presence of innovation champions, and advanced analysis of the existing organizational culture.

Since this was an exploratory study, there are several recommendations for future research. The recommendations for future research are: 1) development of a method for determining the success of innovations, 2) investigation of the role that feedback and control mechanisms have in the innovation process, 3) investigation of the effect of organizational culture on innovations, 4) further investigation of how AFLC encourages innovation, 5)

investigation of the role of innovation champions, and 6)
longitudinal studies of the process of innovation.

INITIATION, ADOPTION, AND IMPLEMENTATION
OF
ADMINISTRATIVE INNOVATION IN THE AIR FORCE:
A CASE STUDY

I. Introduction

This chapter contains a general background on innovation, why it is important to the Air Force, and basic information on the Aerospace Guidance and Metrology Center (AGMC), at Newark A.F.B., the organization on which this case study is based. The purpose of this study is explained, and the specific research objectives are stipulated. Finally, the scope and limitations of this research are stated.

Background

Department of Defense maintenance budgets probably will not rise, and might decline over the next few years. In contrast maintenance requirements can reasonably be expected to increase as new weapon systems become operational (27:52). This creates a disparity between resources and requirements that can be mitigated by squeezing higher productivity and better quality output from the resources that we have. One way of increasing productivity and quality is through innovation.

An innovation that is currently being disseminated throughout the Air Force Logistics Command (AFLC) is the QP4 - Quality for People, Process, Product and Performance

program. QP4 originated at AGMC. It is based on W. Edwards Deming's management philosophy of Statistical Process Control (SPC) (30:68). SPC is a concept and methodology that uses proven statistical analysis techniques to determine whether a repetitive activity is in a predictable or desired state, and to enhance the ability to manage the activity in that state once it is attained (34:1). QP4 involves changing the whole organizational philosophy to make continuous improvements in quality and productivity a way of life for everyone (32:24). QP4 also requires genuine participation from the workforce, and the willingness to respond to that participation on the part of management. This change in organizational culture is significant if not radical for a bureaucratic organization like the Air Force. This makes QP4 an innovative program.

Scope

Innovation Defined. Before outlining the scope of this thesis it is necessary to understand what is meant by the term innovation. Innovation has been defined several different ways (1:639; 7:195; 19:519; 9:676). For the purposes of this thesis, innovation is defined as a three phase process involving initiation, adoption, and implementation. Initiation is the introduction of an innovative (new) idea or proposal. Adoption refers to an organization embracing an innovative idea or proposal as a mandate for change. Implementation is realization of the innovation such that it becomes ingrained within organizational behaviors. The diffusion of the innovation

throughout the organization is considered to be part of the implementation phase (41:1422; 7:195).

There are three commonly recognized types of innovations: administrative, technological, and ancillary. The typeology utilizing the terms administrative, technological, and ancillary is based on the nature of the innovation. Beyond this, there are many ways of further categorizing these three types of innovations. For instance an administrative innovation can be classified as either high risk or low risk, or as an incremental innovation as opposed to a radical innovation (18:683; 12:1423). Administrative innovations change an organization's structure or its administrative processes. They are more remotely related to the basic work activity than technical innovations (26:692). "Technological innovations are those that bring change to organizations by introducing changes in the technology." Technology is commonly considered to be a tool, physical equipment, a technique, or any system in which employees or the organization extend capabilities (9:677). Ancillary is the term used to refer to organization-environment boundary spanning innovations. For example a marketing innovation depends not only on the organization, but on acceptance in the market for success, (9:677).

The definition chosen for innovation is complicated, but necessary to properly investigate the subject. No reliable theory of innovation within organizations has been developed despite a large amount of research on the subject. At least

one reason for the lack of a reliable theory is the failure to recognize innovation as a multi-phased process (9:675). Another reason for the lack of a reliable theory is the failure to distinguish between the various types of innovations (7:208-209). The various phases of the innovation process do not have identical attributes. Likewise, different types of innovation don't have the same attributes. Thus, differentiation between the various phases, and the different types of innovation is necessary to understand the process (9:676).

Subject of Research. The focus of this thesis is on all three phases of an administrative innovation, with QP4 as the subject. QP4 has been successfully initiated, adopted, and implemented at AGMC.

Success here indicates that the first two phases of the definition were achieved. The third phase is well underway. Furthermore, QP4 has improved both productivity and the level of quality at AGMC, which makes it a particularly valuable type of innovation for the Air Force at this time (38:72). Even though QP4 is currently being disseminated throughout AFLC it is too early to judge how successfully it will be diffused across the command, since dissemination began in January 1988. The diffusion is being accomplished through prototyping efforts at each of the Air Logistic Centers. Since QP4 is just beginning to be disseminated throughout AFLC, assessment diffusion will be limited.

Problem Statement

Given that QP4 is an example of a successful innovation, the QP4 program will be investigated to determine the conditions that made it possible. The objective of the investigation is to explore how innovation can be more effectively nurtured by the Air Force. This research effort will focus on lessons learned from the QP4 program for improving the process of initiating, adopting, and implementing, beneficial administrative innovations in the Air Force.

Specific Research Objectives

As stated in the previous section, the primary objective of this thesis is to improve the process of initiating, adopting, implementing, and diffusing beneficial innovations in the Air Force by investigating the QP4 program. The following specific research objectives were formulated to facilitate achievement of the primary objective:

1. Determine how successful QP4 has been as an innovation.
2. Determine the history of the QP4 program.
3. Determine what characteristics are associated with successful innovations in the literature. These can then be compared to the factors associated with the success of QP4.
- 3B. Determine what factors are associated with QP4.
4. Ascertain what strategy was used to introduce the concept behind QP4, to get QP4 adopted, and to implement QP4.

5. Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4 at AGMC.

6. Determine how the Air Force Logistics Command encourages innovation.

7. Determine what the major decision points have been in the QP4 program.

8. Determine how knowledge from the literature on the innovation process can be used to improve the Air Force's method of nurturing innovation.

Limitations

This study is exploratory. Despite a large amount of research on the general topic of innovation to date, the generalizability of this research to the Air Force is minimal. Most of the research has been conducted in very different types of organizations (1:635). Also, researchers have used different definitions of innovations. This has seriously limited the comparability of the research. For the reasons just mentioned, not much evidence has accumulated to support a theory of organizational processes which underlie innovation.

Exploratory research is oriented toward obtaining information that will be insightful, rather than obtaining a representative cross-section. Therefore due to the depth and complexity of the research, this thesis will center only on the QP4 program.

II. Literature Review

Overview

There are four overall goals for this chapter. First of all, a more in-depth examination of the topic of administrative innovations is provided. Second, a structure is provided which makes it possible to answer the first research objective: "Determine how successful QP4 has been as an innovation." Next, information will be presented to help answer the second and seventh research objectives. The second and seventh research objectives are: "Determine what characteristics are associated with successful innovations in the literature, These can then be compared to the factors associated with the success of QP4." and "Determine how the Air Force Logistics Command encourages innovation." Lastly, literature about the QP4 program will be examined, to help answer research objective two: "Determine the history of the QP4 program."

Measuring the Success of Innovations

When an innovation is said to be successful, the implication is that all three phases of the innovation process have been successfully completed. Moreover, if an innovation makes it to the implementation stage it can logically be assumed that the first two phases have been successfully completed. Thus, the focus when attempting to determine the overall success of an innovation should be on the implementation stage. However evaluating the success of

the implementation of an innovation is impossible without having some criteria in which to judge the success. The literature of innovation has largely overlooked the actual meaning of successful implementation.

Nevertheless, Goodman, et al. have developed a theoretical framework for assessing the success of implementation efforts (22:1-6). Basically, the framework evaluates the success of an innovation by determining to what degree an innovation has been institutionalized. This framework has four dimensions - knowledge, behavior, attitudes/evaluations, and normative/value consensus. Knowledge refers to degree of awareness on how to utilize the new technology or methodology. Behavior is concerned with the extent to which the new technology, or methodology is utilized. Attitudes/evaluations alludes to the degree to which different constituencies express favorable or negative attitudes toward the new technology or methodology. Lastly, Normative/value consensus is concerned with the degree to which organizational members use the new technology or methodology, because they believe that it is appropriate for the organization. This use of the new technology or methodology influences the attitudes and actions of other organizational members.

Another method of determining the success of an innovation is to measure the degree to which the objectives of the innovation have been achieved. Here again, objectives sometimes are not explicitly stated. With other innovations,

even explicitly stated objectives can only be measured in a subjective manner. Furthermore, this method of determining the success of an innovation takes a more narrow perspective, by not considering the issue of institutionalization.

Examination of Administrative Innovation

An extraordinarily large amount of empirical research has been conducted on the topic of innovation. Unfortunately, there is an enormous amount of variation in the findings. Factors that are found to be important in one study are found to be unimportant, or counter productive in another study. The most plausible explanation for the lack of cumulative research results is the lack of an integrative theory of innovation. In other words, future research designs and past research results need to be properly organized. Before an integrative theory can be developed, there must be more clarity on several conceptual issues (13:700).

One of the issues that must be clarified is the distinction between the types of innovation. There has been significant controversy in simply coming up with a definition for innovation. Innovation was defined as a three phase process earlier in this thesis. Beyond dividing the definition of innovation into phases, however, the typology of an innovation must be specified. The type of definition used depends to some degree on the purpose of the research. For instance, the purpose of the research might be to determine which organization is the leader in incorporating

new ideas or processes. On the other hand, the purpose could be to determine how new ideas or processes can be more effectively cultivated in an organization. Two elemental ways of viewing innovation depend on which of the research objectives, from the just given example, is applicable. Innovation is the introduction of something new to the focal organization. This definition is in opposition to another common definition which holds that in order to be considered to be an innovation the focal organization must be one of the first organizations to embrace the change.

Both definitions are valuable for understanding different aspects of innovation. However, "the introduction of something new to the focal organization," (1:632) is more applicable to this research because the purpose of this research is to determine how the Air Force can more effectively cultivate innovations. It is easy to see how research results would be confused if a distinction was not made between two preceding types of innovations.

Administrative vs. Technical Innovation. In the introduction of this paper it was declared that an administrative innovation would be the subject of this research. The distinction between administrative and technical innovations is the most common differentiation in the literature.

Administrative innovations are defined as those that occur in the social system of an organization. The system here refers to the relationships among people who interact to accomplish a particular goal or task. It also includes those rules, roles, procedures, and structures that are related to the communication and

exchange among people and between the environment and people (10:394).

Technical innovations are defined as:

... innovations resulting from the use of technology. They are defined as innovations that occur in the technical system of an organization and are directly related to the primary work activity of the organization (10:394).

The distinction between administrative and technical innovations is important for this research, because of the different paths that each follow from conception to adoption and implementation. Administrative innovations start at the top of the organization and trickle down. Where as, technical innovations start at the lower levels of the organization and work their way up. Experts in the technology of an organization will tend to be those working in the core technology of an organization, technicians, mechanics, foremen etc. These people are the technical experts who have the knowledge to determine whether a technical innovation will mesh with the current technology, and how to implement the innovation. Technical innovations proposed by administrators and others outside the technical core tend to be out of synchronization with the current technology, because of the lack of technical expertise that administrators possess. Conversely, upper level managers are the experts on organizational and administrative arrangements. They are in a position to see the big picture administratively. Moreover, they have the organizational power, access to communication channels, and control over resources necessary to adopt and implement administrative

innovations. Finally, top management positions are boundary spanning in that they have contact with other organizations and professional societies. This boundary spanning role serves as a gateway for new ideas, or potential innovations (7:195).

Although the administrative and technical innovations follow different paths from conception to approval and implementation, there does seem to be a relationship between the two. There is evidence that the adoption of administrative innovation facilitates the adoption of technical innovation. Administrative innovations often change an organization's climate, communication, human resource policies, and interdepartmental relations. Such changes often create more opportunities for the initiation and adoption of technical innovations (10:406).

Not only does there seem to be a relationship between administrative and technical innovation, but it appears that the relationship between the two must be balanced. For example, some U.S. manufacturing organizations have improved productivity and quality in response to international competition. They have done this by introducing employee involvement schemes such as labor-management quality teams and/or profit sharing plans (administrative innovation) along with computer-controlled manufacturing techniques and robots (technical innovation) (10:406). Neither innovation would be as effective at improving performance if implemented without

the other. However, when both types of innovation are evident there is a synergetic effect on performance.

The distinction between administrative and technical innovation is important. Understanding this distinction and the interrelationship is a crucial step that must be taken before innovation can be more effectively nurtured. Furthermore, making the distinction between innovation types is essential to the research process. Factors found to be important to the cultivation of technical innovations may be inversely important to administrative innovations.

Phases of Innovation. Just as with administrative vs. technical innovations, predictor variables found to be important to one phase of an innovation might not be important to another phase. For example, the results from different research efforts have found structural complexity to increase, to decrease, and to have no effect on innovation. However, later investigators who viewed innovation as a multi-phased process have argued that structural complexity and organic forms of organization promote proposals for change but may hinder the adoption and implementation of any one of these (1:633). Thus, innovation should be conceptualized as a multi-phased process. Each phase requires distinct behaviors from the organizational participants. Innovation is typically divided into three phases: 1) initiation of an innovative idea or proposal, this is the introduction of the concept; 2) adoption of an innovation as represented by an organizational mandate for

change; and 3) implementation is the realization of the innovation such that it becomes ingrained in the organization's behaviors (41:1422).

The importance of recognizing that innovation is a multi-phased process is pivotal to the research process. Without this recognition the contradictions in the research results will preclude the accumulation of a coherent body of knowledge on the subject of innovation.

Characteristics Associated with Successful Innovations

The limitations of past research findings become obvious when attempts are made to define the factors associated with successful innovation. As stated earlier, much of the research on innovation, particularly the early research, doesn't distinguish between the types of innovation or to what phase of innovation the characteristic is beneficial.

Even though a considerable amount of the research findings are contradictory, if the findings are carefully examined there is evidence of factors that are associated with successful administrative innovation. These factors are examined in the next few pages.

Organizational Size. The relationship of organizational size to the adoption of innovations is a controversial one.

Damanpour asserts that:

Although several researchers have argued that there is no evident relationship between size and the rate of adoption of innovations (Mohr, 1969; Utterback: 1974), most empirical studies have revealed that larger organizations adopt more innovations (Aiken & Hage, 1971; Kaluzny et al., 1974; Kim, 1980; Moch & Morse, 1977; Rosner, 1968). Moreover size has been found to be

positively related to adoption of both technological and administrative innovations (Kimberly & Evanisko, 1981; Zmud, 1984) (9:680).

Large organizations have more resources, or to put it another way more organizational slack, so that the potential loss due to unsuccessful innovations can more easily be tolerated. In addition, large organizations tend to have more diverse and complex facilities that evidently encourage the adoption of a larger number of innovations (9:680).

The relationship between organizational size and innovativeness seems to be curvilinear, at least for technical innovations. Ettlie's research shows that increasing organization size, if accompanied by an aggressive innovation policy, promotes technical innovation up to the point at which there are diminished returns (17:42). The reason for the diminishing returns is not explained. No studies were found which demonstrate, or attempt to demonstrate, a curvilinear relationship between organizational size and innovativeness.

Structural Complexity. There is an interrelationship between organizational size and structural complexity. As size increases the organization faces a series of demands for better coordination and control. The increased differentiation and structural complexity necessary to satisfy these demands produces specialists searching for new solutions to the task demands within their specializations. Hence, structural complexity is also related to innovativeness (3:175). More specifically, structural

complexity refers to the extent to which an organization is horizontally, and vertically differentiated, and role specialized. The structural characteristics of an organization may be placed on a continuum from small and simple to large and complex (1:634).

Aiken, Bacharach, and French go into more detail on how structural complexity is expected to promote proposals for innovations (1:636). The higher degree of specialization inherent in structurally complex organizations results in the identification of a wider range of problems. In addition, more diverse kinds of information, and a broader range of perspectives result in problem solving innovations. The diversity of interests can be expected to increase proposals for innovation as the various occupational groups, and departments seek to enhance or protect their relative position. Finally, structural complexity requires, or at least makes possible, the formal or informal assignment of special responsibilities for proposing organizational changes to particular functions or subunits. For instance, increasing vertical differentiation into a multi-level hierarchy may cause changes in the roles of some administrative personnel. They are encouraged or required to delegate some operational responsibilities and concern themselves with broader issues.

The results of Aiken, Bacharach, and French's research generally did not confirm their expectations concerning the relationship between structural complexity and

innovativeness. They conclude that more research is required (1:647-651). Furthermore, results from a study by Damanpour indicate that functional differentiation, and specialization (an indication of structural complexity) had a stronger positive effect on technical innovations than on administrative innovations. Even so, structural complexity was significantly correlated with administrative innovation (9:685). Thus it seems that there is a correlation between structural complexity and administrative innovation. However, the extent of this relationship will have to be validated by future research.

Formalization. A term which is similar in meaning to structural complexity is formalization. Where as structural complexity refers to the extent to which an organization is horizontally and vertically differentiated and role specialized. Formalization reflects the degree of functional differentiation (4:236). The term formalization is mentioned because of the frequency with which it appears in the literature on innovation.

Compatibility. The compatibility of an innovation to the adopting organization is often mentioned as a factor in explaining the success of innovation efforts. Compatibility is concerned with the innovation's organizational fit. It is also concerned with the innovations's impact on individuals' attitudes regarding change, convenience of change, power shifts, etc. Compatibility is generally positively correlated with the adoption of innovation (4:237). Research

by Zmud indicates that compatibility acts as a moderating factor between centralization and the adoption of innovation (41:1423-1424).

Centralization. The degree to which an organization is centralized is another facet of the structure of organizations that is correlated to innovativeness (41:1423-1424; 29:716). Centralization seems to affect the various phases and types of innovation differently. Decentralization disperses responsibility downward, broadening the perspectives and initiative of lower-level organizational members. Hence, it is logical to assume that decentralization will have the affect of increasing the number of innovations initiated, particularly technical innovations. However, decentralization could hinder the initiation of technical innovations for innovations that are incompatible with the interests of organizational members. Regardless of compatibility, centralization facilitates the initiation and adoption of administrative innovation by creating a dominant coalition of highly rationalized decision mechanisms. The effects of centralization on the initiation and adoption of innovation is further enhanced when a high degree of formalization is present. Kwon and Zmud confirmed that the literature on innovation generally supports this view of the role of centralization (4:236).

Collaboration. Collaboration between administrative and technical core employees on innovations is viewed as a means of reducing resistance to management's initiatives.

Collaboration engages core employees in the innovation process. When the level of professionalism is low in the technical core, collaboration is a realistic proposal strategy that administrators can use to increase the adoption of both technical and administrative innovations. However, if the technical core is highly professional a high degree of collaboration is not expected to be needed. Daft found that in school districts with a high degree of teacher professionalism (the technical core), that "teachers apparently see problems, want to solve them, know about innovations, and propose most innovations that are adopted in the district (7:203)." Conversely, Daft found that in school districts with a low level of professionalism, that administrators collaborate more with teachers in proposing administrative as well as technical innovations. Moreover, less professionalized districts had a higher rate of adoption for administrative innovations. A large amount of collaboration is essential during the implementation stage of an innovation, regardless of whether the technical core is highly professional (7:196).

Administrative, Technical Balance. In a similar vane, Damanpour and Evan's contend that a

balanced rate of adoption of administrative and technical innovations is more effective at helping organizations to maintain or improve their level of performance than either administrative or technical innovations alone (10:392)."

Damanpour and Evan use the example of replacing a card catalog system with a computer-based cataloging system in a

library. This technical innovation necessitates changes in the social system. Such changes as devising new procedures for cataloging library materials, and training the staff will be required in order to operate the new terminals. If the social system is not prepared it cannot adjust to the demands required by the change in the technical system. Thus, without the proper balance between the two systems, high performance cannot be achieved (10:396).

The technical system is spawned and controlled by the social system (10:397). Therefore, changes in the social system can be expected to have a greater impact on the technical system than vice-versa. Further, changes in the social system might have a larger impact on the total system by preparing it for suitable changes in the technical system. Damanpour and Evan's have data to support this contention. They conclude that the importance of administrative innovations in preparing organizations for technical changes is often under-appreciated. In particular, the importance of administrative innovations for institution building by creating new structural forms is frequently overlooked (10:406).

Boundary Spanning Activities. The structure of an organization itself can facilitate the innovation process by providing boundary spanning positions. Boundary spanning roles are one means for organizations to deal with the necessity of cross-boundary communication (37:587). One critical aspect of the innovation process is the ability of

the innovating unit to gather information from the external environment and transmit it internally.

Yet while information from external areas is crucial to the effective development and diffusion of innovation, substantial literature suggests that communication across organizational boundaries is both inefficient and prone to bias and distortion (37:587).

Aiken, Bacharach, and French present evidence that organizational members whose tasks require that they maintain greater contacts with outside groups do propose an inordinate proportion of administrative innovations. Contacts with the environment of the organization provide officials in boundary spanning positions with information about organizational problems and solutions (1:649). Tushman speculates that state of the art information is often needed to propose effective innovations. Therefore, officials in boundary spanning positions should place some priority on their contacts with universities, professional societies, and professional literature (37:592). Even lower level employees that are in boundary spanning positions propose an extraordinary share of the total number of innovations (1:649). The power of lower level employees in boundary spanning positions may be increased, because their superiors may perceive their contacts as important for coping with environmental uncertainties. This increased power can then be used for successfully proposing innovations (1:650).

Type of Communication. Ebadi and Utterback have conducted research to determine how the frequency of interorganizational communication, the centrality of the

innovation within the communication network, and the diversity of communication effects the success of technological innovation. They found that the frequency with which communication takes place had a more profound effect on the success of the innovation than either the centrality of the innovation in the communication, or the diversity of the communication. However, the position of a particular innovation within the communication network (centrality), and the diversity of the communication contacts were also positively correlated with successful innovations. Moreover, Ebadi and Utterback found some support for the proposition that the formality of the communication is negatively correlated with the success of the innovation (15:572-574).

Ebadi and Utterback's findings are probably not directly transferrable to the research by Fox and Morrison. However, Fox and Morrison's research tends to confirm the importance of frequent and diverse communication to the success of administrative innovation. More importantly, Fox and Morrison confirm the importance of informal communication. They point out that over the last decade researchers have found that effective managers spend most of their time interacting informally with peers, bosses, subordinates, and members of other organizations. This informal mode of communication seems to be important because formal systems and procedures for gathering sensitive information often fail to work quickly and accurately enough to be very useful. Furthermore, formal information systems don't work very well

at conveying threatening or easily misinterpreted information.

Reports of cost overruns or explanations of policies that affect the working conditions or security of employees... are likely to be received cynically if they seem mechanically broadcast--such as exhortations to work more productively (20:2).

Fox and Morrison claim that effective informal communication networks have five essential characteristics. First of all, there must be an exchange. Members must have a common interest. Second, members must establish and maintain trustworthiness. Any betrayal of trust moves quickly through a network, and may take years to repair. Third, there must be freedom from competition so that members feel free to share confidences and provide support. Fourth, members must take the opportunity to build personal relationships with other members. This is important so that other members don't have the perception that a particular member's interests are only self-centered or self-serving. Finally, there must be genuine sincerity among members. This is important for gaining support and cooperation (20:6-7).

Rate of Internal Verbal Communication. Further support for the importance of frequent communication to administrative innovations comes from the research of Aiken, Bacharach, and French. Their research results suggest that the rate of internal verbal communication is the most consistent and positive predictor of the innovation proposal rate from middle management. Internal verbal communication apparently provides information about problems and possible

solutions. That internal verbal communication is a strong predictor of the proposal rate by middle management, it is consistent with middle management's primary role as internal coordinators (1:649). Similar research by Evan and Black supports the importance of internal communication. They found that there is a positive correlation between the degree of communication between line and staff, and successful administrative innovation (19:526).

Managerial and Workforce Attitudes. Communication is an important tool for molding the attitudes of organization members. In turn, proper attitudes are important to the success of innovations. The importance of organization members attitudes seems almost self-evident. However, the importance of attitudes is often over looked during the innovation process. Zmud's research findings confirm the importance of attitudes to the innovation process. Zmud found that innovation success is strongly related to the existence of favorable management attitudes toward the innovation. His findings also show some support for the assertion that innovation success is positively related to the existence of a favorable receptivity toward change within the organizational membership as a whole. However, the effect of organizational receptivity toward change on innovation success is greater for technical innovations than for administrative innovations (40:735). These findings are compatible with the theory that administrative innovations are pushed from the top of an organization. Where as,

technical innovations are pulled from the lower echelons of the organization.

Level of Education. Another factor that most people would agree effects the attitudes of people is education. It is generally acknowledged that the level of education a person has effects the attitudes of that person. Several studies have found a positive correlation between education level and the initiation and/or adoption of innovations. It is thought that education increases receptivity toward change (4:234). Kimberly and Evanisko state that research has found that "the higher the level of education, the more receptive an individual has been found to be to innovation (26:696)."

Professionalism. Closely related to education is professionalism. Professionalism reflects the professional knowledge of organizational members, which requires both education and experience. As the professional level of an individual increases participation in professional activities, exposure to new ideas, and the desire for recognition from peers are also likely to increase. Thus, highly professional members tend to bring greater boundary-spanning activities, a sense of self-confidence, and commitment to moving beyond the status quo to the organization (9:679).

Damanpour, however, found that professionalism is more highly correlated with technical innovation than with administrative innovation (9:685). Even though professionalism might be more highly related to technical

innovation than to administrative innovation, Daft found strong links to administrative innovation. His findings led him to declare that within an organization either the technical core or the administrative core will be dominate. In other words, if the administrative core is dominate the organization will tend to have more administrative innovation. Moreover, Daft's results indicated that in school districts where there was a high degree of professionalism amongst the teachers (the technical core) that the technical core would be dominate. If there was an absence of professionalism in the technical core, the administrative core was dominate (9:206). It is currently unclear what effect the professionalism of administrators has upon innovation.

Administrative Intensity. Administrative intensity is not dependent upon the professionalism of administrators, but it does reflect the number of administrators. Also referred to as the managerial ratio, administrative intensity is an indicator of managerial overhead. The successful adoption of innovations depends to a great extent on the leadership, support, and coordination provided by managers. Additionally, administrative innovations originate from the management of an organization. Therefore, it is logical that administrative intensity be positively correlated with the initiation of all types of innovation, but more so with administrative innovation (9:679-680). Damanpour's research findings indicate that administrative intensity is indeed

positively correlated with all types of innovation. Further, administrative intensity is more highly correlated with administrative innovation than with technical innovation (9:682).

Innovation Champions. Van de Ven surmised that an innovative idea without a champion gets no where. According to Van de Ven people develop, carry, react to, and modify ideas. "People are connected to ideas over time through a social-political process of pushing and riding their ideas into good currency... (39:6)" Hence, it seems logical to assume that not only the ratio of managers is important to innovation, but also the degree of commitment to a particular innovation by an individual or champion.

Uncertainty. The relationship between uncertainty and administrative innovation is not very clear. There is, however, strong evidence that uncertainty has a positive effect on technical innovation. Uncertainty refers to the variability of an organization's environment, encompassing both instability and turbulence. It is believed that uncertainty stimulates innovation through an organizations' effort to survive and grow. There is a large body of evidence that shows positive correlation between uncertainty and technical innovation (4:240). However, there seems to have been a lack of research on the effect of uncertainty on administrative innovation. Therefore, the relationship between uncertainty and administrative innovation is still undefined.

Implementation Planning and Monitoring. Though no correlation has been found between implementation planning and monitoring, and successful innovations, it seems logical that implementation planning and monitoring would be beneficial. It would seem that some type of monitoring system would help keep the implementation plan on track. Although not much empirical research has been done on control strategies, Gray has developed a framework for implementation planning and monitoring innovations (8:43-44; 23:15). The following describes the framework:

First, the ranking of program components determines the relative importance of various aspects of the new program. Second, the evaluation is started during the implementation process, and long before any complete implementation is expected. Once started the evaluation is continually updated until all implementation falls into two different categories, fidelity and sufficiency. For fidelity the task is to assess what aspects of the innovation have been implemented, what have been dropped, and what have been altered. Sufficiency focuses on those parts which were altered to assess whether the alterations fulfill the function of the omitted part and therefore will support the goals of the innovation (23:11)

Advanced planning is required before the implementation is started. According to the framework the various components of the program are ranked in order of importance to the innovation. Later, in the implementation phase, the innovation is evaluated to determine if changes occurred to these components. This evaluation determines the fidelity of the innovation. The evaluation also focusses on determining whether those components which were altered or omitted fulfill the same function as originally intended. This is an evaluation of sufficiency. With such a framework innovators

can better determine whether the innovation is on track. If it is not on track, the framework allows innovators to more effectively take corrective action.

AFLC's Method of Innovation

AFLC encourages innovation in many ways. This review is aimed at providing insight into the formal programs that AFLC uses to promote innovation.

Policy Overview. Most of the programs that encourage innovation do so indirectly. The primary objective of these programs is to increase productivity, which is accomplished through innovation. More specifically AFLC has the goal of increasing productivity by 20 percent by 1992. The 20 percent goal was set by Executive Order 2552 (11:5). Not all of the productivity improvement programs encourage innovation. Nevertheless, most of the formal methods of encouraging innovation are productivity improvement programs. AFLC's policy is to encourage everyone to participate in the productivity improvement programs (11:3-7).

Specific Programs. The Productivity, Reliability, Availability and Maintainability Program (PRAM) and the Value Engineering program (VE) are designed "to fund the development/optimization, testing, and demonstration of original construction, a system, or a method (11:9)." PRAM funds projects intended to reduce current and potential operations and support costs without sacrificing effectiveness. Prototyping is used to eliminate normal programming and budget processing time.

VE seeks to analyze the functional requirements of systems, equipment, facilities, and operations. This analysis is aimed at providing these essential functions at the lowest total cost, while maintaining the needed performance, reliability, safety, quality, and maintainability. VE projects are initiated with a form that informs the local management of the expected time and resource expenditures. Headquarters, Air Force Logistics Command (HQ, AFLC), is responsible for final approval of projects. Approval is based on return on investment of funds, technical feasibility, nonmonetary impacts, and test development equipment not to exceed \$3,000 (11:9-10).

The Repair Technology Program (REPTECH) is oriented toward technological innovations. It aims at demonstrating the applicability of existing basic technology to the repair process. Moderate to high risk projects are chosen which result in major changes to the maintenance processes used at the ALCs. REPTECH is intended to provide solutions to depot maintenance technical problems. Only projects that utilize new technology, are technically feasible, and fill a technology void are funded. Funding is provided to purchase technology, not equipment (except demonstration equipment) or facilities (11:10).

The Industrial Maintenance Productivity through Accountability, Creativity, and Technology program (PACER IMPACT) was established to encourage maintenance people to get involved in productivity improvement. Groups from HQ,

AFLC, each ALC, AGMC, and AMARC have been established to explore, identify, develop, and implement productivity. The groups are divided into five areas: 1) technology enhancement, 2) material asset management, 3) environmental, 4) methods and process engineering, and 5) work force development and motivation (11:12).

PACER INNOVATE is the program AFLC developed to implement DOD's Model Installation Program management approach. The program is intended to push decision-making to the lowest organizational level, and to mitigate overregulation. Through PACER INNOVATE any idea that can be realized with available resources and does not violate security, safety, or legal directives may be tested to determine its potential value (11:13).

The Air Force suggestion program seeks to motivate people to submit inventions, and suggestions that increase efficiency, or effectiveness. In order to achieve these objectives the Suggestion Program has established formal channels of communication between management and rank and file workers. Cash, nonmonetary, and honorary awards are given for worthy suggestions (11:13).

QP4 Examined

Now that the literature on innovation has been reviewed, the innovation which is the subject of this study, QP4, is examined. The examination of QP4 is intended to provide a better understanding of the specific circumstances of this study. This understanding is necessary in order to fully

comprehend the analysis and conclusions of this study. An examination of QP4 is also needed in order to appreciate the drastic "cultural" changes that accompany some innovations.

QP4 is based on the concept of process management. Thus, the concept of process management is explained. The role that statistical process control plays in process management is evaluated. Next, the "cultural" changes that often accompany process management innovations are explored. Then, some of the benefits of process management are reviewed. Finally, the structure of QP4 at AGMC is presented.

The Concept of Process Management. Before the notion of process management can be understood the concept of process must be defined. Harrington defines process as: "A series of activities that takes an input, adds value to it, and produces an output (application of skills adding value to an input) (24:137)." Another definition of the term process comes from Thompson: "the whole combination of people, equipment, input materials, methods and environment that work together to produce an output (35:619)." Process management involves the conscience and continuous management of all the processes within an organization. The goal of process management is to continually improve the processes of the organization, and thereby improve quality and productivity. In order to accomplish the goal of continuous improvement, process management relies on the participation of the workforce and statistical measurements.

To provide further insight into processes some observations that Kane has made about IBM's processes that involve people will be presented (25:1). First, processes involving people adapt over time, when they are left unregulated. However, they adapt for comfort rather than competitiveness, because the individuals that work in these processes seek self-control in place of environmental control. Second, everyone in an organization works within a process, and someone should be responsible for each process. Lastly, the elements that the process manager controls are information, people, materials, and techniques. These elements are applied with a great amount of variability. There is no one correct way to organize these elements. However, there are good process management principles which we can derive.

According to Kane, the principles of process management are directed toward allowing the process manager to make resources productive. These principles are aimed at gaining knowledge of the work activity, and performing analysis aimed at: 1) determining specifically how input becomes output, how the value is added; 2) determining how defects are caused; 3) determining how defects are removed; 4) determining how well the output conforms to existing requirements; 5) procedural simplification and improvement of process efficiency; and 6) changes necessary to meet future requirements (25:2).

Deming's Philosophy. Many process management or process improvement programs, including QP4, are based on the

philosophy of W. Edwards Deming. Deming's philosophy emphasizes constancy of purpose. In other words it is management's responsibility to provide a consistency and continuity of purpose for the organization, and to seek ever more efficient ways of achieving that purpose. Deming believes that making a profit is necessary for organizational survival, but that profit should never be considered the main purpose of the organization. Instead, the purpose should be to provide the best and least costly transportation system for customers, or to build the computer that best meets customers needs for the least cost, or too provide the highest quality of maintenance for the least cost (36:4).

The best way to understand Deming's philosophy is to examine his "14 points" (refer to Appendix A). While Deming's "14 points" outlines the Deming philosophy, the Deming circle provides a structure for focussing on defect correction and defect prevention (refer to Figure 1.). The circle symbolizes a problem analysis and quality improvement cycle. Baker and Artinian describe Windsor Export Supply's four step adaption of the Deming circle. The four steps of the circle for their team effort were:

Step 1. The team decides what could be its most important accomplishments; what changes (within its control) are desirable. It determines what data are available to guide the change and whether new observations are needed. If so a process or test is planned. The team also decides how the observations will be used.

Step 2. The team looks for existing data that could answer the question raised in step 1; if existing data can't answer that question, the change or test is executed, preferably on a small scale.

Step 3. The effects of the change or test are observed.

Step 4. The results are studied to answer the question: what did we learn (2:61).

Statistical Process Control. QP4, as well as other process management programs rely heavily on the use of statistics. As indicated by Deming's "14 points", his philosophy involves the extensive use of statistics. QP4, as well as other process management programs rely heavily on the use of statistics. Statistical process control (SPC) is a term used to describe the use of statistics to control process variation. The concept is not new. Statistical techniques were widely used by the United States during World War II. However, after the war the use of statistics decreased dramatically in the United States. The encroachment of Japanese industry has caused a resurgence in the use of statistical techniques in the United States (36:2-6). Butler and Bryce define SPC as: "the application of

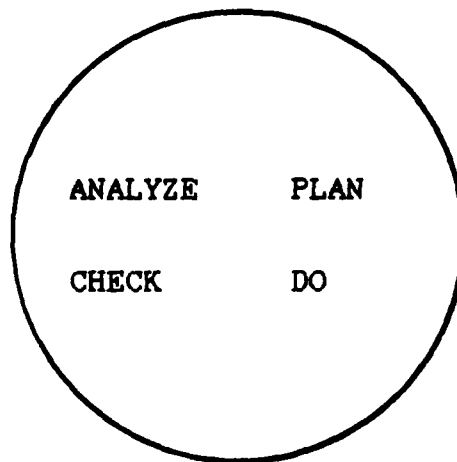


Figure 1. The Deming Circle

appropriate statistical tools to processes for continuous improvement in quality of product and services and productivity in the workforce (6:42)." A similar definition is offered by Thompson:

the use of statistical methods such as control charts to analyze a process or its output over time so as to take appropriate action(s) to achieve and maintain a state of stability/predictability and to improve the capability of the process (35:619).

The reasoning behind SPC is that by determining the variability of actual process, as opposed to what we think it is, we can often make immediate improvements. Conversely, if we don't know what the variability of the process is, we can't improve it (6:44).

Preston, St John, and Smith claim that to maximize the benefits of SPC, a participative management approach is required (31:437). They assert that this participative management approach is best exemplified by Deming's "14 points". SPC and the philosophy of process management are so interrelated that it does not make sense to apply one without the other. In fact, the philosophy of process management has effectively incorporated the principles of SPC into it. Moreover, when process management is implemented within an organization there is often radical cultural change that takes place (5:20-22).

Process Management and Cultural Change. Bushe defines culture as: "a set of shared meanings held by members of a group that effects their perceptions and interpretations of events and actions (5:20)." Culture gives specific meanings

to objects and abstract symbols. Culture allows for shared interpretations of actions. It also guides the behavior of members. One distinctive type of culture is organizational culture. Organizational culture refers to the phenomena where the shared meanings of members of an organization differ or expand upon those of society at large. Examples of organization cultures are banking culture, manufacturing culture, military culture, academic culture (5:22).

With innovations as encompassing as process management there is the possibility that the new method of doing things will clash with the normal existing methods. The normal way of approaching quality control in the United States tends to involve inspecting finished products at the end of the manufacturing or repair process to determine whether or not they are fit for use. The predominate culture here has advocated separate production and quality control functions, with each function having somewhat competing objectives. The causes of defects are not usually fully understood. This culture contrasts with the one which accompanies process management. Here, management encourages workers to statistically study the processes that they are a part of, so that they can determine the specific cause of defects. The workforce as a whole is responsible for improvements in quality and productivity. There isn't a separate quality control function that takes on the responsibility for quality (5:21). Considering the vast difference in the two cultures just described, it is not hard to understand why many

American manufacturers have had problems implementing SPC (5:22). Each organization should be examined to determine how an innovation will interact with its culture. With this information in hand, any cultural change that will be necessary can be planned instead of being allowed to just happen.

Benefits of Process Management. Process management, when implemented as intended by its leading advocates, has led to increases in both productivity and quality in numerous organizations (2:67; 25:10; 14:195; 21:617; 36:6). Preston, St. John, and Smith assert that the beneficial effects of process management on product quality and productivity are well documented. Process management programs at Windsor Export Supply, IBM, Westinghouse, General Tire, Ford, Nashua Corporation, and the Pontiac Division of General Motors have yielded improvements in both productivity and quality. These examples, although not all inclusive, demonstrate the beneficial effects that process management has had in both white and blue collar settings. Moreover, these are examples of American organizations, demonstrating that process management can be beneficial in American organizations. However, there are cases where culture has been an obstacle to implementing process management in American organizations (5:22).

QP4 at AGMC. QP4 started out at Newark A.F.B., in a 1986 pilot, under the name of QPI. The purpose of the pilot was to determine whether process management could be

successfully implemented within the Department of Defense (DOD). The success of the pilot convinced HQ, AFLC to use this pilot as a 90-day prototype for the entire command, in September of 1987. QP4 incorporates the principles of participative management with SPC. In other words QP4 is an application of process management, based on the philosophy of W. Edwards Deming. There is no evidence that process management had been successfully applied to any DOD organization, or to any repair facility (38:1). That this is the first application of this methodology to a repair facility, in government or private industry, and the first application to any DOD organization, confirms that QP4 is truly a legitimate innovation.

The Organization Structure at AGMC. The innovation structure will be explained using AGMC's QP4 program as an example. QP4 was designed to have an organization structure that paralleled the existing structure. To this end, the organization structure developed for QP4 contained three levels, the Executive Group, the Steering Committee and the various QP4 teams (38:33).

Executive Group. The Executive Group meets monthly, and consists of AGMC's top management, including the center commander and all of the directorate level managers. The Executive Group's role is to legitimize QP4 by accomplishing several objectives. Objectives include guiding, supporting, listening to, resolving conflicts,

setting priorities, and providing resources on matters concerning QP4 (38:35).

Steering Committee. The Steering Committee is made up of the division chiefs from the various directorates involved with QP4, the Process Action Team (PAT) leaders, and one PAT Team technician from each area. Their role is to develop an overall plan and to commit resources. Objectives for the Steering Committee are to solve problems that arise between and among the various PAT Teams and the various divisions. In addition, the Steering Committee is tasked with measuring the progress of QP4. In essence, the top objective for the Steering Committee is to support the PAT Teams by solving problems beyond the teams control (38:36).

PAT Teams. The PAT Teams are composed of two technicians per shift from the production area, and the first line supervisors from each shift. A technical advisor, who has more advanced training in process management techniques, is assigned to each team. Additionally, specialists from the area are assigned as team members. The specialists include such positions as the industrial engineering technicians, the industrial engineering planners, schedulers, and the quality assurance specialist. Besides the regular team members, personnel from other areas may be required to attend team meetings to address cross-functional problems. Moreover, Executive Group and Steering Committee members are also encouraged to attend some of the team meetings. Attendance

of non-team members tends to promote horizontal and vertical communications.

The role of the teams is to identify and solve problems within the processes that they are responsible for. Team objectives are to continually study the repair processes from their area in order to identify quality problems. Accomplishment of the team objectives makes it possible to continually improve productivity and quality. Further, the teams are responsible for any necessary follow-up, troubleshooting, and improvement verification required in their areas.

Team meeting schedules are intended to be flexible enough to provide for frequent meetings, or meetings of longer duration when required. Teams are not compelled to meet when there is nothing to discuss. Team meetings are determined by results and diminishing returns rather than by a rigid schedule. Nevertheless, meetings typically last from 30 to 90 minutes, and teams normally meet once every week (38:39).

CAT Teams. Corrective Action Teams (CAT) are formed ad hoc by the PAT Teams to work on specific problems. The CATs are formed to quantify problems that have been identified in the PAT Team meetings, but are too long, specialized, or complex to solve using all the PAT Team members. The size of CATs vary from one member to several members. CAT members may come from the sponsoring PAT Team, other employees within the work area, or from other work

areas. These teams are formed for only a limited duration. Once they have completed their assigned task they are disbanded (38:39).

Summary

This review has examined the topic of administrative innovation, and described a specific innovation, QP4. A theoretical framework was provided for assessing the success of innovations. The literature was explored to determine what factors impact administrative innovation. Support has been presented for the value of process management. The structure of QP4 was discussed. This background material provided information used to develop interview guides, in chapter 3. It also provides a basis for comparison with the data gathered pertaining to QP4. Another objective of this chapter was to present the methodology and the merits of process management to provide a better understanding of the concepts of QP4. More specific material was introduced on the QP4 program.

III. Methodology

Overview

This methodology was aimed at attainment of specific research objectives listed in Chapter I. Objectives three, and six were by largely answered by the literature review. The research objectives are as follows:

1. Determine how successful QP4 has been as an innovation.
2. Determine the history of the QP4 program.
3. Determine what characteristics are associated with successful innovations in the literature. These can then be compared to the factors associated with the success of QP4.
- 3B. Determine what factors are associated with QP4.
4. Ascertain what strategy was used to introduce the concept behind QP4, to get QP4 adopted, and to implement QP4.
5. Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4 at AGMC.
6. Determine how the Air Force Logistics Command encourages innovation.
7. Determine what the major decision points have been in the QP4 program.
8. Determine how knowledge from the literature on the innovation process can be used to improve the Air Force's method of nurturing innovation.

Beyond attainment of the research objectives, the intent of the methodology was to answer some questions which resulted from the literature review. These questions are:

1. How was communication accomplished during the three innovation phases of QP4?

2. What role, if any, did a champion play in QP4?

3. What system has been established to monitor the implementation effort?

4. How effective has the implementation monitoring system been?

5. What effect has uncertainty had on the success of QP4?

6. How have the implementation efforts taken into account organizational culture?

In congruence with the exploratory nature of this research the chief concern in devising the methodology was the need to maximize the depth and breadth of the investigation consistent with the limited time available. Accordingly, a case study approach was chosen. Case studies are better suited for the detailed analysis of a phenomena, which is required in exploratory research (16:61). Such detailed analysis should be useful in determining what attributes are associated with successful administrative innovations. This type of insight should be more important than obtaining a representative cross-section of the process of administrative innovation, because of the lack of previous research in the Air Force setting. It is also appropriate

because of the lack of a coherent theory of administrative innovations.

Research Instrument Design

Not much is known about the process of administrative innovation in an Air Force setting. Furthermore, the lack of a viable theoretical structure on administrative innovations in general adds to the difficulties of developing a comprehensive questionnaire. Consequently, interviews were used because of the flexibility to immediately probe more deeply into a subject in reaction to answers given by respondents. A general interview guide approach was used for the interviews. A general interview guide approach involves outlining a set of issues that are to be explored with each respondent before interviewing begins. This approach provided some structure that helped simplify qualitative analysis of the data. The interview guide approach offered opportunity to probe with follow-up questions based on responses. The interview guide approach was also used for group interviews. In the group interviews the interview guide approach allowed for individual perspectives and helped to keep the interview focused. Two interview guides were developed. One for group interviews, and one for the individual interviews. Questions for the interviews were developed using the pertinent research objectives as a guide. Knowledge attained from the literature also suggested additional questions.

Data Collection

Individual interviews were conducted with key participants in the QP4 program. The key participants include management and staff involved with QP4. Interviews were also conducted with format participants. The total number of interviews conducted at Newark A.F.B. was ten. This included focus group interviews, conducted with five current PAT Teams. The focus group interviews were used to capitalize on a synergistic reaction as the respondents reacted to each others responses. Three key personnel were also interviewed at HQ, AFLC, at Wright-Patterson A.F.B. The purpose of these interviews were to get headquarter's perspective on QP4.

Most interviews were tape recorded. Training manuals, inter-office reports, progress reports, briefing outlines, and any other pertinent material concerning the QP4 program was examined to supplement the information obtained from the interviews.

Data Analysis

Due to the exploratory nature of this research, analysis of the data was qualitative. Qualitative analysis of the research required judgement to be used, rather than statistical techniques. Cluster analysis was used to help categorize the responses. However, much of the analysis involved summarizing the data. An assessment of the investigative questions was made based on the summarized

data. Finally, conclusions and recommendations were made based upon the assessments.

IV. Findings

Introduction

This chapter presents the results of the interviews. Benefits that have resulted from QP4 are also presented. Cluster analysis was used to make the interview findings easier to understand, and more meaningful. Cluster analysis involves grouping all similar responses into a single category. This analysis makes it possible to determine what proportion of respondents answered in a similar manner. Additionally, cluster analysis makes it easier to discern patterns in the responses. For example, if the majority of the respondents believe the intergroup communication channels are functioning ineffectively, there is strong evidence of a problem in the communication channels. If only a single respondent indicates a problem with the communication channel, the response could possibly be dismissed as biased. The number of responses to each question varies. The respondents have differing backgrounds. Those subjects interviewed were instructed not to answer the questions that pertained to aspects of the program that they were not familiar with.

The results of the individual interviews conducted at Newark A.F.B., the PAT Team interviews conducted at Newark A.F.B., and the individual interviews conducted at HQ, AFLC are presented separately. The results of the individual interviews conducted at Newark A.F.B. was further separated

based on whether the respondent was a manager or technical advisor. Such a breakdown made it possible to analyze the different perspectives of each group of respondents. These group perspectives are important because each group sees a different aspect of QP4. For some of the questions cluster analysis was deemphasized, because each person had only a fragment of the answer. In situations such as this an attempt was made to piece together the answer from individual responses. The large number of responses necessitated presenting a summary of the responses of each question. Appendix B contains tables which list all of the responses to each question, categorized by respondent type.

Benefits of QP4

The implementation of QP4 across the logistics command began in January 1988. Due to the newness of the program it is too early to determine its entire impact. However, the pilot for QP4 began in late 1986 at AGMC, Newark A.F.B. and certain economics of the pilot have already been disclosed in internal reports. Considering training and contracting costs, the pilot seems to have been quite worthwhile. Total cost for the pilot was \$756,000, (refer to Table I. for a breakdown of the costs and savings). While the verified savings were \$490,000, and the projected total savings are \$768,000. In addition, more long-term savings are predicted from the large reductions in the recycle rate for the three types of workload - G9 Gyro, VM8, and Electronic Modules - that were included in the pilot.

Table I

Economic Summary for QPI Pilot
(Costs are in dollars)

| | Cost |
|---|----------|
| Contractor (IITRI) | |
| One Year Contract | 197,000 |
| Training & Presentation | 25,000 |
| Additional Support | 95,000 |
| Total Cost of Contractor | 317,000 |
| Other Implementation Costs | 106,000 |
| Cost of Having Personnel Away Job for Training | 333,000 |
| Total Cost | 756,000 |
| | Savings |
| Verified Gross Savings | 490,000 |
| Projected Total Gross Savings (1st year) | 768,000 |
| Net Savings Verified | -266,000 |
| Net Savings Projected | 12,000* |

* Totals do not include intangible savings of reduced recycles.

The recycle rate tracks the number of times that a particular component must be tested, repaired and then retested. When either the testing or the repair process is inadequate the recycle rate increases (38:72). For control and comparison purposes recycle data was obtained on two processes similar to the G9 Gyro, VM8, and Electronic Modules for the same time periods that were used to demonstrate the reduction in recycles. The recycle data for the SPN GEAN IMU and the SPN GEAN IEU serves as a control to determine whether any factors other than QP4 were responsible for the reduction in the recycle rates. Recycles did not significantly decrease from 1986 to 1987 for the SPN GEAN IMU. The recycle

rate actually increased in 1987 to 18.4% from 14.9% in 1986 for the SPN GEAN IEU. The fact that the recycle rate for the control processes did not decrease in 1987 is further evidence that the recycle rate decrease in the QP4 areas was due to QP4. Tables II., III., and IV. show the recycle rates for the G9 Gyro, VMA, and the Electronic Modules respectively. Tables V. and VI. show the recycle rates for two similar workloads at AGMC where QP4 was not implemented.

Table II

Recycle Rate for the G-9 Gyro
(QP4 was active in the work area throughout 1987)

| <u>1986</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> | <u>1987</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> |
|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|
| J | 34 | 9 | 26.5% | J | 27 | 6 | 22.2% |
| F | 18 | 8 | 44.4% | F | 21 | 5 | 23.8% |
| M | 37 | 17 | 45.9% | M | 8 | 2 | 25.0% |
| A | 40 | 20 | 50.0% | A | 14 | 3 | 21.4% |
| M | 51 | 16 | 31.4% | M | 21 | 2 | 9.5% |
| J | 42 | 8 | 19.0% | J | 24 | 5 | 20.8% |
| J | 14 | 4 | 28.6% | J | 20 | 2 | 10.0% |
| A | 15 | 2 | 13.3% | A | 26 | 2 | 7.7% |
| S | 4 | 0 | 0.0% | S | 14 | 2 | 14.3% |
| O | 29 | 6 | 20.7% | O | 19 | 3 | 15.8% |
| N | 2 | 0 | 0.0% | N | 40 | 9 | 22.5% |
| D | 18 | 3 | 16.7% | D | 25 | 3 | 12.0% |
| TOTAL | 304 | 93 | 30.6% | TOTAL | 259 | 44 | 17.0% |

Table III

Recycle Rate for the VM8 Velocity Meter
(QP4 was active in the work area throughout 1987)

| <u>1986</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> | <u>1987</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> |
|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|
| J | 32 | 3 | 9.4% | J | 32 | 7 | 21.9% |
| F | 5 | 5 | 100.0% | F | 31 | 10 | 32.3% |
| M | 16 | 4 | 25.0% | M | 30 | 6 | 20.0% |
| A | 34 | 17 | 50.0% | A | 27 | 7 | 25.9% |
| M | 48 | 6 | 12.5% | M | 24 | 2 | 8.3% |
| J | 44 | 11 | 25.0% | J | 26 | 2 | 7.7% |
| J | 26 | 5 | 19.2% | J | 24 | 2 | 8.3% |
| A | 38 | 7 | 18.4% | A | 21 | 1 | 4.8% |
| S | 6 | 0 | 0.0% | S | 19 | 6 | 31.6% |
| O | 8 | 5 | 62.5% | O | 40 | 6 | 15.0% |
| N | 8 | 2 | 25.0% | N | 34 | 4 | 11.8% |
| D | 30 | 6 | 20.0% | D | 36 | 3 | 8.3% |
| TOTAL | 295 | 71 | 24.1% | TOTAL | 344 | 56 | 16.3% |

Table IV

Recycle Rate for the Modules
(QP4 was active in the work area throughout 1987)

| <u>1986</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> | <u>1987</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> |
|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|
| J | 144 | 30 | 20.8% | J | 188 | 58 | 30.9% |
| F | 142 | 21 | 14.8% | F | 180 | 47 | 26.1% |
| M | 120 | 51 | 42.5% | M | 130 | 28 | 21.5% |
| A | 208 | 56 | 26.9% | A | 123 | 31 | 25.2% |
| M | 181 | 54 | 29.8% | M | 172 | 39 | 22.7% |
| J | 185 | 77 | 41.6% | J | 138 | 23 | 16.7% |
| J | 158 | 31 | 19.6% | J | 164 | 28 | 17.1% |
| A | 207 | 44 | 21.3% | A | 163 | 13 | 8.0% |
| S | 184 | 29 | 15.8% | S | 156 | 18 | 11.5% |
| O | 142 | 27 | 19.0% | O | 238 | 19 | 8.0% |
| N | 13 | 1 | 7.7% | N | 183 | 26 | 14.2% |
| D | 104 | 31 | 29.8% | D | 98 | 14 | 14.3% |
| TOTAL | 1788 | 458 | 25.3% | TOTAL | 1933 | 344 | 17.8% |

Table V

Recycle Rate for the SPN GEAN IMU
(QP4 was not active in the work area in either year)

| <u>1986</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> | <u>1987</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> |
|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|
| J | 38 | 6 | 15.8% | J | 70 | 12 | 17.1% |
| F | 24 | 4 | 16.7% | F | 82 | 14 | 17.1% |
| M | 33 | 8 | 24.2% | M | 89 | 14 | 15.7% |
| A | 75 | 11 | 14.7% | A | 74 | 17 | 23.0% |
| M | 41 | 4 | 9.8% | M | 107 | 22 | 20.6% |
| J | 58 | 15 | 25.9% | J | 152 | 32 | 21.1% |
| J | 55 | 14 | 25.5% | J | 152 | 26 | 17.1% |
| A | 68 | 20 | 29.4% | A | 161 | 29 | 18.0% |
| S | 100 | 20 | 20.0% | S | 139 | 29 | 20.9% |
| O | 70 | 12 | 17.1% | O | 185 | 38 | 20.5% |
| N | 82 | 14 | 17.1% | N | 172 | 35 | 20.3% |
| D | 89 | 14 | 15.7% | D | 126 | 22 | 17.5% |
| TOTAL | 733 | 142 | 19.3% | TOTAL | 1509 | 290 | 19.2% |

Table VI

Recycle Rate for the SPN GEAN IEU
(QP4 was not active in the work area in either year)

| <u>1986</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> | <u>1987</u> | <u>PROD</u> | <u>RECYCLE</u> | <u>PERCENT</u> |
|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|
| J | 5 | 0 | 0.0% | J | 13 | 2 | 15.4% |
| F | 3 | 2 | 66.7% | F | 24 | 2 | 8.3% |
| M | 21 | 3 | 14.3% | M | 47 | 7 | 14.9% |
| A | 4 | 1 | 25.0% | A | 53 | 8 | 15.1% |
| M | 12 | 2 | 16.7% | M | 13 | 6 | 46.2% |
| J | 15 | 1 | 6.7% | J | 14 | 1 | 7.1% |
| J | 10 | 3 | 30.0% | J | 28 | 9 | 32.1% |
| A | 24 | 4 | 16.7% | A | 23 | 7 | 30.4% |
| S | 16 | 2 | 12.5% | S | 18 | 2 | 11.1% |
| O | 13 | 2 | 15.4% | O | 13 | 1 | 7.7% |
| N | 24 | 2 | 8.3% | N | 9 | 2 | 22.2% |
| D | 47 | 7 | 14.9% | D | 5 | 1 | 20.0% |
| TOTAL | 194 | 29 | 14.9% | TOTAL | 260 | 48 | 18.4% |

Responses to Individual Questions

Each of the various interview guide questions were analyzed individually, (refer to Appendices C and D for examples of the interview guides). Cluster analysis was deemphasized for the first three questions. The first three questions are concerned with the strategy that was used to introduce the concept of QP4, getting the concept adopted, and implementing QP4. Only a small percentage of those interviewed had knowledge of the strategies behind QP4. Each respondent presented the part of the strategy of which he/she was familiar.

What Strategy was Used to Introduce the QP4 Concept to AGMC and then to AFLC? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. the purpose of the question was to help answer research objective four: "Ascertain what strategy was used to introduce the concept behind QP4, to get QP4 adopted, and to implement QP4." There were basically two clusters of answers, or more correctly two scenarios in response to this question. One cluster being comprised of the responses from the management at Newark A.F.B. This cluster was more focused on the introduction of the concept to AGMC. The other cluster was comprised of responses from HQ, AFLC. Not surprisingly, this cluster was more oriented toward how the concept was introduced to the entire command. There were also a few unique responses that didn't fit into the two main clusters, but were not contradictory.

Five out of the six managers at Newark felt qualified to respond to this question. The concept behind QP4 was introduced to the Directorate of Maintenance Division Chief, and another member of the division at a seminar sponsored by the American Society for Quality Control (ASQC) in approximately 1981. Shortly after this, the Division Chief convinced the Deputy Center Commander to attend a similar seminar. These three individuals were repeatedly mentioned as champions for QP4. After their initial exposure to the concept, they made an effort to make upper level managers at AGMC more aware of the concept of process management. Increasing the awareness of top management was made easier because of the visibility of the Deputy Center Commander. The effort involved encouraging members of upper management to attend various conferences conducted by individuals like W. Edwards Deming and Joseph M. Juran.

The effort to increase awareness of the basic concept behind QP4 lasted about three years. Included in the effort was a joint seminar that was set-up by Newark A.F.B. and the Newark Chamber of Commerce. Guest lecturers were invited from the Massachusetts Institute of Technology, Wright State University and Jackson State University to address the issue of process management.

While the effort to increase the awareness of top management went on, one of the three individuals mentioned that his attention was focussed on devising a method for funding the innovation. PRAM funding was finally decided to

be the best alternative. The advantage of seeking PRAM funding was that it decreased the risk associated with the innovation, since the funding came from outside AGMC.

The management personnel interviewed at HQ, AFLC described how the concept was introduced to the command as a whole. Their responses were also combined into a scenario. Top management in the command and the personnel in general have been gradually introduced to the concept of process management. The Production Certification Acceptance (PAC) program, which was put into place in the early 1980s, made production personnel responsible for inspecting their own work. After PAC was implemented, but before QP4 came along Quality Assurance personnel, who formerly were responsible for inspection, were trained in the use of statistics. These events helped prepare AFLC personnel to understand the concepts that QP4 is based on.

What Strategy was Used to Persuade AGMC and then AFLC to Adopt the QP4 Program? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer research objective four: "Ascertain what strategy was used to introduce the concept behind QP4, to get QP4 adopted, and to implement QP4." In essence the management personnel at AGMC who were interviewed said that the decision to adopt QP4 came as a result of the two or three year effort to increase top management awareness of the concept of process management. The awareness and the funding provided by PRAM was enough to

convince upper management to try the QPI pilot. Moreover, one of the three management personnel from AGMC that responded to this question indicated that having a champion in the position of the Deputy Center Commander was instrumental in getting the pilot started. After the pilot was started HQ, AFLC became interested. HQ, AFLC was under pressure from the AFLC Commander to improve processes. Another member of AGMC's management said that HQ, AFLC was purposely not involved until the pilot for QPI was already started. The reason for not involving HQ, AFLC was to avoid any interference that might have resulted. After the pilot demonstrated that the concept was beneficial both AGMC and HQ, AFLC decided to expand the program.

The respondents from HQ, AFLC focussed on the directive from the AFLC Commander to come up with a viable process management program. This decision apparently was not influenced by the efforts taking place at Newark A.F.B. However, the QPI pilot at Newark A.F.B. provided a program already in the pilot stage that allowed the directive to be carried out more quickly and more easily. Thus, QPI was designated as a pilot for the command as well as for AGMC.

What Strategy was Used to Implement the QP4 Program. Once the Decision to Adopt it had been Made? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer research objective four: "Ascertain what strategy was used to introduce the concept behind QP4, to get QP4

adopted, and to implement QP4." The answers to this question were widely divergent in that there were many unique responses given by only one person. The divergent answers reflect the differing relationships that each respondent had with the program. Four out of the six AGMC managers who responded to this question mentioned that selecting a contractor with the background to help with the implementation effort was a major part of the strategy. To this end, a request for proposal was sent out. Then a preproposal conference was held at AGMC, which was attended by 23 potential contractors. There was a two-way exchange of ideas between the contractors and the AGMC personnel, which was helpful in the development of a statement of work. This meeting allowed AGMC to obtain input from several potential contractors before making a selection. The Illinois Institute of Technology Research Institute (IITRI) was awarded the contract. IITRI's responsibility was to help with the training, the implementation, the development of software, and the expansion of QPI.

Two of the six respondents indicated that the statement of work was then used as the implementation plan for the QPI pilot. After selecting the contractor the next step, as indicated by two of the six respondents, was to train upper management on what their role would be in the new program. Then the personnel who were to be directly involved in the pilot study were trained. One manager indicated that frequent communication throughout the chain of command has

frequent communication throughout the chain of command has been necessary throughout the implementation effort. In addition, the base newspaper was regularly used to publicize the effort. A quality center was established. One of the primary duties of the quality center is to oversee the QP4 program, and coordinate all related activities.

The strategy is constantly evolving. As the interviews for this research were being conducted the emphasis in the PAT Team training was being shifted from primarily teaching SPC skills, to teaching team building skills that are essential for effective participative management.

Respondents from HQ, AFLC also had divergent, but compatible responses to this question. Once the decision was made by the AFLC Commander to implement QP4, letters were sent to the ALC Commanders explaining the program and asking for support. Key managers at each of the ALCs had already been exposed to the program through their participation in various meetings, and to some extent through training and seminars at AGMC.

The goal of QP4 is to obtain long-term incremental gains. In order to achieve these gains a new organization was formed at HQ, AFLC. The organization is QP. Moreover, each ALC will have its own QP office. The overall mission of QP at HQ, AFLC is to focus on developing policy and direction for the command's quality efforts, including QP4. Moreover QP is tasked with providing resources for the quality improvement efforts by cultivating senior leadership

A two-part strategy has been developed for the implementation of QP4 throughout AFLC. The strategy consists of differing responsibilities for Head Quarters and for the local ALCs. Head Quarters is responsible for the development of overall policy and for providing resources. While the program will be executed on a local basis at each ALC. Another part of the overall strategy calls for the targeting of the senior civilians in the command. It is believed that the senior civilians must be behind any innovation in order to provide long-term stability for the innovation. HQ, AFLC wants to show some QP4 successes in order to keep the implementation momentum going. Along with publicizing QP4 program successes, there is an attempt to provide recognition for the accomplishments of the individual participants in the program. The program is being implemented in only a small number of organizations at each ALC initially. The program will gradually expand. Frequent communication is considered crucial.

What Major Obstacles were Encountered when Introducing the QP4 Concept? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer research objective five: "Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4." A complete listing of the responses is in Appendix B, Exhibit 1. The most common response from both groups concerned the lack of commitment on behalf of middle

management (branch and section level) to QP4. In addition, those who introduced the concept at AGMC seemed to suffer from a lack of time. The personnel introducing the concept at AGMC also had to overcome the attitude of some people that this concept will just lead to "another short-term program".

What were the Major Obstacles when Trying to Persuade AGMC and then AFLC to Adopt the QP4 Program? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer research objective five: "Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4." A complete listing of the responses is in Appendix B, Exhibit 2. The belief that there was a lack of money and resources for a program like QP4, was the most common response. Another response was that the budget driven personnel cutbacks were an obstacle, because of the amount of time personnel would have to spend on the new program.

What Obstacles have been Encountered During the Implementation of QP4? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, the technical advisors, and the PAT Teams. The purpose of the question was to help answer research objective five: "Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4." A complete listing of the responses is in Appendix B, Exhibit 3. Three AGMC managers, one HQ, AFLC manager, and one

technical advisor mentioned that the lack of commitment of middle managers to the program has been a major obstacle. Moreover, four of the PAT Teams and one of the technical advisors indicated that the attitude of some people that QP4 is just the "program of the month" was an obstacle. Another commonly mentioned obstacle that was mentioned by three AGMC managers, one technical advisor, and one PAT Team was the lack of time to perform both regular duties and QP4 duties.

Promoting consistency across the command, without causing standardization was seen as an obstacle by two of the HQ, AFLC managers. Along with this, the reluctance of quality personnel to accept their new roles in QP4, was also seen as an obstacle by two HQ, AFLC managers.

What were the Major Decision Points for QP4? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer research objective seven: "Determine what the major decision points have been in the QP4 program." A complete listing of the responses is in Appendix B, Exhibit 4. Four of the AGMC managers and two HQ, AFLC managers indicated that assessing the pilot program's success, in order to determine whether or not to formalize the program, was a major decision point. Determination of what approach to take in the program was mentioned by four AGMC managers. Deciding what area of the organization to implement the pilot, and determining how QP4 should be funded were common responses.

What Individual Incentives do you Believe are Present in the Air Force to Encourage Innovations such as QP4? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, the technical advisors and the PAT Teams. The purpose of the question was to help answer research objective six: "Determine how the Air Force logistics command encourages innovation." A complete listing of the responses is in Appendix B, Exhibit 5. "A personal sense of accomplishment" was the most common response. Other common responses were personal recognition, the suggestion program, and a belief that QP4 has made it easier to innovate further.

How has QP4 Increased Quality and Productivity? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, the technical advisors and the PAT Teams. The purpose of the question was to help answer research objective one: "Determine how successful QP4 has been as an innovation.", and research objective three B: "Determine what factors are associated with QP4." A complete listing of the responses is in Appendix B, Exhibit 6. The majority of all four types of respondents believed QP4 has been successful at increasing productivity and quality. The most frequently given response was that QP4 has increased quality and productivity by providing a method of quantifying and analyzing processes. Another common response was that better communication has improved quality and productivity.

What Factors do You Believe made it Possible for QP4 to be a Successful Program? This question was directed to the PAT Teams. The purpose of the question was to help answer research objective one: "Determine how successful QP4 has been as an innovation.", and research objective three B: "Determine what factors are associated with QP4." A complete listing of the responses is in Appendix B, Exhibit 7. All five PAT Teams agreed that continuous and extensive upper management support is the primary factor that has made it possible for QP4 to be a successful program. Four PAT Teams mentioned that extensive working level support was another primary factor. That first line supervisors are very active in the program, was mentioned by three PAT Teams.

To what Degree do you Believe that QP4 has been Institutionalized? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, and to the technical advisors. The purpose of the question was to help answer research objective one: "Determine how successful QP4 has been as an innovation." A complete listing of the responses is in Appendix B, Exhibit 8. With the exception of one technical advisor, none of the respondents believed that QP4 had been institutionalized yet. Two AGMC managers said that once everybody has received their initial training that QP4 will be much closer to institutionalization. One AGMC manager and one HQ, AFLC manager mentioned that there are no indicators in place that

permit major management decisions to be made based on processes.

How was Communication Accomplished, and what Type of Information was Exchanged During the Period when the QP4 Concept was being Introduced? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer the research question: "how was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 9. Everybody who responded to this question indicated that much of the communication took place at seminars or briefings, where experts informed upper management about the concept that QP4 is based upon. The concept was also discussed at meetings that were not specifically convened for discussing the concept. The base newspaper was used to familiarize people with the concept.

How was Communication Accomplished, and what Type of Information was Exchanged During the Period when the QP4 Program was being Adopted? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer the research question: "How was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 10. The responses were very similar to those of the previous question.

How has Communication been Accomplished, and what Type of Information has been Exchanged During the Current Period in which the QP4 Program is being Implemented? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, the technical advisors and to the PAT Teams. The purpose of the question was to help answer the research question: "How was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 11. Four of the AGMC managers and two technical advisors replied that Executive Group and Steering Committee meetings are a major means of exchanging operational information about QP4. The PIB network transmits executive summaries that address specific QP4 projects from the various ALCs, according to three AGMC managers and one HQ, AFLC manager. Monthly video conferences and internal customer/supplier relationships were also mentioned.

How has Communication Between Groups been Accomplished? This question was directed to the PAT Teams. The purpose of the question was to help answer the research question: "How was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 12. All five PAT Teams said that reading meeting minutes of other teams was one of the main methods of communication. Area bulletin boards and monthly technical advisor meetings were each mentioned by a PAT Team.

How Does Communication Between the Different Levels of the Organization Take Place? This question was directed to the PAT Teams. The purpose of the question was to help answer the research question: "How was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 13. Four of the teams replied that the Steering Committee meetings facilitate the exchange of QP4 related information between organization levels. Technical advisors and other PAT Team members are sometimes invited to present information to Steering Committee meetings. Meeting minutes are available to all levels of the organization. Management members frequently attend PAT Team meetings, which enhances communication between organization levels according to one PAT Team.

How Effective have the Established Communication Channels been at Facilitating the Goals of QP4? This question was directed to the PAT Teams. The purpose of the question was to help answer the research question: "How was communication accomplished during the three innovation phases of QP4?" A complete listing of the responses is in Appendix B, Exhibit 14. All five of the PAT Teams interviewed indicated that the QP4 communication channels have been effective. One team indicated that there is much more two-way communication between the organization levels. Another group said that the effectiveness of the communication was evidence that management cares about the program.

How Much of the Success of QP4 can be Attributed to the Efforts of an Individual? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, and to the technical advisors. The purpose of the question was to help answer the research question: "What role, if any, did a champion play in QP4?" A complete listing of the responses is in Appendix B, Exhibit 15. The most popular answer was that one or two people were very instrumental in making QP4 successful. The other main response was that there were a small group of individuals, as opposed to a single person, who played the major role in the success of QP4.

How has QP4 Effected the Degree to which You Participate in the Decisions that Effect Your Work? This question was directed to the PAT Teams. The purpose of the question was to help answer research objective one: "Determine how successful QP4 has been as an innovation." A complete listing of the responses is in Appendix B, Exhibit 16. All of the teams agreed that QP4 has increased the degree to which they participate in work related decisions.

How Does Management Respond When You Request Assistance From Them? This question was directed to the PAT Teams. The purpose of the question was to help answer the research question: "How effective has the implementation monitoring system been?" A complete listing of the responses is in Appendix B, Exhibit 17. Of those teams that had asked for assistance, two out of the five teams interviewed, all said

management had been helpful. The teams that had not requested assistance tended to be recently formed teams. However, the newer teams said that the indications were that management would be helpful if there assistance was requested.

To What Extent do You Perceive the Future Existence of AGMC to be Linked to the Success of Productivity and Quality Improvement Programs such as QP4? This question was directed to management personnel at Newark A.F.B., the technical advisors and the PAT Teams. The purpose of the question was to help answer the research question: "What effect has uncertainty had on the success of QP4?" A complete listing of the responses is in Appendix B, Exhibit 18. A significant majority replied that quality and productivity improvement is extremely important to the future of Newark A.F.B. Three of the AGMC managers thought that quality and productivity improvement might have some impact, but not that much.

How Will Enthusiasm be Maintained After the Easy Problems have been Solved Leaving Only Long-term Difficult Problems? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC, and to the technical advisors. The purpose of the question was to help answer the research question: "How have the implementation efforts taken into account organizational culture?" A complete listing of the responses is in Appendix B, Exhibit 19. The most popular response was that the workforce will have to be continuously informed that QP4 is a long-term

commitment. The procedures of QP4 will have to become the routine way of doing business, according to two AGMC managers. One technical advisor indicated that tough long-term problems are already being successfully addressed.

What Kinds of Efforts have been Made to Analyze the Effect that the Existing Organizational Culture Will have on QP4? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer the research question: "How have the implementation efforts taken into account organizational culture?" A complete listing of the responses is in Appendix B, Exhibit 20. Three of the AGMC managers and two of the HQ, AFLC managers did not believe much effort had been made to analyze what effect the existing organizational culture would have on QP4. However, one of the AGMC managers, who was one of the three people who helped introduce the concept behind QP4, said there was an informal effort to analyze the organizational culture. He and the other two people who were the driving forces behind introducing the concept concluded that the organizational climate was right for QP4, based on several organizational factors. Similarly, one of the HQ, AFLC managers believed that the logistics command's culture had been examined in 1981, by a task force assembled to determine how to improve quality in Maintenance (MA) across the command.

How Effective have the Feedback and Control Systems been at Keeping QP4 Running Smoothly? This question was directed to the management personnel both at Newark A.F.B. and at HQ, AFLC. The purpose of the question was to help answer the research question: "What system has been established to monitor the implementation effort?" A complete listing of the responses is in Appendix B, Exhibit 21. Most of the managers thought that the feedback and control systems had been at least fairly effective. Three of the AGMC managers believed that the only feedback systems in place were informal. The types of feedback systems mentioned included Steering Committee meetings, the monitoring of performance indicators, informal communication networks, the monitoring of PAT Team meeting minutes, reports to the AFLC Commander every two months, monthly video teleconferences and access to the PIB network. Some of the control mechanisms that were mentioned included decisions from the Quality Council's monthly meeting, Steering Committee decisions, decisions of the AFLC Commander, and the fact that technical advisors are trained to get around obstacles.

V. Analysis

The purpose of this chapter is to discuss the results of the interviews and the literature review as they apply to the research objectives. Moreover, these results are applied to the research questions which resulted from the literature review.

How Successful is QP4

QP4 is still being implemented, but it is appropriate to assess how successful it has been up to this point. The theoretical framework of Goodman et al., is well suited for this type of assessment (22:1-6). This framework allows for evaluation based upon four dimensions - knowledge, behavior, attitudes/evaluations, and normative/value consensus. Knowledge refers to degree of awareness on how to utilize the new technology or methodology. Behavior is concerned with the extent to which the new technology, or methodology is utilized. Attitudes/evaluations refers to the degree to which different constituencies express favorable or negative attitudes toward the new technology or methodology. Lastly, Normative/value consensus is concerned with the degree to which organizational members use the new technology or methodology, because they believe that it is appropriate for the organization. This use of the new technology or methodology influences the attitudes and actions of other organizational members. Even with this framework, however,

assessment of the success of an innovation is still very much a subjective undertaking.

The assessment of how successful QP4 has been will be limited to the QP4 program at Newark A.F.B. The implementation of QP4 at the other ALCs has been underway for less than a year. Moreover, no data was collected at the other ALCs.

Knowledge. QP4 training, at AGMC, seems to have been effective at teaching the basics of process management, to upper management and to the working level employees. Whether middle managers have been properly trained as to their role in process management is less clear. Training for the working level employees also included the specific techniques that are necessary to employ process management in practice. However, even though the training emphasized statistical techniques, many of the trainees have not actually used statistical techniques since the training. Therefore, it is reasonable to assume that knowledge of specific statistical techniques is not as extensive as knowledge of the principles of process management in general. Nevertheless, all have access to technical advisors who have a more in-depth knowledge of statistics. Although the training was criticized for not emphasizing team building skills, direct participation in the program has helped disseminate this type of knowledge. Thus, at AGMC, the overall rating for this dimension is good.

Behavior. People seemed to be utilizing the methodology of QP4 as it was intended. PAT Teams were meeting regularly. CAT Teams were working on specialized and complex problems. The Executive Committee, the Steering Group, and the technical advisors appeared to be functioning as they were intended too. Five of the PAT Teams mentioned that there was extensive upper management support for the program. While, four of the PAT Teams cited extensive working level support in applying new approaches to problems. Similarly, three of the PAT Teams said that the first line supervisors were very active in the program. However, one of the technical advisors believed that the support for, and participation in QP4 was limited to PAT and CAT Team members only. Furthermore, he believed that they were basically uninvolved with the program except at team meetings.

The tangible monetary savings that resulted from QP4 was a significant \$490,000 (38:72). The recycle rate has been reduced in areas where the pilot was conducted. Moreover, during informal conversations at AGMC, many of the people offered individual examples of QP4 successes.

Considering the just mentioned information, it appears that the methodology of the QP4 program is widely utilized. Moreover, it appears that problems are being successfully solved through the utilization of QP4. It is reasonable then to conclude that QP4 has been largely successful in the behavioral dimension.

Attitudes/Evaluations. There were no interview questions that directly measured the attitudes of QP4 participants. However, many positive responses were volunteered. For example, many of those interviewed at AGMC believed that QP4 had improved both vertical and horizontal communication. There were also many responses to the effect that QP4 had provided a method of quantifying and analyzing processes. Three of the PAT Teams mentioned that QP4 had made people more conscious of the need to increase productivity. While responses such as those just mentioned were common, most of the negative comments were from two individuals.

It appears that most of the attitudes and evaluations of QP4 are positive. However, since there was no systematic attempt to measure or record the attitudes and evaluations, this judgement is based solely on the opinion of the researcher.

Normative/Value Consensus. No attempt was made to determine how successful QP4 has been along this dimension.

Other Indicators. As far as could be determined QP4's objectives were not explicitly stated. However, improvements in quality and productivity seem to be the major goals of the program. Both productivity and quality have been improved. During the pilot program there were \$490,000 in verified savings. Moreover, the recycle rate decreased in those areas where QP4 was implemented. The recycle rate is an indicator of both quality and productivity. Thus, it seems that QP4

has been successful, as measured by the extent to which its objectives have been obtained.

QP4 Attributes Compared with Attributes in the Literature

The purpose of this section is two-fold. First of all, the intent is to determine how the factors associated with QP4 match-up with those factors that are correlated with successful innovation. Secondly, this comparison will be used to help answer research objective eight: "Determine how knowledge from the literature on the innovation process can be used to improve the Air Force's method of nurturing innovation." Furthermore, some of the specific questions that were generated by the literature review will be addressed. These questions are: "How was communication accomplished during the three phases of QP4?", "What role, if any, did a champion play in QP4?", and "What effect has uncertainty had on the success of QP4?"

Chapter 2 discussed the characteristics that have been associated with successful innovations in the literature. The limitations of past research, necessitates the warning that the supporting evidence for most of these characteristics is not conclusive.

Organizational Size. Newark A.F.B. is the smallest of the Air Logistics Centers. Ettlief's research shows that increasing organization size promotes technical innovation up to the point at which there are diminished returns (17:42). The diminished returns may be caused in part by the increased difficulty in communication and administrative coordination

associated with large organizations. In fact, according to an AGMC manager, small size made communication easier. In addition, the small size of Newark A.F.B. may have made it easier to coordinate the effort to introduce the concept of QP4.

Even though Newark A.F.B. is the smallest ALC, it has access to the vast resources of AFLC, and to take it one step further, the Air Force. Having access to a large amount of resources may make the potential loss due to unsuccessful innovation more easily tolerated. Moreover, being part of the Air Force, Newark A.F.B. is very centralized, and structurally complex. Both centralization and structural complexity are associated with administrative innovativeness (41:1423-1424; 29:716; 4:236; 9:685). Thus, it is reasonable to assume that Newark A.F.B.'s small size eased communication and coordination problems, but being part of a larger organization gave it the advantages of being centralized and structurally complex.

Compatibility. There seems to have been at least a minimal degree of compatibility between QP4 and the organizational climate at Newark A.F.B., and with the organizational climate in the AFLC. According to an AGMC manager, the suggestion program, a barometer for participation, was active. The PAC program had already been implemented, so production workers were already inspecting their own work. Furthermore, there was a wide spread belief

at AGMC, especially at the working level, that improvement was needed in the area of quality and productivity.

Research by Zmud indicates that compatibility acts as a moderating factor between centralization and the adoption of innovation (41:1423-1424). Though it is impossible to determine the actual degree of compatibility of QP4 to the organization at Newark A.F.B., it seems plausible that compatibility may have acted as a moderating factor in the adoption of QP4 at Newark A.F.B.

Collaboration. Collaboration of administrative employees with technical core employees on innovations is viewed as a means of reducing resistance to management's initiatives. Collaboration engages core employees in the innovation process (7:202). Collaboration is certainly essential during the implementation stage of an innovation (7:196). Some collaboration did take place at Newark A.F.B. Of the three men who appear to have been most involved in the initiation and adoption phases two were upper level managers, while one was a GS-8 Quality Inspector. There also seems to be a high level of involvement of all organization levels in the implementation phase. Thus, it seems that collaboration has been an important factor throughout all three phases of QP4.

Administrative, Technical Balance. A balance between administrative and technical innovation promotes higher organizational performance, than either administrative or technical innovation alone (10:392). Furthermore,

administrative innovation can pave the way for increased technical innovation (10:397). While there is no evidence of a balance between administrative and technical innovation at Newark A.F.B. in particular, the presence of such AFLC programs as PACER IMPACT made it easier to find funding for QPI. Moreover, two of the PAT Teams and some of the AGMC managers indicated that QP4 has made it easier to introduce additional innovations that improve quality and productivity. Thus, it appears that an earlier administrative innovation, PACER IMPACT, was conducive to the adoption and implementation of QP4. Further, there is evidence that QP4 has made it easier to initiate, adopt, and implement technical innovations.

Boundary Spanning Activity. One critical aspect of the innovation process is the ability of the innovating unit to gather information from the external environment and transmit it internally. The structure of an organization can facilitate the innovation process by providing boundary spanning positions (37:587). Newark A.F.B. does not appear to have an inordinate amount of boundary spanning positions. However, upper management at the base seems to be well networked with the community. There also seems to be a high amount of participation in professional organizations, such as ASQC. In fact, the concept behind QP4 was introduced to Newark A.F.B.'s management through attendance of an ASQC seminar. Even after the concept was introduced, seminars sponsored by professional organizations, and the Newark

Chamber of Commerce were used to increase management awareness of the principles behind QP4. Boundary spanning activities were critical to the success of the QP4 program.

Communication. Ebadi and Utterback have conducted research to determine how the frequency of interorganizational communication, the centrality of the innovation within the communication network, and the diversity of communication effects the success of technological innovation (15:572-574). They found that the frequency with which communication takes place had a more profound effect on the success of the innovation than either the centrality of the innovation in the communication, or the diversity of the communication. However, the position of a particular innovation within the communication network (centrality), and the diversity of the communication contacts were also positively correlated with successful innovations.

The research question: "How was communication accomplished during the three innovation phases of QP4?" was formulated to investigate the effect of communication on QP4. There is no evidence that Newark A.F.B. either communicated more frequently or had a more central role in the interorganizational communication that takes place in AFLC before QP4 was introduced. However, interorganizational communication during the implementation stage of QP4 has been frequent throughout AFLC. Monthly video teleconferences, PIB reports, regularly scheduled meetings, etc. where QP4 is discussed are now occurring.

Ebadi and Utterback also found some support for the proposition that the formality of the communication is negatively correlated with the success of innovations (15:572-574). Informal modes of communication seems to be important because formal systems and procedures for gathering sensitive information often fail to work quickly and accurately enough to be very useful. Furthermore, formal information systems don't work very well at conveying threatening or easily misinterpreted information (20:6-7).

One AGMC manager said that much time was spent when in the initiation phase informally convincing key staff members of the value of the concept behind QP4. Internal customer/supplier relationships, which are an informal means of communication, are now encouraged. In addition, the Quality Center, that was initiated after the implementation of QP4 began, facilitates informal communication by providing a centralized location or organization for it to occur.

Frequent formal and informal communication about QP4 has occurred. However, it appears that the frequent interorganizational communication about QP4 has been taking place only since the implementation phase began. The information gathered is inadequate to determine how frequent communication in general was before the initiation phase of QP4. The effect of communication is hard to judge. Frequent informal communication seems to have been taking place throughout the effort at Newark A.F.B. Therefore, informal

communication may have been a positive factor in the QP4 innovation.

Managerial and Workforce Attitudes. Proper attitudes are important to the success of innovations. Zmud found that innovation success is strongly related to the existence of favorable management attitudes toward the innovation. His findings also show some support for the assertion that innovation success is positively related to the existence of a favorable receptivity toward change within the membership as a whole of an organization (40:735).

Answers to the question concerning the strategy used during the initiation phase of QP4, indicate that much time and effort was expended to favorably influence the attitudes of upper level managers toward the concept behind QP4. Advanced publicity about QP4 in the form of newspaper articles and letters were intended to favorably influence the attitudes of the rank and file workforce concerning QP4. The question: "What factors do you believe made it possible for QP4 to be a successful program?", revealed that one of the main factors was the positive attitude of upper management in the form of support for the program. The positive attitude of the workforce was also one of the main factors mentioned as being responsible for the success of QP4. On the other hand, not much effort was expended to favorably influence the attitudes of middle managers. Perhaps because of this inadequate of effort, the lack of commitment of middle managers was the most frequently mentioned obstacle.

Education and Professionalism. Several studies have found a positive correlation between education level and the level of professionalism and the initiation and/or adoption of innovations (4:234; 26:696; 9:679). Unfortunately, no objective information was acquired concerning the level of education or professionalism at Newark A.F.B. Hence the role that education and professionalism may have played in QP4 is unknown.

Administrative Intensity. Damanpour's research findings indicate that administrative intensity is indeed positively correlated with all types of innovation. Further, administrative intensity is more highly correlated with administrative innovation than with technical innovation (9:682). No information was acquired that would help determine managerial overhead at Newark A.F.B. The role that administrative intensity played in QP4 is unknown.

Role of Champions. The literature review that was conducted did not find any empirical research concerning the role that champions play in the process of innovation. However, Van de Ven surmised that an innovative idea without a champion gets no where (39:6). Thus, research question: "What role, if any, did a champion play in QP4?", was formulated. Respondents at Newark A.F.B. and to a lesser extent respondents at HQ, AFLC believed that much of the success of QP4 could be attributed to the efforts of a single person. Although there were seven different individuals that people indicated were champions, one person was chosen by

four different respondents, while three people were each chosen by three respondents. These results indicate that three or four different people may have been champions. It is highly probable that the enthusiasm and efforts of these "champions" were key factors in the success of QP4.

Uncertainty. The relationship between uncertainty and administrative innovation is not very clear. There is, however, strong evidence that uncertainty has a positive effect on technical innovation. The research question: "What effect has uncertainty had on the success of QP4?" was formulated to help clarify the relationship between uncertainty and administrative innovation. Uncertainty refers to the variability of an organization's environment, encompassing both instability and turbulence. It is believed that uncertainty stimulates innovation through an organizations's effort to survive and grow. There is a large body of evidence that shows positive correlation between uncertainty and technical innovation (4:240). However, there seems to have been a lack of research on the effect of uncertainty on administrative innovation.

The vast majority of those interviewed at AGMC perceive that, at least to some extent the future existence of AGMC was linked to the success of productivity and quality improvement programs such as QP4. Uncertainty seems to have been present at AGMC. Unfortunately, it is not possible to determine the effect it had on the success of QP4.

Obstacles Encountered

Research objective five: "Discover what obstacles were encountered during the initiation, adoption, and implementation phases of QP4." will be addressed in the section. Examination of the obstacles by phases should be most useful to future innovators, because their innovations will probably go through the same phases.

Initiation Phase. The most serious obstacles encountered during the initiation phase was a lack of time experienced by those who introducing the concept. These people were responsible for performing their regular duties, so the introduction of the concept was an additional duty. The other major obstacle involved convincing upper management that this would not be "just another program". Great effort was required to assure management that the benefits would be substantial, and long-term. These efforts were complicated by the need to be "bilingual". To put it another way, those involved in the initiation effort had to be able to communicate effectively to the rank and file workers, as well as to management. One HQ, AFLC manager mentioned that answering the question of what is broke, was a major obstacle. Introducing the concept involved convincing the organizational members that there was a need for change.

An obstacle was created during this phase, that has haunted the program in the implementation phase. The familiarization effort focused too much on upper management at the expense of middle management (branch and section

level). This problem was acknowledged by both the AGMC and the HQ, AFLC managers.

Adoption Phase. The main obstacle faced during this phase was the determination of where the funding for the program would come from. There seemed to be a widespread belief that there was not enough money available to fund QP4, because of the large amount of training required. At AGMC, at least, the availability of PACER IMPACT funding helped alleviate this obstacle. Middle management's unwillingness to change was also mentioned as an obstacle. This unwillingness was perhaps compounded by the lack of emphasis on familiarizing middle management with the concept in the initiation phase.

Implementation Phase. Lack of commitment to the program by middle management was the most commonly mentioned obstacle in this phase. To a large extent, middle management seems to have been left out of the initiation, adoption and implementation efforts. Being left out, middle managers probably do not fully understand what their role is in QP4. Moreover, they apparently do not have a sense of ownership of the program.

The lack of time to perform both regular duties and QP4 associated duties has apparently extended from the personnel introducing the concept to all levels during this phase. A shortage of time was mentioned by a PAT Team, a technical advisor, as well as three of the AGMC managers. Compounding this problem, three AGMC managers said that it has been

difficult to persuade first-line supervisors to give their workers time for their QP4 duties. It is hoped that program successes will help convince supervisors that time spent on QP4 duties is well spent. There was also a fairly widespread belief that the QP4 training has been too oriented toward teaching SPC techniques. As a result of this orientation not enough training has been conducted on team building, or people oriented skills, which are crucial to an effort that requires widespread participation. The training was being revised to include more team building skills, at the time the interviews took place. The attitude that QP4 is "just the program of the month" carried over into this phase, according to four of the PAT Teams and one of the technical advisors. However, this attitude appears to be centered at the lower echelons of the organization, since none of the managers mentioned this as a problem. Interestingly, nobody who pointed out this problem, had the "just the program of the month" attitude. The overwhelming majority of PAT Team members that were interviewed believed that this program was of a more permanent nature. Thus, it is possible that the more contact people have with the program, the less likely they are to have the attitude that QP4 "is just the program of the month".

The HQ, AFLC managers were more preoccupied with promoting consistency across the command, while avoiding standardizing of the QP4 program. The concern here is mainly to assure that everyone uses the same terms, so that

effective communication can take place. Terminology aside, it is hoped that QP4 will be more vibrant and effective if there is less mandatory guidance from HQ, AFLC. The current accounting systems are not capable of measuring the costs that are pertinent to QP4. This leaves HQ, AFLC with the options of either living with the current inadequate accounting system, or going to the expense of modifying the accounting system. Further, if the accounting system is modified the decision must be made as to what costs are relevant.

Applicability to Future Innovations. Many of the obstacles that the QP4 program has faced are probably unique to this innovation. However, the degree of uniqueness is dependent upon the type of innovation they are compared with. By examining these obstacles, perhaps a more realistic perspective can be attained. Future innovators should pay attention to some obstacles, such as the way middle management has been neglected during the innovation process of QP4, because such obstacles are applicable too a broad range of innovations.

AFLC's Method of Nurturing Innovation

AFLC has a variety of good programs that promote innovation. The programs themselves seem to be well designed. However, the responses to the interview question: "What individual incentives do you believe are present in the Air Force to encourage innovations such as QP4?", showed that few people were aware of more than one or two of the

programs. Since most of the programs depend on workforce participation, it is a logical conclusion that the programs should be better publicized. Perhaps such avenues as workforce presentations, and distribution of pamphlets to individuals could be used more effectively. Better publicity would help AFLC capitalize on the considerable effort and resources that these programs represent.

Major Decision Points

This section helps answer research objective seven: "Determine what the major decision points have been in the QP4 program." Knowledge of what the major decision points for innovations are can be a valuable planning tool for future innovators. With this knowledge future innovators can more effectively devise their strategy by focussing their attention on the major decisions that will need to be made.

The most frequently mentioned decision points will be discussed first. Introduction and familiarization with the concept is just a first step. After the concept had been introduced to AGMC, management had to determine precisely what type of program should be developed. Not only is there the need to develop a program, but the decision had to be made as to which area of the organization the program should be implemented in first. Such factors as the "culture" of the department, the type of work performed, the type of problems likely to be faced, and what areas are likely to show early successes should be considered when deciding where to initially implement. Besides developing a program, there

must be a means of funding the effort. The availability of funding is critical to the innovation process. Access to outside funding, decreases the risks involved in the innovation process. In other words, when an organization is not gambling its own hard to obtain funding on an innovation the risk is diminished (9:680). Access to PRAM funding lowered the risk of undertaking the QPI pilot. Next, determination of whether the pilot was successful was common to both AGMC and HQ, AFLC. This determination had to be made so that the decision could be made as to whether or not to formalize the pilot into a full blown program. The task of determining whether the pilot was successful is easier when the criteria of success is well defined in advance. Other decision points included determining how to disseminate information, what type of training to perform, who should perform the training, and whether to use a contractor/consultant.

Feedback and Control System

This section address the research questions: "What system has been established to monitor the implementation effort?", and "How effective has the implementation monitoring system been?" Although not much research has been conducted on the subject of implementation monitoring, Gray has developed an implementation monitoring framework. Gray describes his framework as follows:

First, the ranking of program components determines the relative importance of various aspects of the new program. Second, the evaluation is started during

the implementation process, and long before any complete implementation is expected. Once started the evaluation is continually updated until all implementation falls into two different categories, fidelity and sufficiency. For fidelity the task is to assess what aspects of the innovation have been implemented, what have been dropped, and what have been altered. Sufficiency focuses on those parts which were altered to assess whether the alterations fulfill the function of the omitted part and therefore will support the goals of the innovation (23:11).

The key to this framework is a preranking of the various components of an innovation. Components are ranked according to their importance to the success of the innovation. This ranking provides a prioritized criteria in which to appraise how well the implementation effort is proceeding. More importantly, these criteria provide a basis for determining what control actions need to take place.

Responses to the interview question: "How effective have the feedback and control systems been?", indicate that no formal preranking of program components took place.

Responses to this question revealed that the AGMC managers believe that the feedback and control function is being performed effectively. Feedback and control appears to be fairly effective, even though half of the respondents said that no formal system was established. Some of the feedback mechanisms mentioned were informal communication, monitoring of PAT Team meeting minutes, management attendance at PAT Team meetings, feedback at the weekly instructors meeting and reports to the Steering Committee. Control is exercised at the Steering Committee, and Executive Group meetings, as well as the weekly instructors meeting. Thus, the management

structure of QP4, seems to be a reasonably effective mechanism channeling feedback to those who are responsible for control. The establishment of the Executive Group and the Steering Committee has provided an accessible forum where control can take place. Still, preranking of the components of innovation, combined with evaluation based on the fidelity and sufficiency of each of the components would have been beneficial. If a framework similar to Gray's had been followed, feedback and control would probably have been more straight forward and effective.

Organizational Culture

The process management approach to quality and productivity is a radical departure from the inspection oriented approach that has traditionally been used in AFLC. Equally relevant is the fact that many innovations involve a change to the organization's "culture". In view of this, the research question: "How have the implementation efforts taken into account organizational culture?", was formulated.

Responses to the interview question: "What kinds of efforts have been made to analyze the effect that the existing organizational culture will have on QP4?", indicate that no formal effort was made to analyze how the existing "culture" would effect QP4. The only effort that was made to determine how the existing organizational "culture" would effect QP4, was an informal effort by the three people who were instrumental in introducing the concept that QP4 is based on. A more in-depth analysis of the existing

organizational "culture" may have made it possible to avoid some of the obstacles that occurred.

VI. Conclusions and Recommendations for Future Research

Conclusions

Overview. This research was exploratory in nature. The intent of the research was to gain a basic understanding of how successful innovations occur in the Air Force in general, and in AFLC in particular. It is hoped that this understanding will be helpful to decision-makers in improving the method used to nurture innovations. The case study approach precluded investigating any particular facet of innovation in an empirically rigorous manner. In view of this, recommendations for future research will be made.

The Success of QP4. This research was a case study of a single innovation. A case study approach made it possible to investigate most aspects of the innovation process as they applied to QP4. QP4 was chosen because it appeared to be a successful innovation, although it is still in the implementation stage. Since most of the findings of this research are based upon the QP4 innovation, an attempt was made to determine how successful QP4 is as an innovation. A theoretical framework developed by Goodman et al, was used to assess the success of QP4. This framework allows for evaluation based upon four dimensions - knowledge, behavior, attitudes/evaluations, and normative/value consensus. Notwithstanding that QP4 is still in the early stages of the implementation phase, it was judged to be reasonably successful along the first three dimensions. Success along

the normative/value consensus dimension was not evaluated. It should be stressed, however, that even with this framework, assessment of the success is still very much a subjective undertaking. Beyond evaluating QP4 using the just mentioned framework, there were \$490,000 in verified savings during the one year QPI pilot. Furthermore, QP4 has lowered recycle rates, which are an indicator of quality.

Insights. It was determined that the Air Force has a variety of good programs that promote innovation. Programs are available, such as PRAM, that provide funding for potential innovations. The funding provided by these programs reduces the risk for organizations considering innovations. Other programs such as PACER INNOVATE provide a means of circumventing regulations which would otherwise prevent a particular innovation from occurring. Judging from the responses to: "What individual incentives do you believe are present in the Air Force to encourage innovations such as QP4?", it appears that these programs should be better publicized. Most of the respondents named only one or two programs. These programs depend upon workforce participation.

Compatibility. Many of the respondents mentioned that the existence of the PAC program had made transition to QP4 easier. Previous research suggests that compatibility between innovations and the organization acts as a moderating factor between centralization and the adoption of innovation. This relationship between compatibility and adoption,

suggests that incremental innovations can pave the way for more radical changes later on.

Balance. The PRAM program was instrumental to the QP4 innovation by providing funding for a pilot. PRAM an administrative innovation, helped promote further innovation - QP4. Similarly, many of the interviewees asserted that QP4 has provided a methodology and organizational climate which makes further administrative and technical innovation more likely. Previous research has shown that a balance between administrative innovation and technical innovation promotes higher organizational performance. Moreover, administrative innovation can pave the way for further innovations (10:392). These findings suggests that decision-makers should evaluate the organization to determine what types of innovations will be most beneficial.

Boundary Spanning Activity. The concept behind QP4 was introduced to the managers of Newark A.F.B. through their participation in professional organizations. Being networked to the surrounding community was also helpful. Newark A.F.B. and the Newark Chamber of Commerce cosponsored a seminar that helped raise awareness of the concept behind QP4. Previous research has recognized the importance to the innovating organization of gathering information from the external environment and transmitting it internally (37:587). Boundary spanning activities should be encouraged. Without such activities the initiation phase of the innovation process is likely to be adversely effected.

Innovation Champions. Champions apparently played a crucial role in all three phases of the innovation process in QP4. The enthusiasm that champions inject into the innovation seems to be one of the key ingredients of successful innovation. In recognition of this some means must be found to better reward and encourage champions.

Organizational Culture. The effect of the existing organizational culture on QP4 was only informally analyzed. A more in-depth analysis of the existing organizational culture might have made it possible to avoid some of the obstacles that were encountered with QP4.

Feedback and Control. Respondents indicated that feedback and control for QP4 has generally been effective. The organizational structure was designed to facilitate feedback and control. However, no preranking of program components took place. Such a ranking would have facilitated more effective feedback and control during the implementation phase.

Aids for Future Innovators. The innovation strategy that was used for the QP4 program is documented in Chapter 4. The obstacles that were encountered are documented in Chapters 4 and 5. Major decision points are also documented in Chapters 4 and 5. It is hoped that future innovators will benefit from examining the strategy behind QP4, and the obstacles this strategy encountered. Examination of the major decision points should also be an

aid to future innovators by pointing out some of the decisions that will have to be made.

Recommendations for Future Research

Further research is advised in many areas. Since this study was exploratory, many of the findings have not been rigorously examined. Recommendations for further research include the following:

1. Some method must be devised for determining how successful an innovation is. The approach advocated by Goodman et al. is a good candidate (22:1-6). However, other approaches should be examined. Moreover, it may prove fruitful to modify Goodman's approach. Once a method is chosen, it will be possible to evaluate all innovations against the same criteria.

2. The role that feedback and control mechanisms play in the innovation process, should be more thoroughly examined. Intuitively, Gray's model seems to be a useful tool for innovators (23:11). Unfortunately, no empirical research could be found to substantiate the usefulness of this model.

3. More research needs to be conducted to determine the effect that the existing organizational "culture" has on innovations. A better understanding of this relationship would be helpful to future innovators, by allowing them to develop more effective innovation strategies.

4. AFLC's method of encouraging innovation should be more rigorously examined. Some of the programs that tend to

encourage innovation were listed in this study. However, due to time constraints, an in-depth investigation was not conducted. It is difficult to improve the status quo, unless the status quo is well understood.

5. The function of innovation champions should be researched further. If their role is as important as it now seems, better methods for encouraging, and rewarding champions need to be developed.

6. More longitudinal studies need to be conducted to determine how the events of the early innovation phases effect later stages. This study was cross-sectional. Yet, an attempt to assess all three phases of the innovation was made. Longitudinal research is better suited for this type of undertaking. A good starting point would be to examine QP4 at a later stage of the implementation phase. With such research, it would be possible to study how innovations are diffused throughout large organizations.

Appendix A: Deming's "14 Points"

1. Create constancy of purpose for improvement of product and service. Management must define what direction the organization should be headed. This direction must then be articulated into goals and strategies so that the public, the customers and the employees understand what to expect from the organization.

2. Adopt the new philosophy of refusing to allow defects. It must be understood that the organization can no longer live with: 1) accepted levels of mistakes, 2) materials that are not suited to the job, 3) people who do not know what their job is and are afraid to ask, etc.

3. Cease dependence on mass inspection and rely only on statistical control. Responsibility for inspection should be delegated to the worker involved with the product. Organizations must require statistical evidence of process control.

4. Reduce the number of vendors, requiring suppliers to provide statistical evidence of quality. Materials and services should be bought on the basis of quality as well as price. The vendor(s) that meet the organization's requirements must be identified, and worked with.

5. Recognize that there are two sources of waste and defects. The cause of errors can be traced to either management or the worker. Typically, management accounts for

about 80 to 85 percent of the errors, and workers account for the rest.

6. Train all employees, and institute modern aides to training on the job. It is important that statistical methods be used in training.

7. Give all employees the proper tools to do the job right. There are several requirements for achieving permanent quality improvement. More time must be found to help people on the job. Statistics must be used to distinguish between local faults and system faults. Finally, management must stop blaming the workforce for faults in the system.

8. Encourage communication and productivity. Management needs to eliminate the atmosphere of fear that prohibits employees from taking risks. To do this management must form partnerships that give everyone job security. A method of compensation and rewards which helps the worker identify with the prosperity of the organization should be established.

9. Encourage different departments to work together on problem solving. Employees from the various departments must understand the problems that the other departments face. Moreover, they must understand the interrelationships.

10. Eliminate posters and slogans that do not teach specific improvement methods. Goals and slogans are management's way of circumventing its responsibility toward

quality. If goals and slogans are the only action management takes, the gap between management and the workers widens.

11. Use statistical methods to continuously improve quality and productivity. Do work standards take into account quality as well as quantity, or are shipments made that are deficient in quality so that the schedule can be met?

12. Eliminate all barriers to pride in workmanship. Everyone in the organization needs to understand statistical reasoning and be able to use elementary statistics. Since the systems in use today can be measured quantitatively, they can be described and analyzed using statistics. Managerial decisions should be based on valid relevant data. Everyone involved in gathering, analyzing, discussing and/or deciding on the data should be able to reason statistically.

13. Provide ongoing retraining to keep pace with changing products, methods, etc. Organizations must be dynamic to keep pace with their changing environment. Thus, as technology, methods, equipment etc. change workers must be trained. They must know how to use, operate and maintain the equipment. Furthermore, if new management styles demonstrate that they are effective, managers need to adapt themselves to the new techniques.

14. Create a Structure in top management that will push every day on the above 13 points. This will help to define top management's permanent commitment to quality.

Management's actions as well as its words must demonstrate its commitment to quality (28:24; 33:14).

Appendix B: Responses to the Interview Questions

Exhibit 1

RESPONSES TO: WHAT MAJOR OBSTACLES WERE
ENCOUNTERED WHEN INTRODUCING THE QP4 CONCEPT
TO AGMC AND THEN TO AFLC?

(By the Six AGMC Managers who responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 3 | A lack of time experienced by those involved in introducing the concept. |
| 3 | Not enough effort expended to familiarize middle management (branch and section level) with the concept. |
| 2 | Attitude on behalf of organization members that this is "just another program". |
| 2 | A shortage of funding for the effort. |
| 1 | The need to show that the program wouldn't just benefit those who were promoting it. |
| 1 | The need to be "bilingual" in order to explain the benefits of QP4 to both management and the working level employees. |

RESPONSES TO: WHAT MAJOR OBSTACLES WERE
ENCOUNTERED WHEN INTRODUCING THE QP4 CONCEPT
(By the Three AFLC Managers who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | Gaining the commitment of middle management (branch and section level). |
| 2 | The shift from a product to a process orientation. |
| 1 | Answering the question: "What is broke?" |
| 1 | Gaining the commitment of the AFLC managers. |
| 1 | Determining who the targets were. |

Exhibit 2

RESPONSE TO: WHAT WERE THE MAJOR OBSTACLES WHEN
TRYING TO PERSUADE AGMC AND THEN AFLC
TO ADOPT THE QP4 PROGRAM?

(By Five AGMC Managers and One HQ, AFLC Manager)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | The belief that there was a lack of money and resources for a program like this, (one AGMC manager and one HQ, AFLC manager). |
| 1 | The unwillingness of middle management to change, (AGMC manager). |
| 1 | The difficulty in determining who the silent dissenters were, (AGMC manager). |
| 1 | The fact that their were budget driven manpower cutbacks at the time of adoption, (AGMC manager). |
| 1 | Deciding who would do the training, (HQ, AFLC manager). |

Exhibit 3

RESPONSES TO: WHAT OBSTACLES HAVE BEEN ENCOUNTERED
DURING THE IMPLEMENTATION OF QP4?

(By the Six AGMC Managers Who Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 3 | Convincing first-line supervisors to give their workers time for their QP4 duties. |
| 3 | There has never been a defined role for middle management in QP4. This has caused this group to feel left out. As a result, QP4 doesn't have the full support of most middle managers. Many middle managers don't see the need for their direct participation in the program. |
| 2 | The training is too oriented toward teaching SPC techniques as opposed to team building skills. |
| 1 | A lack of understanding of the long-term cultural impact that QP4 will have on the organization. |
| 1 | The first groups of people who were trained didn't have the opportunity to apply what they had learned immediately after their training. |
| 1 | The statistics used in SPC were not oriented toward a repair environment. |
| 1 | The QP4 program is expanding rapidly, but the foundation is still shaky. |
| 1 | The rapid expansion of the program has strained the training resources. Therefore, those initially trained have not received any follow-on training. |
| 1 | QP4 is getting into areas that are harder to quantify. Thus it is harder to justify expending the resources on the expansion. |
| 1 | Implementing QP4 will involved massive organizational changes, (more decentralization, more participation, etc.). |

- 1 Work Center Teams are still in place, but are redundant to PAT Teams. This might create the appearance that there is no long term commitment to QP4.
- 1 Sustaining enthusiasm for the program until it is until it is the normal way of doing things.

**RESPONSES TO: WHAT OBSTACLES HAVE BEEN ENCOUNTERED
DURING THE IMPLEMENTATION OF QP4?
(By the Three HQ, AFLC Managers Who Responded)**

**NUMBER GIVING
THIS RESPONSE**

RESPONSE

- 2 The reluctance of quality personnel to accept their new roles in QP4.
- 2 Promoting consistency with the QP4 program across the command, without causing it to be standardized.
- 1 Providing assurance that the increase in productivity and quality will not result in job losses.
- 1 The implementation efforts have tended to leave middle management out. As a result, there is a lack of commitment on behalf of the branch and section level managers.
- 1 Working with archaic accounting systems that are not capable of measuring quality costs.

RESPONSES TO: WHAT OBSTACLES HAVE BEEN ENCOUNTERED
DURING THE IMPLEMENTATION OF QP4?

(By the Four Technical Advisors Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | Some people just don't want to apply themselves, because of resistance to change. |
| 2 | Some people don't like to gather data, and apply statistical techniques. |
| 1 | Middle managers (branch and section level) push production at the expense of QP4. |
| 1 | The attitude that QP4 is just the program of the month. |
| 1 | The conflicting demands of one's regular duties and the additional duties imposed by QP4. |
| 1 | Some people have a fear of working on a computer. |

RESPONSES TO: WHAT OBSTACLES HAVE BEEN ENCOUNTERED
DURING THE IMPLEMENTATION OF QP4?
(By Five PAT Teams That Were Interviewed)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 4 | The attitude that this is just the program of the month. |
| 2 | Statistics do not seem to be applicable to most of the problems that QP4 has been applied to, so far. Although statistics have the potential to be useful. |
| 2 | The training is too oriented toward teaching SPC techniques as opposed to team building skills. |
| 2 | Initially there was poor attendance at the PAT Team meetings, but there seems to be good attendance now. |
| 1 | High technical advisor turnover. |
| 1 | Poor communication across groups and shifts. |
| 1 | Lack of time to perform QP4 duties. |
| 1 | Difficulty in setting meeting times and places. |
| 1 | Lack of role definement for support personnel. |
| 1 | Lack initial publicity to make people aware of QP4. Some people were unaware of QP4 at the time they were asked to join CAT Teams. |
| 1 | The software used for the QP4 database is not user friendly. |
| 1 | The training was too statistically oriented. Not enough emphasis on problem solving skills. |
| 1 | Some problems are long-term, and frustrating. |

Exhibit 4

**RESPONSES TO: WHAT WERE THE MAJOR
DECISION POINTS FOR QP4?
(From the Five AGMC Managers Who Responded)**

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--|---|
| 4 | Determination of whether the pilot was working, and whether to spread the program. |
| 4 | Determination of what approach to take, and what management structure it should have. |
| 3 | The decision as to what area of the organization to implement the pilot. |
| 2 | Determination of where the funding for QP4 should come from. |
| 1 | Ascertaining whether process management was applicable to a repair environment. |
| 1 | Deciding whether to use a contractor for training, or to do it in-house. |
| 1 | Development of a statement of work, and contractor selection. |
| 1 | Determination of what type of training to provide. |
| 1 | Determination of how much money to spend on training. |

**RESPONSES TO: WHAT WERE THE MAJOR
DECISION POINTS FOR QP4?
(By the Two HQ, AFLC Managers Who Responded)**

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--|--|
| 2 | The decision to formalize QP4, based on the success of the 90-day prototype. |
| 1 | The decision to do a 90-day prototype on the already underway QPI program at Newark A.F.B. |

Exhibit 5

RESPONSES TO: WHAT INDIVIDUAL INCENTIVES DO
YOU BELIEVE ARE PRESENT IN THE AIR FORCE
TO ENCOURAGE INNOVATIONS SUCH AS QP4?
(From the Six AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 2 | The Air Force Suggestion Program. |
| 2 | Personal recognition. |
| 1 | A sense of accomplishment. |
| 1 | Senior civilians offer the continuity, that allows individuals to find long-term sponsors for innovations. |
| 1 | Managers that are willing to listen and provide encouragement. |
| 1 | QP4 has improved recognition for individuals, and hence is making further innovation easier. |
| 1 | The PRAM office provides funding for innovative ideas. |
| 1 | PACER INNOVATE. |
| 1 | R&M 2000. |
| 1 | There is a much emphasis on productivity in the command. Thus, when somebody has a new idea management is willing to listen. |
| 1 | The concept of encouraging risk taking is understood in the logistics command. |
| 1 | There is not much monetary incentive. |

RESPONSES TO: WHAT INDIVIDUAL INCENTIVES DO
YOU BELIEVE ARE PRESENT IN THE AIR FORCE
TO ENCOURAGE INNOVATIONS SUCH AS QP4?
(From the Two HQ, AFLC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|-------------------------------------|
| 1 | The chance for a promotion. |
| 1 | Personal recognition. |
| 1 | A personal sense of accomplishment. |
| 1 | Monetary awards are not effective. |
| 1 | Management must show that it cares. |

RESPONSES TO: WHAT INDIVIDUAL INCENTIVES DO
YOU BELIEVE ARE PRESENT IN THE AIR FORCE
TO ENCOURAGE INNOVATIONS SUCH AS QP4?
(From the Three Technical Advisors Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | A personal sense of accomplishment. |
| 1 | A management that is willing to listen. |
| 1 | There is no incentive for individuals to be innovative. |
| 1 | The personnel performance appraisal system. |

RESPONSES TO: WHAT INDIVIDUAL INCENTIVES DO
YOU BELIEVE ARE PRESENT IN THE AIR FORCE
TO ENCOURAGE INNOVATIONS SUCH AS QP4?
(From the Five PAT Teams That Were Interviewed)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | The Air Force Suggestion Program. |
| 2 | QP4 has provided a structure for introducing innovations by improving communications and reducing red tape. |
| 2 | A personal sense of accomplishment. |
| 1 | Personal recognition. |
| 1 | Frustration with the way things are. |

Exhibit 6

RESPONSES TO: HOW HAS QP4 INCREASED
QUALITY AND PRODUCTIVITY?
(From the Six AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 2 | By making people aware of the entire process. |
| 2 | QP4 improves both vertical and horizontal communication. |
| 1 | By providing a method for quantifying and analyzing the process. |
| 1 | QP4 has Let the workers know that somebody is listening. |
| 1 | QP4 has allowed workers to feel a sense of accomplishment. |
| 1 | QP4 has put the emphasis on teamwork. |
| 1 | QP4 has not been hampered by specific goals. |

RESPONSES TO: HOW HAS QP4 INCREASED
QUALITY AND PRODUCTIVITY?
(From the Three HQ, AFLC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 1 | QP4 has given us a systematic method to statistically analyze and solve problems. |
| 1 | QP4 has destroyed the myth that automation is a cure-all. |
| 1 | QP4 has destroyed the myth that productivity and quality improvement are incompatible. |
| 1 | QP4 has been successful because we realize that we are going to lose resources, but our workload will not decrease. |
| 1 | QP4 has defined what is wanted. |
| 1 | There are many examples of small incremental improvements. |

RESPONSES TO: HOW HAS QP4 INCREASED
QUALITY AND PRODUCTIVITY?
(From the Four Technical Advisors Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 2 | By making people aware of the entire process. |
| 2 | By providing a method of quantifying and analyzing the process. |
| 2 | QP4 improves both vertical and horizontal communication. |
| 1 | QP4 puts the emphasis on solving problems, rather than finding blame. |
| 1 | Only a small percentage of people are involved in each work area, and these are the PAT and CAT Team members. Therefore QP4 has not been very successful at increasing quality and productivity. |

RESPONSES TO: HOW HAS QP4 INCREASED
QUALITY AND PRODUCTIVITY?
(From the Five PAT Teams That Were Interviewed)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 3 | QP4 has made people more conscience of the need to increase productivity. |
| 2 | The recycle rate has been reduced. |
| 2 | By providing a method for quantifying and analyzing the process. |
| 1 | QP4 has improved communication. |
| 1 | Productivity seems to have decreased because of the time that has been diverted to QP4. |
| 1 | Many of the quality indicators show improvement. |
| 1 | Some of the QP4 projects have facilitated learning and higher job performance by inexperienced workers. |

Exhibit 7

RESPONSES TO: WHAT FACTORS DO YOU BELIEVE MADE
IT POSSIBLE FOR QP4 TO BE A SUCCESSFUL PROGRAM?
(From the PAT Teams That Were Interviewed)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 5 | Continuous and extensive upper management support. |
| 4 | Extensive working level support in applying new approaches to problems. |
| 3 | First line supervisors are very active in the program. |
| 2 | The worker on the floor realizes that someone will now listen to him/her, because of the openness fostered by QP4. |
| 1 | The PAC program laid the foundation for QP4. |
| 1 | A strong feeling that a program like this was needed. |
| 1 | The belief among people that the program will endure. |
| 1 | All of the organizations seem to be supporting QP4, which provides momentum for it. |

Exhibit 8

RESPONSES TO: TO WHAT DEGREE DO YOU BELIEVE
THAT QP4 HAS BEEN INSTITUTIONALIZED?
(From the Six AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 6 | QP4 has not been institutionalized yet. |
| 2 | Once the initial training is complete QP4 will be much closer to institutionalization. |
| 1 | QP4 is still thought of as a program, not a normal part of the job. |
| 1 | If QP4 is to be institutionalized, management must continually stress approaching problems by looking at the process. |
| 1 | There are not indicators in place that allow major management decisions to be made based on processes. |
| 1 | One of the limitations of our planning is that we didn't determine how to institutionalize QP4. |
| 1 | The more we utilize QP4, the more it will become institutionalized. |
| 1 | We must find some way of retaining the experience of technical advisors as they move from one area to another. |

RESPONSES TO: TO WHAT DEGREE DO YOU BELIEVE
THAT QP4 HAS BEEN INSTITUTIONALIZED?
(From the Three HQ, AFLC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 3 | QP4 has not been institutionalized yet. |
| 1 | It has been institutionalized to a higher degree at Newark A.F.B. |
| 1 | It has been institutionalized to a much higher degree at the upper and lower levels of the command. Middle management is the weak link. |
| 1 | QP4 must show success, and get everybody on board. There must be quantifiable measurements. QP4 must be removed from personalities, in order to gain consistency. Senior civilians must be behind the program. All of these things must take place before QP4 will be institutionalized. |

RESPONSES TO: TO WHAT DEGREE DO YOU BELIEVE
THAT QP4 HAS BEEN INSTITUTIONALIZED?
(From the Four Technical Advisors Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 3 | QP4 has not been institutionalized yet. |
| 1 | QP4 has for the most part been institutionalized. |
| 1 | The more we utilize QP4, the more it will become institutionalized. |
| 1 | QP4 is institutionalized only at the working level. |
| 1 | Most of the people are beginning to accept QP4 as the way of doing things. |

Exhibit 9

RESPONSES TO: HOW WAS COMMUNICATION ACCOMPLISHED,
AND WHAT TYPE OF INFORMATION WAS EXCHANGED DURING
THE PERIOD WHEN THE QP4 CONCEPT WAS BEING
INTRODUCED TO AGMC AND THEN TO AFLC?
(From the Three AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 3 | Briefings from experts in process improvement, to increase the awareness of top management. |
| 1 | Through the quality council that was formed during this period. |
| 1 | It was decided in advance who the audience should be. |
| 1 | The base newspaper was used. |
| 1 | Spent a great deal of time informally convincing key staff members of the concept's value. |
| 1 | Made quarterly updates on the success of process management programs in private industry. |

RESPONSES TO: HOW WAS COMMUNICATION ACCOMPLISHED,
AND WHAT TYPE OF INFORMATION WAS EXCHANGED DURING
THE PERIOD WHEN THE QP4 CONCEPT WAS BEING
INTRODUCED TO AGMC AND THEN TO AFLC?
(From the Two HQ, AFLC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 2 | The concept was discussed meetings that were not specifically scheduled for this purpose. |
| 2 | The concept was discussed at briefings, seminars, and conferences. |
| 2 | The concept was disseminated through written correspondence. |

Exhibit 10

RESPONSES TO: HOW WAS COMMUNICATION ACCOMPLISHED,
AND WHAT TYPE OF INFORMATION WAS EXCHANGED DURING
THE PERIOD WHEN THE QP4 PROGRAM WAS BEING ADOPTED
(From the Two AGMC Managers Who Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 1 | Discussed at all kinds of meetings. |
| 1 | HQ, AFLC personnel were invited to the training seminars for upper management. |

RESPONSES TO: HOW WAS COMMUNICATION ACCOMPLISHED,
AND WHAT TYPE OF INFORMATION WAS EXCHANGED DURING
THE PERIOD WHEN THE QP4 PROGRAM WAS BEING ADOPTED
(From the Two HQ, AFLC Managers Who Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 1 | The AFLC commander made it clear that he owned the process. |
| 1 | The concept was discussed meetings that were not specifically scheduled for this purpose. |
| 1 | The concept was discussed at briefings, seminars, and conferences. |
| 1 | The concept was disseminated through written correspondence. |

Exhibit 11

RESPONSES TO: HOW HAS COMMUNICATION BEEN ACCOMPLISHED, AND WHAT TYPE OF INFORMATION HAS BEEN EXCHANGED DURING THE CURRENT PERIOD WHERE THE QP4 PROGRAM IS BEING IMPLEMENTED AT AGMC AND THROUGHOUT AFLC?

(From the Six AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|-----------------------------|--|
| 4 | Executive Group meetings. |
| 4 | Steering Committee meetings have been used. Technical advisors and other PAT Team members have been invited to brief here. |
| 3 | The PIB system transmits executive summaries from the various ALCs. The executive summaries relate success stories. |
| 2 | Presentations in conjunction with PACER IMPACT. |
| 2 | Monthly video conferences are devoted to the subject of QP4. All of the ALCs participate in these conferences. |
| 2 | Internal customer/supplier relationships are encouraged. |
| 1 | Most of the regular conferences within the logistics command are utilized to discuss QP4 issues. |
| 1 | Informal communication is used. The quality center helps facilitate this informal mode of communication, by providing a focal point. |
| 1 | AGMC has provided training to personnel from HQ, AFLC, and to personnel from other ALCs. |
| 1 | The QP4 Focus Room is a centralized location where anybody can have access to such things as meeting minutes. |
| 1 | The AFLC commander examines each ALC's QP4 program as he travels. |

- 1 Managers sometimes attend PAT Team meetings. However, there are now so many teams that this form of communication is diluted.
- 1 Meeting minute taking skills vary, limiting the effectiveness of this form of communication.
- 1 Fear of the computer, limits the use of this medium for some people.
- 1 The increased effectiveness of communication is the most important factor in the increase in productivity.
- 1 There should be a dedicated person in each division to facilitate QP4 communication, and keep the program running smoothly.

RESPONSES TO: HOW HAS COMMUNICATION BEEN ACCOMPLISHED, AND WHAT TYPE OF INFORMATION HAS BEEN EXCHANGED DURING THE CURRENT PERIOD WHERE THE QP4 PROGRAM IS BEING IMPLEMENTED AT AGMC AND THROUGHOUT AFLC?

(From the Four Technical Advisors Who Responded)

NUMBER GIVING THIS RESPONSE

RESPONSE

- 2 Steering Committee meetings have been used. Technical advisors and other PAT Team members have been invited to brief here.
- 1 There should be a dedicated person in each division to facilitate QP4 communication, and keep the program running smoothly.
- 1 Other organizations are invited to send people to participate on CAT Teams.
- 1 Sometimes people from other organizations sit-in on PAT Team meetings.
- 1 Weekly PAT Team activity reports.
- 1 Meeting minutes are of limited value, because nobody reviews them.
- 1 Communication is poor. Information seems to be exchanged only at PAT Team meetings.

RESPONSES TO: HOW HAS COMMUNICATION BEEN
ACCOMPLISHED, AND WHAT TYPE OF INFORMATION
HAS BEEN EXCHANGED DURING THE CURRENT PERIOD
WHERE THE QP4 PROGRAM IS BEING IMPLEMENTED
AT AGMC AND THROUGHOUT AFLC?

(From the Three HQ, AFLC Managers Who Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 1 | The concept is discussed meetings that were not specifically scheduled for this purpose. |
| 1 | The concept is discussed at briefings, seminars, and conferences. |
| 1 | The concept is disseminated through written correspondence. |
| 1 | PACER IMPACT communication channels (PIB) are used. |
| 1 | Written paraphenelia is used. |

Exhibit 12

RESPONSES TO: HOW HAS COMMUNICATION BETWEEN
GROUPS BEEN ACCOMPLISHED?
(From the Five PAT Teams that were interviewed)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 5 | Meeting minutes are available for all teams or individuals to read. |
| 1 | There is a communication bulletin board in each area where the minutes and other pertinent information is posted. |
| 1 | The meeting minutes can be accessed through a local area computer network that utilizes Z-248s. |
| 1 | PAT Team communication is facilitated through the formation of CAT Teams, with members from more than one PAT Team. |
| 1 | There is a technical advisors meeting once a month where intergroup communication takes place. |
| 1 | Many PAT Team meeting times are rotated between morning and afternoon once a week, so that members on swing and graveyard shifts have the opportunity to participate every other week. |

Exhibit 13

RESPONSES TO: HOW DOES COMMUNICATION BETWEEN
THE DIFFERENT LEVELS OF THE ORGANIZATION TAKE PLACE?
(From the Four PAT Teams that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 4 | The Steering Committee is used for this type of communication. |
| 3 | Every level of the organization has access to the meeting minutes. |
| 1 | Management members frequently attend PAT Team meetings. |
| 1 | Executive Group meetings sometimes serve this purpose. |

Exhibit 14

RESPONSES TO: HOW EFFECTIVE HAVE THE ESTABLISHED
COMMUNICATION CHANNELS BEEN AT FACILITATING
THE GOALS OF QP4?

(From the Five PAT Teams that Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 5 | The communication channels have been effective. |
| 1 | There is much more two way communication between organization levels with QP4, than there was before. |
| 1 | The effective communication taking place is evidence that upper management cares about the program. |

Exhibit 15

**RESPONSES TO: HOW MUCH OF THE SUCCESS OF
QP4 CAN BE ATTRIBUTED TO THE EFFORTS
OF A SINGLE PERSON?
(From the Six AGMC Managers that Responded)**

**NUMBER GIVING
THIS RESPONSE**

RESPONSE

6 Much a the success of QP4 can be attributed
to the efforts of one to three individuals

**RESPONSES TO: HOW MUCH OF THE SUCCESS OF
QP4 CAN BE ATTRIBUTED TO THE EFFORTS
OF A SINGLE PERSON?
(From the Three HQ, AFLC Managers that Responded)**

**NUMBER GIVING
THIS RESPONSE**

RESPONSE

2 Much a the success of QP4 can be attributed
to the efforts of one to three individuals

1 Not that much of the success could be
attributed to the efforts of one or two
people. There was a group of people who
were responsible.

**RESPONSES TO: HOW MUCH OF THE SUCCESS OF
QP4 CAN BE ATTRIBUTED TO THE EFFORTS
OF A SINGLE PERSON?
(From the Four Technical Advisors that Responded)**

**NUMBER GIVING
THIS RESPONSE**

RESPONSE

2 Not that much of the success could be
attributed to the efforts of one or two
people. There was a group of people who
were responsible.

1 Much a the success of QP4 can be attributed
to the efforts of one to three individuals

1 Just about everybody has contributed to the
success of QP4.

Exhibit 16

RESPONSES TO: HOW HAS QP4 EFFECTED THE DEGREE
TO WHICH YOU PARTICIPATE IN THE DECISIONS
THAT EFFECT YOUR WORK?
(From the Five PAT Teams that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 5 | QP4 has greatly increased the degree to which we participate. |
| 2 | Everybody seems to communicate more, now that QP4 is in affect |
| 1 | Everybody, even those not on teams, has increased their participation. |
| 1 | The technical advisors have much more input. |

Exhibit 17

**RESPONSES TO: HOW DOES MANAGEMENT RESPOND
WHEN YOU REQUEST ASSISTANCE FROM THEM?
(From the Five PAT Teams that responded)**

**NUMBER GIVING
THIS RESPONSE**

RESPONSE

- | | |
|---|--|
| 3 | We have not actually faced that problem yet, but all indications are that they will be helpful. |
| 2 | They have responded well. |
| 1 | Management responds as a result of their direct participation in the program. Direct participation includes attendance at PAT Team meetings, Steering Committee meetings, etc. |
| 1 | First-line supervisors have responded very well. |

Exhibit 18

RESPONSES TO: TO WHAT EXTENT DO YOU PERCEIVE
THE FUTURE EXISTENCE OF AGMC TO BE LINKED
TO THE SUCCESS OF PRODUCTIVITY AND QUALITY
IMPROVEMENT PROGRAMS SUCH AS QP4?
(From the Six AGMC Managers Who Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|--|
| 2 | Quality and productivity improvement is extremely important to the future of this base. |
| 2 | AGMC's ability to increase productivity and quality is becoming increasingly important for its future, as the budget shrinks. |
| 1 | Quality and productivity improvement will have some impact, but not that much. |
| 1 | Quality and productivity improvement is not an important factor in determining AGMC's future. |
| 2 | AGMC is vulnerable because it is a small base. |
| 2 | A record of successfully taking on challenges has an impact on the workload we get here. Although, this record doesn't effect congressional level decisions. |
| 1 | Threats to AGMC's future are more related to changes in technology than not increasing quality and productivity. |

RESPONSES TO: TO WHAT EXTENT DO YOU PERCEIVE
 THE FUTURE EXISTENCE OF AGMC TO BE LINKED
 TO THE SUCCESS OF PRODUCTIVITY AND QUALITY
 IMPROVEMENT PROGRAMS SUCH AS QP4?
 (From the Four Technical Advisors that Responded)

NUMBER GIVING
 THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 4 | Quality and productivity improvement is extremely important to the future of this base. |
| 1 | The civil service cannot be competitive with private contractors, unless there are increases in quality and productivity. |

RESPONSES TO: TO WHAT EXTENT DO YOU PERCEIVE
 THE FUTURE EXISTENCE OF AGMC TO BE LINKED
 TO THE SUCCESS OF PRODUCTIVITY AND QUALITY
 IMPROVEMENT PROGRAMS SUCH AS QP4?
 (From the Five PAT Teams that Responded)

NUMBER GIVING
 THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 4 | Quality and productivity improvement is extremely important to the future of this base. |
| 1 | Quality and productivity improvement is not an important factor in determining AGMC's future. |
| 1 | The importance of increasing quality and productivity is magnified because of the budget crunch. |
| 1 | AGMC is vulnerable because contractors and other installations can take our workload away from us if we don't efficiently put out high quality products. |
| 1 | The importance of productivity and quality improvement to AGMC can be better understood by looking at what the Japanese automobile manufacturers have done to the the American manufacturers. |

Exhibit 19

**RESPONSES TO: HOW WILL ENTHUSIASM BE MAINTAINED
AFTER THE EASY PROBLEMS HAVE BEEN SOLVED
LEAVING ONLY LONG-TERM, DIFFICULT PROBLEMS?
(From the Four AGMC Managers that Responded)**

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--|---|
| 2 | Management will have to continually provide reinforcement to those involved in QP4. |
| 2 | The procedures of QP4 will have to become the routine way of doing business. |
| 1 | The workforce will have to be continuously informed that QP4 is a long-term commitment. |
| 1 | Upper level management will have to generate big top-down projects for QP4 to work on. |

**RESPONSES TO: HOW WILL ENTHUSIASM BE MAINTAINED
AFTER THE EASY PROBLEMS HAVE BEEN SOLVED
LEAVING ONLY LONG-TERM, DIFFICULT PROBLEMS?
(From the Three HQ, AFLC Managers that Responded)**

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--|---|
| 2 | The workforce will have to be continuously informed that QP4 is a long-term commitment. |
| 1 | Spectacular successes must be celebrated, in order to build momentum for QP4. |
| 1 | There are enough short-term items to keep the momentum going for QP4. |

RESPONSES TO: HOW WILL ENTHUSIASM BE MAINTAINED
AFTER THE EASY PROBLEMS HAVE BEEN SOLVED
LEAVING ONLY LONG-TERM, DIFFICULT PROBLEMS?
(From the Four Technical Advisors that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 1 | The workforce will have to be continuously informed that QP4 is a long-term commitment. |
| 1 | Tough long-term problems don't present a problem. We are already working on this type of problems. |
| 1 | The successes the program achieves will help keep it going. |
| 1 | There must be better incentive programs. |
| 1 | There need to be some type of goals. |

Exhibit 20

RESPONSES TO: WHAT KINDS OF EFFORTS HAVE BEEN
MADE TO ANALYZE THE AFFECT THAT THE EXISTING
ORGANIZATIONAL CULTURE WILL HAVE ON QP4?
(From the Six AGMC Managers that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 3 | There was not much effort to analyze the affect the existing organizational culture will have on QP4. |
| 2 | There was not much anticipation. However, we are now dealing with the cultural affects as we confront them. For instance, the training is being changed to include more team building skills. |
| 1 | The effects of culture are not fully understood, even at this point. |
| 1 | The three people who have pushed QP4 from the beginning informally analyzed the organizational culture. They decided the time was right for a program like this as indicated by: 1) an active suggestion program, 2) the small size of the organization makes communication easier, 3) the presence of a technically competent workforce, 4) management was well networked with the community, 5) the retention rate was high, 6) the organization was transitioning to new technology, and 7) the presence of a steady workload. |
| 1 | We are now anticipating, in effect, more of a horizontal organization to result from QP4. |

RESPONSES TO: WHAT KINDS OF EFFORTS HAVE BEEN
MADE TO ANALYZE THE AFFECT THAT THE EXISTING
ORGANIZATIONAL CULTURE WILL HAVE ON QP4?
(From the Three HQ, AFLC Managers that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|--|
| 2 | There was very little effort to analyze the effect that the existing organizational culture would have on QP4. |
| 1 | In 1981 a task force was assembled to determine how to improve quality in Maintenance (MA) across the command. At this time various people were interviewed from organizations throughout the command. to determine what could be done to improve quality. |

Exhibit 21

RESPONSES TO: HOW EFFECTIVE HAVE THE FEEDBACK
AND CONTROL SYSTEMS BEEN AT KEEPING
QP4 RUNNING SMOOTHLY?

(From the Six AGMC Managers that Responded)

| NUMBER GIVING THIS RESPONSE | RESPONSE |
|--------------------------------|---|
| 3 | Feedback and control mechanisms have been effective. |
| 3 | All we have are informal feedback and control mechanisms, but they have been fairly effective. |
| 2 | Everybody has direct access to the Quality Center. Thus, anybody can bring any problem to the attention of management through the Quality Center. |
| 2 | Performance indicators, such as recycle rates are one form of feedback. |
| 2 | Steering Committee meetings are used as a feedback mechanism, and to initiate corrective action. |
| 2 | The informal communication network is a valuable feedback mechanism. |
| 2 | There is a Friday morning meeting with instructors to plan for next week based on this week's experiences. This meeting is a form of feedback. |
| 1 | PAT Team meeting minutes are monitored. |
| 1 | Direct feedback is obtained when managers sit-in on PAT Team meetings. |
| 1 | There is a Directorate level Quality Council meeting once a month where feedback and action can take place. |
| 1 | It is impossible to develop any overall indicators or measurements, that could be used as a feedback mechanism. |
| 1 | Technical advisors are trained on how to get around obstacles. |

RESPONSES TO: HOW EFFECTIVE HAVE THE FEEDBACK
AND CONTROL SYSTEMS BEEN AT KEEPING
QP4 RUNNING SMOOTHLY?

(From the Two HQ, AFLC Managers that Responded)

NUMBER GIVING
THIS RESPONSE

RESPONSE

- | | |
|---|---|
| 1 | There are monthly video teleconferences, that are dedicated to matters concerning QP4. |
| 1 | PACER IMPACT benefits summaries document both the cost of PAT Teams, and the benefits from them. |
| 1 | The AFLC commander receives reports on QP4 every two months. |
| 1 | All ALCs have access to the PIB network, which transmits information about QP4. |
| 1 | Initially it was thought that a set of quality indicators needed to be developed specifically for QP4. However, the decision has been made to use the current quality indicators. |

Appendix C: Interview Guide Used for
Individual Interviews

INTERVIEW GUIDE

1. What strategy was used to:
 - A. To introduce the QP4 concept to AGMC and then AFLC?
 - B. To persuade AGMC and then AFLC to adopt the QP4 program?
 - C. To implement the QP4 program, once the decision to adopt it at AGMC and AFLC had been made?
2. What were the major obstacles that were encountered when:
 - A. Introducing the QP4 concept?
 - B. Trying to persuade AGMC and the AFLC to adopt the QP4 program?
 - C. Implementing the QP4 program?
3. What were the major decision points for QP4?
4. What individual incentives do believe are present in the Air Force to encourage innovations such as QP4?
5. How has QP4 increased quality and productivity?
6. To what degree do you believe that QP4 has been institutionalized?
7. How was communication accomplished, and what type of information was exchanged during:
 - A. The period when the QP4 concept was being introduced?
 - B. The period when the QP4 program was being adopted?
 - C. The current period in which the QP4 program is being implemented?
8. How much of the success of QP4 can be attributed to the efforts of an individual?
10. To what extent do you perceive the future existence of AGMC to be linked to the success of productivity and quality improvement programs such as QP4?

11. How will enthusiasm be maintained after the easy problems have been solved, leaving only long-term difficult problems?

12. What kinds of efforts have been made to analyze the affect that the existing organizational culture will have on QP4?

13. How effective have the feedback and control systems been at keeping QP4 running smoothly?

Appendix D: Interview Guide Used for
Group Interviews

INTERVIEW GUIDE
(Group)

1. What obstacles have been encountered during the implementation of QP4?
2. What individual incentives do you believe are present in the Air Force to encourage innovations such as QP4?
3. How has QP4 increased quality and productivity?
4. What factors do you believe made it possible for QP4 to be a successful program?
5. How has communication between groups been accomplished?
6. How has communication between the different levels of the organization taken place?
7. How effective have the established communication channels been at facilitating the goals of QP4?
8. How has QP4 effected the degree to which you participate in the decisions that effect your work?
9. How does management respond when you request assistance from them?
10. To what extent do you perceive the future existence of AGMC to be linked to the success of productivity and quality improvement programs such as QP4?

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VITA

Mr. Jacobs was born [REDACTED]

[REDACTED] He graduated from high school [REDACTED] in 1975. After graduating from high school he attended the University of Utah, from which he received a Bachelor of Science in Management, and a Bachelor of Science in Marketing in 1981. While attending the University of Utah Mr. Jacobs was hired by Hill A.F.B. as part of the Student Cooperation Program. Upon completion of his Bachelor of Science degrees he became an Aircraft Scheduler at Hill A.F.B. In 1985 Mr. Jacobs received a Masters of Human Resource Management degree from the University of Utah. Mr. Jacobs continued working as an Aircraft Scheduler until entering the School of Systems and Logistics, Air Force Institute of Technology, in June 1987.

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Department of Defense maintenance (DOD) budgets are expected to decline, while maintenance requirements are expected to rise. Innovation is one means of achieving the increased quality and productivity, necessary to meet DOD maintenance requirements in a decreased funding environment.

This research is a study of a recent Air Force innovation, QP4 - Quality for People, Process, Product and Performance. A case study approach was chosen.

QP4 was judged to be a successful innovation. QP4's success was due in part to the way that AFLC nurtures innovation. Factors that were found to be important to innovation within the Air Force setting include: the balance between administrative and technical innovation, the presence of boundary spanning activities, the presence of innovation champions, and advanced analysis of the existing organizational culture.

Since this was an exploratory study, there are several recommendations for future research. The recommendations for future research are: 1) development of a method for determining the success of innovations, 2) investigation of the role that feedback and control mechanisms have in the innovation process, 3) investigation of the effect of organizational culture on innovations, 4) further investigation of how AFLC encourages innovation, 5) investigation of the role of innovation champions, and 6) longitudinal studies of the process of innovation.

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