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A comparative analysis of high-technology aerospace technical and non-technical marketing managers

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A COMPARATIVE ANALYSIS OF HIGH-TECHNOLOGY AEROSPACE TECHNICAL AND NON-TECHNICAL MARKETING MANAGERS

A Dissertation

Presented to the

Graduate Faculty of the

School of Business and Management

United States International University

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

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by

Adolph Lambert Padilla

San Diego, 1988

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Approved by:

Frederick W. Dow — 5/2/88

F. W. Dow, Ph.D., Dean, Chairperson — Date

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G. D. Carey, Ph.D.

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My most sincere thanks to the other members of the Committee. Dr. F.R. Korf was extremely generous with his thoughts, methodology, valued technical assistance, and critical constructive evaluation. of this research. Dr G. D. Carey's participation and sincere professional analyses was especially appreciated.

DEDICATION

To my son, Rick, whose successful recovery was attributed to his will to live and renewed belief in himself and the almighty. . . . .

Also, to my grandson, Ryan. . . . .

This effort is dedicated as an apotheosis and encouragement for their happiness and success in life's endeavors. . . . .

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CHAPTER ONE

The Research Problem

In today's high-technology aerospace environment, engineers and scientists are likely to be an integral segment of that marketing and business development function. Their knowledge and understanding of that industry's technology base can well be considered a major prerequisite for effective high-technology aerospace marketing.

Normally, engineers assume key roles in manufacturing because issues of produceability and reliability have important technology overtones. Further, engineers, as marketing managers, can, and do play a vital role in the process of fitting together the technology of the aerospace business enterprise and the expressed needs of the high-technology marketplace.

Many of those marketing managers (engineers with formal education and training in engineering and scientific specialties) in high-technology aerospace companies arrived at their present managerial positions through the process of promotion from within the functional organizations such as engineering, program management, or from research and development positions, or were hired from a competitor company where marketing experience may have been gained.

Other sources of high-technology aerospace marketing managers in recent years are former government service employees - both civilian and military. Many of these people have outstanding program background credentials and a high level of professional management and leadership training and experience, but often lack training and experience as technology marketing specialists.

High-technology aerospace marketing managers evolve from two different and explicit backgrounds - technical and non-technical. The technical background manager is primarily from an engineering or scientific discipline. These managers are predominantly technology-trained and market-place-oriented, but may very well lack training or experience in management, administration and personnel skills.

The non-technical manager is predominantly from a business or liberal arts background in terms of education, training, and experience, and generally has an appreciable level of business management and administrative expertise.

The marketing manager's style of management has long been of interest and concern to CEO's and other top management, as well as to human resources managers.

Various theories have been proposed and examined in an effort to better understand those managerial functions and behaviors which spell success. Mintzberg (1973, 1980)

suggested a theoretical model which sought to classify diverse managerial behavior into a logical framework.

The thrust of the present study was to compare the managerial work attitudes and perceptions of high-technology aerospace marketing managers from two backgrounds, engineering and non-engineering.

The following five questions are posed for the present study:

1. To what extent are Mintzberg's managerial roles regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing management work in aerospace companies?

2. To what extent are Mintzberg's managerial skills and work characteristics regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing managerial work in aerospace companies?

3. To what extent do engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers?

4. What similarities and significant differences between engineers and non-engineers are evident from comparisons of the responses to the twelve demographic items of the questionnaire?

5. What significant relationships between demographic characteristics of the respondents and other variables of the study are evident in each of the two groups, and in the combined group of engineers and non-engineers?

The research utilized Mintzberg's framework of managerial roles, skills, and work characteristics in order to provide answers to questions one and two of the five research questions posed. The third question was specifically designed to determine the extent to which engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers. The fourth question uses the demographic characteristics obtained by the questionnaire in an attempt to identify similarities and significant differences between the surveyed engineers and non-engineers, as well as to investigate relationships between those variables and demographic characteristics. The fifth question was designed to identify the significant relationships between demographic characteristics of the respondents and other variables of the study that are evident in each of the two groups, and in the combined group of engineers and non-engineers.

Delineation

The research was concerned with managerial work attitudes and perceptions of (1) engineers performing high-technology marketing management work and (2) non-engineers performing the same kind of marketing management work in the high-technology aerospace industry. Alexander (1979), McCall and Segrist (1980), and Pavet and Lau (1985) found some support for the influence of functional specialty on the perceived importance of Mintzberg's managerial roles. However, these studies focused on managers in selected functional specialties such as production, sales, accounting, and Research and Development (R&D). While these studies lent support to Mintzberg's model of managerial work, the model has not been tested in the light of the job of the high-technology marketing manager.

The present study was designed to be a point of departure for expansion of the data base in two ways: (1) the study systematically gathered information about the managerial work attitudes and perceptions from marketing managers with technical and engineering backgrounds and (2) it concurrently provided a relative benchmark in the form of responses for identical items obtained from marketing managers with non-engineering (business or liberal arts) backgrounds.

The research was conducted with engineers and non-engineers performing high-technology marketing management

work while employed in the aerospace industry. The commonalty of the work environment permitted similarities and significant differences in managerial work attitudes and perceptions to be evaluated in terms of education and experience background variability.

The research questions were examined using Mintzberg's framework of managerial work with a sample population. In order to obtain the data requisite to answer these research questions, an instrument was constructed using the operational definitions which were provided in the description of Mintzberg's model. The instrument developed and previously used by Pavet and Lau (1985) in similar studies was modified slightly in format and demographics to fit the current study. This process constituted the basis for an empirical examination applying Mintzberg's model of managerial work.

The research setting was a large multi-division Aerospace company located in southern California.

Variables and Relationships

Detailed below are the study's variables categorized by their types.

Independent variables.

I. The engineer marketing manager -- An individual with a formal education in engineering or other scientific discipline and/or technical training

and experience in engineering who is performing high-technology marketing management work within an aerospace firm.

II. The non-engineer marketing manager -- An individual with a formal education in business or liberal arts who also is performing high-technology marketing management work within an aerospace firm.

Dependent variables - The dependent variables consisted of (1) the managerial roles, defined by Mintzberg (1973, 1980) as behaviors that contribute to the present-oriented and fragmented nature of managerial work, and (2) the managerial skills and work characteristics based on Mintzberg's description of how managers perform their work.

I. Mintzberg's managerial role categories are defined as interpersonal, informational, and decision roles. These are further broken down into the ten dependent variables described as follows: (An eleventh role [Technical Expert] was added by Pavett and Lau (1980) based on interviews with public sector executives, and is used in this study). Sample items defining each role are presented in Table 1.

a. Interpersonal roles

(1). Figurehead, Symbolic head; obliged to perform a number of routine duties of a legal or social nature.

TABLE 1

Example Items for Each Managerial Role

Role	Example Items
Figurehead	•Making yourself available to consumers or sponsors. •Touring your organization's staffs and facilities.
Leader	•Providing guidance and direction to your subordinates. •Attending to the training and development needs of your subordinates.
Liaison	•Attending outside conferences or meetings. •Developing personal relationships with people outside your unit who sponsor your work.
Monitor	•Staying tuned to what is going on in outside organizations. •Monitoring output of formal management information systems.
Disseminator	•Keeping members of your work unit informed. •Transmitting ideas and information from outside contacts.
Spokesperson	•Keeping sponsors, consumers or others informed about your unit's activities. •Keeping professional colleagues informed about your unit.
Entrepreneur	•Maintaining supervision over planned changes to improve your unit. •Evaluating the outcomes of internal improvement projects.
Disturbance Handler	•Resolving conflicts either within your unit or between units. •Taking immediate action in response to a crisis.
Resource Allocator	•Attending to the staffing requirements in your unit. •Distributing budgeted resources.
Negotiator	•Handling formal grievances. •Negotiating with groups outside your organization for necessary materials.
Technical*	•Identifying and solving complex scientific or engineering Expert problems. •Providing technical quality control through the review process.

SOURCE: Henry Mintzberg, The Nature of Managerial Work, (New York: Harper & Row, Pub., 1973); *Pavett and Lau (1980).

(2). Leader, Responsible for the motivation and activation of subordinates; responsible for staffing, training and associated duties.

(3). Liaison, Maintains self-developed network of outside contacts and informers who provide favors and information.

b. Informational Roles

(1). Monitor, Seeks and receives wide variety of special information (much of it current) to help him develop a thorough understanding of the organization and its environment; he emerges as the nerve center of internal and external information about the organization.

(2). Disseminator, Transmits information received from outsiders or from other subordinates to members of the organization; some information factual, some involving interpretation and assessment of organizational influencers.

(3). Spokesperson, Transmits information to outsiders on organization's plans, policies, actions, organization's industry.

c. Decision Roles

(1). Entrepreneur, Searches organization and its environment for opportunities and initiates "improvement projects" to bring about change; supervises design of certain projects as well.

(2). Disturbance Handler, Responsible for corrective action when organization faces important, unexpected disturbances.

(3). Resource Allocator, Responsible for the allocation of organizational resources of all kinds--in effect the making or approval of all significant organizational decisions.

(4). Negotiator, Responsible for representing the organization at major negotiations.

(5). Technical Expert, Providing expertise to projects. Serving as a consultant to internal or external projects.

II. Mintzberg's managerial skills and work characteristics are described below:

a. Mintzberg's four managerial skills groups consist of the following: (Example items for each of the skills groups are listed in Table 2)

Table 2

Mintzberg's Managerial Skill Categories
And Related Example Items

Skill Category	Relevant Sample Items
1.Conceptual Skills	• Ability to undertake systematic planning. • Time management ability. • Ability to evaluate the feasibility of new projects. • Ability to reach conclusions with a minimum of information. • Critical thinking; questioning methods and techniques that others take for granted. • Diagnosing problems. • Good memory for facts. • Mathematical skills.
2.Human Skills	• Working long hours. • Patience. • Flexibility. • Coolness under stress. • Ability to sell one's ideas; persuasiveness. • Ability to communicate verbally. • Ability to communicate in writing. • Listening carefully to others.
3.Technical Skills	• Analyzing financial data. • Budgeting skills. • Technical ability in your specialty (e.g., science, engineering, marketing, personnel, financial mgmt). •Keeping up-to-date in your technical specialty.
4.Political Skills	• Ability to get the information you need to do your job. • Ability to create an environment in which subordinates work effectively. • Friendships and connections with superiors. • Survival skills, being able to protect one's self and one's position from others. • Building a power base. • Building and maintaining a network of contacts. • Developing and maintaining social relationships with work associates. • Willingness to take risks. • Willingness to question directives or orders from above. • Crisis management ability.

a. Conceptual skills

b. Human skills

c. Technical skills

d. Political skills

b. Mintzberg's managerial work characteristics applied to the current study are listed in Table 3.

Table 3

Mintzberg's Managerial Work Characteristics

Job Characteristics
1. The majority of information comes from sources other than the formal Management Information System (M.I.S.).
2. The job is present-oriented, precluding time for self development.
3. The daily work routine is fragmented with interruptions and unscheduled events.
4. The greatest block to doing the job is the constant barrage of "fire drills."
5. Meetings burn up an unnecessary amount of time.
6. It is virtually impossible to set and stick to a work schedule.
7. Managers with a technical/professional background are generally more loyal to the organization than to their profession.
8. Socializing constitutes an important part of a manager's job.
9. Briefings and official tours interfere with ability to do an effective.job

The Research Approach

The descriptive-correlational approach was selected for the current study because this approach expands on characteristics of elements which have been observed. As noted by Emory (1980:113), the applicability of descriptive research is appropriate in studies designed to assess the nature of human behavior, advocating that this approach could "describe phenomena or estimate the proportions of the population that have certain characteristics."

The intent of the study was to compare high-technology marketing managers from two backgrounds by applying Mintzberg's framework of managerial work in a high technology aerospace setting. The research assessed the respondents' managerial work attitudes and perceptions of the various managerial roles, skills, and work characteristics defined by Mintzberg's model. Since the model which formed the basis for the research already had been formulated, the intent of the current study was to provide evidence relative to the applicability of that model to the high-technology marketing managers in aerospace firms.

The study was designed to answer the stated research questions.

Criteria for Data Source

A criterion for the data source identified to form the basis for the findings reported in the current study specified that the participants be employed in a major high-technology aerospace firm located in Southern California. In addition, the individuals who were administered the questionnaire developed for the study were required to have been employed in a managerial position at the time the study was conducted and be performing marketing-related work.

Background

Defining the exact nature of the manager's job is somewhat elusive. Yet the effective performance of the job is essential to both personal and organizational success. Every year thousands of people attend management seminars and go into MBA programs hoping to learn how to become effective managers or to enhance their current managerial performances. However, management education has come under sharp criticism (Stewart, 1984) partly because of the outdated assumptions that it makes about the nature of managerial work. Historically, the 1916 work of Fayol has dominated management theory, textbooks and courses. The underlying framework of most management education tools is based upon Fayol's portrayal of the manager as a reflective planner, organizer, leader, controller and decision maker.

More recent management theorists and researchers (e.g.,

Bales (1950); Carlson (1951); Kotter (1982); Luthans, Hennessey & Rosenkrantz (1983); McCall & Segrist (1980); Mintzberg (1973, 1980); Morse & Wagner (1978); Pavett & Lau (1983,1985); and Stewart (1982) recognize the fact that the manager is not the controlled, reflective planner that the textbooks portray. As an outcome of either observational or survey research, there is evidence that managers engage in a number of diverse behaviors that far transcend Fayol's original framework.

There are several recent frameworks and empirical studies that could be used to describe managerial work. For example, Stewart (1982) proposed a framework for examining managerial work. She pointed out that management work can be encompassed in three broad categories: demands common to a job that must be done; choice in the tasks that can be done; and constraints that limit what the job holder can choose to do. Kotter (1982) in his multiple method research, found that top managers spent a considerable amount of time interacting with others (oftentimes outside their own work unit) and having short and disjointed conversations that consisted mainly of joking and talking about non-work related topics.

The above examples essentially corroborate the earlier work of Mintzberg (1973, 1980) who concluded that managers do not follow the typical management prescriptions that focus on the manager as a reflective planner, organizer,

controller and leader. Instead, the manager's job is seen as involving a diverse set of roles and behaviors that contribute to the present-oriented and fragmented nature of managerial work.

Based upon observation of five chief executives, Mintzberg (1973, 1980) proposed a typology for describing the nature of managerial work. He maintained that managers perform the ten different but highly interrelated roles shown in Table 1 on page 8.

According to Mintzberg, a manager's job can be characterized as fragmented, present-oriented and predominantly reactive rather than proactive. However, the degree to which these characteristics accurately describe a manager's job should be contingent upon the manager's functional specialty. Differences in time orientations may produce differences in the way managers from differing functional specialties, educations, experiences, and backgrounds view the characteristics of their jobs.

Mintzberg's framework of managerial work was used as the basis for the present investigation for several reasons. First, recent management textbooks (e.g., Kast & Rosenzweig, 1985; Robbins, 1984; Steers, Jngson & Mowday, 1985) have incorporated the work of Mintzberg (1973, 1980) into the traditional management topical areas. Hence, students of management are regularly exposed to this particular view of managerial work. Second, unlike the other recent

investigations into the nature of management, several previous research studies have used Mintzberg's typology both to describe managerial work and to predict managerial success. Several studies such as those of Alexander (1979), Kurke and Aldridge (1979), McCall and Segrist (1980), Morse and Wagner (1978), Paolillo (1981), and Pavett and Lau (1980, 1983, 1985) have used Mintzberg's framework as a basis for paper-and-pencil surveys that were administered to diverse samples. In general, these studies indicate that Mintzberg's managerial framework is useful for examining the similarities and significant differences of his various managerial roles as they are perceived by managers from different functional specialties and backgrounds.

The present study attempts to provide additional research data which can be of value to aerospace marketing executives, technical managers, and human resources managers. The current study results may also have a bearing in influencing the decision process in selection, placement, training, promotion, and organizational planning activities. Additionally, engineers and non-engineers contemplating high technology marketing management careers may also consider and apply the findings of this research when analyzing their own backgrounds and experience, and may see more clearly how their own attitudes and perceptions towards the various managerial roles and job characteristics offsets the overall achievement of their objectives.

Summary

This chapter presented the research problem, the research approach, a description of Mintzberg's (1973, 1980) theoretical model of managerial roles and its corroborating support that management is not characterized by the traditional view of its functions. Mintzberg's managerial framework was chosen because of previous studies which indicated that it is useful for describing the nature of managerial work and for examining similarities and significant differences in the perceptions of these roles by engineers and non-engineers. The research design was specified as descriptive-correlational and was focused on determining the extent to which the theoretical framework developed by Mintzberg was supported by the responses provided by high-technology marketing managers of major aerospace firms located in Southern California

The research empirically compared engineer-managers with non-engineer managers [both groups performing high-technology aerospace marketing management work] and how these two groups perceive the managerial roles, skills, and characteristics defined by Henry Mintzberg.

The study employed Mintzberg's theoretical framework of managerial work descriptions which characterize the manager's job and the importance of several skills areas for managerial success.

CHAPTER TWO

Review of Selected Literature

This chapter includes a review of research relevant to the current study and areas related to the nature of managerial work, job characteristics, and behavior. These earlier studies were examined and summarized in an effort to suggest the extent to which the findings reported in the published literature were consistent with those which resulted from the current study.

The literature presented in this chapter has been divided into two sections. The first of the two parts presented research related to Mintzberg's theoretical framework of managerial roles, skills, and work characteristics as applied to the influence of hierarchical levels and functional specialties. The second section summarized published correlative findings related to classical management functions also useful in describing managerial work.

Application of Mintzberg's Theoretical Framework Of Managerial Roles, Skills And Work Characteristics

Historically, the 1916 work of Fayol (1949) has predominated management theory, textbooks and courses. The

underlying framework of most management education tools is based upon Fayol's portrayal of the manager as a reflective planner, organizer, leader, controller and decision maker.

More recent management theorists and researchers (e.g., Bales, 1950; Carlson, 1951; Kotter, 1982; Luthans, Hennessey & Rosenkrantz, 1983; McCall & Segrist, 1980; Mintzberg, 1973, 1980; Morse & Wagner, 1978; Pavett & Lau, 1983; Stewart, 1982) recognize the fact that the manager is not the controlled, reflective planner that the textbooks portray. As an outcome of either observational or survey research there is evidence that managers engage in a number of diverse behaviors that encompass only some of Fayol's original framework.

There are several recent frameworks and empirical studies that could be used to describe managerial work. For example, Stewart (1982) proposed a framework for examining managerial work. She pointed out that management work can be encompassed in three broad categories: demands common to a job that must be done; choice in the tasks that can be done; and constraints that limit what the job holder can choose to do.

Kotter (1982) in his multiple method research, found that top managers spent a considerable amount of time interacting with others (oftentimes outside of their own work unit) and having short and disjointed conversations that mainly consisted of joking and talking about non-work

related topics. Kotter points out that this "network" building helped his 15 general managers to implement their goals and plans. Most importantly, however, Kotter did not observe that the managers engaged in the traditionally prescribed behaviors of decision making, giving direct orders or advance planning of their time with others.

Luthans and Lockwood (1983) conducted observational studies of 44 managers and concluded that managerial behavior can be broken down into 12 broad behavioral categories. Examples of these categories are as follows: Planning, coordinating, staffing, training/developing, interacting with outsiders, decision making/problem solving and socializing/politicking. Luthans et al. (1983) subsequently used these categories to predict managerial success in a sample of 52 managers from three organizations. Results indicated that interacting with outsiders and socializing/politicking were related to their index of managerial success.

The above examples essentially corroborate the earlier work of Mintzberg (1973) who concluded that management is not characterized by engaging in traditional functions. Rather, the manager's job consists of brief, discontinuous encounters that can be quite superficial and reactive. Based upon observation of five chief executives, Mintzberg (1973) proposed a typology for describing the nature of managerial work. He maintained that managers perform ten different but

highly interrelated roles. Definitions and example activities for these roles are presented in Table 1, chapter 1, pp 8.

Given the small sample that was examined in his original research, and the observational methodology, conclusions about the generalizability of Mintzberg's research (1973) had been tentative. However, several studies such as Alexander (1979), Kurke and Aldrich (1979), Lau and Pavett (1980, 1983), McCall and Segrist (1980), Morse and Wagner (1978), and Paolillo (1981) have used Mintzberg's framework as a basis for paper and pencil surveys that were administered to diverse samples. In general, these studies indicate that Mintzberg's framework is fairly useful for describing the nature of managerial work and for examining similarities and differences between managerial jobs. For example, Alexander (1979), McCall and Segrist (1980), Paolillo (1981) and Pavett and Lau (1983) used different operationalizations of Mintzberg's managerial roles but all concluded that either hierarchical level or functional areas influence the relative importance of the roles. Other studies (e.g. Lau & Pavett, 1980, 1983, 1985) have used this framework to examine similarities in managerial jobs in the public and private sector.

Mintzberg, in research based on behavioral observations of five chief executives plus a study of their mail, found that the manager's job was characterized by many

brief episodes carried out with a wide variety of different people from inside and outside the organization. The topics covered and contacts made varied considerably in importance and relevance. Most communications were verbal, carried out on the telephone or in unscheduled meetings. Typically, managers received a great deal more information that they transmitted to others. Mintzberg, on the basis of a review of other observational studies using diaries and interviews, indicated that his conclusions applied to other types of managers (foremen, branch managers, vice presidents in charge of divisions,, etc.) besides CEOs (Mintzberg, 1971).

However, most of the discussion of Mintzberg in textbook chapters on managerial work focuses on his conceptualization of the manager's jobs in terms of ten work roles, not simply the number of activities a manager carries out in a day. In his typology, Mintzberg formulated three interpersonal roles (figurehead, leader, and liaison), three informational roles (monitor or nerve center, disseminator, and spokesman), and four decision-making roles (entrepreneur, disturbance handler, resource allocator, and negotiator). He indicated that managers in different types of jobs and at different levels vary in the relative importance of these roles to their overall responsibilities. It has been noted that Mintzberg's managerial roles do not explicitly address the classical "planning" role; however, the "leader" and "resource allocator" roles clearly require the planning functions.

A few studies have attempted to test Mintzberg's roles in actual operating situations. McCall and Segrist (1980) found that the activities found in four of Mintzberg's ten roles (figurehead, disseminator, disturbance handler, and negotiator) overlapped to much with the activities found in other roles to be considered separate. Also an examination of the McCall and Segrist (1980) factor loadings for the items they used to measure Mintzberg's roles indicates that many of the items for the remaining six Mintzberg role scales also loaded heavily on several factors rather than one.

Lau, Newman, and Broedling (1980) used Mintzberg's framework to develop 50 questionnaire items which were administered to 210 government managers and then factor analyzed. Instead of Mintzberg's ten roles, they found four factors (leadership and supervision, information gathering and dissemination, technical problem solving, and executive decision making--planning--resource allocation).

Alexander (1979) supported Mintzberg's hypotheses that sales jobs require more interpersonal roles than production manager's jobs and information roles are especially important on staff jobs, such results appear obvious and do not require documentation.

Only a handful of studies have used Mintzberg's roles to predict managerial success. In their extensive study, McCall and Segrist (1980) found significant relationships

between promotion rates and six of Mintzberg's roles. Pavett and Lau's (1982) study on a small sample of managers indicated that only two of the roles were related to performance evaluations. Lastly, Harrison (1978) found that successful executives engage in more leader and monitor activities than non-successful executives.

The work of Mintzberg and those taking similar approaches has illuminated the specific ways the functional responsibilities are carried out and has provided realism to studies about managerial work.

In their study of Research and Development managers compared to non-Research and Development managers across two sectors, public and private, Pavett and Lau (1980) reported that public sector R and D managers rate the relative importance of eleven roles (Technical role added) in much the same way as non-R and D managers ($p<.01$).

There were a number of differences between the two groups of public sector managers as reported by Pavett and Lau (1980). Managers in R and D rate the importance of the technical expert role significantly higher than non-R and D managers ($p<.05$). Public sector non-R and D managers rated the importance of the entrepreneur role significantly higher than R and D managers ($p<.05$). Although, not significant, there was a tendency for non-R and D managers to rate the leader and disturbance handler roles higher than R and D managers. Also, while not statistically significant,

several of the external informational roles (monitor, spokesperson, liaison) were also rated higher by R and D managers. It was also indicated that managers in the private sector are a fairly homogeneous group. Significant differences between R and D and non-R and D managers were found for two of the eleven managerial roles. R and D managers perceived the technical expert role as more important for successful job performance than did non-R and D managers. The leader role was rated as more important by the non-R and D managers than R and D managers. Non-R and D personnel reported that the leadership activities of guiding, directing training, developing and evaluating subordinates were the most important behaviors for successful job performance. In contrast, R and D managers rated the disseminator role as relatively more important than the other ten roles. Pavett and Lau reported that there is considerable agreement between private sector R and D and non-R and D managers on the relative importance of the eleven roles. A comparison of the relative importance of the eleven roles to the R and D managers in the public sector with their private sector counterparts also disclosed a high degree of similarity ($p<.01$). Public sector R and D managers, however, rated the importance of the resource allocator, leader, monitor, spokesperson, and figurehead roles significantly higher than private sector managers ($p<.05$). According to Pavett and Lau, the difference could

have been due in part to the general evaluation sets of the two sectors, where the data indicated that the public sector managers consistently rated the roles as being more important than did the private sector managers.

Pavett and Lau (1980) reported that with the exception of the importance of socializing activities, both groups of public sector managers rated the work characteristics in a similar manner. Private sector R and D managers agreed more strongly than non-R and D managers that they do not rely on the formal management information system for the information they need. The public sector R and D managers, more than their counterparts in the private sector, were confronted by crises, fire drills and briefings that make maintaining a work schedule difficult. Both groups agreed that their daily work routines are fragmented with interruptions and unscheduled events, that they do not have time for self-development activities, and that they receive most of their information from sources other than formal systems of management information.

In the Pavett and Lau study (1980), differences in the rated importance of the four skill factors were reported for public and private sector R and D and non-R and D managers. Public sector R and D managers rated conceptual skills significantly lower than did the other group of public sector managers. While the mean scores were statistically different, the absolute difference between the scores was

minimal. The R and D personnel reported that the ability to plan, direct and integrate the work of their unit into the broader organizational picture was just slightly less important for success than did managers in other career fields. Both groups of managers rated human skills, technical skills, and power skills in much the same manner. This result was rather surprising since it would be expected that technical skills should be seen as more important for a research and development manager than for other managers. Private sector R and D managers rated all of the skill areas in much the same way as did the non-R and D managers. There were no significant differences between the two groups in the perceived importance of the four skill areas for successful job performance. Both groups reported that human skills and conceptual skills were very important for performing their jobs effectively. Respondents in both sectors agreed that the most important set of skills for effective job performance were the human skills (e.g. verbal and written communication, flexibility, persuasiveness, listening carefully to others, and coolness under stress). Conceptual skills were ranked as second most important followed by technical skills and, lastly political skills.

Correlative Classical Management Functions

A number of empirical studies, not directly cited by Mintzberg (1973), have shown that managers spend time in the classical management functions, Several studies, including

Williams (1956), have gone beyond the recording of observable activities to show that managers at all levels participate in planning, coordination, control, and problem solving activities.

Most management textbooks begin with a discussion of the nature of managerial work which indicates that this topic is the basis of the subject matter of management just as Fayol indicated many years ago. However, during the past ten years or so, the usefulness of the classical functions for classifying managerial work activities has been questioned by a number of writers, especially Mintzberg (1970, 1971, 1973, 1975, 1980) who developed his own typology for describing managerial work. Kotter (1982) also developed a conceptualization of the manager's job as has Stewart (1974, 1976, 1982). Eleven of the twenty-one textbooks examined (Carroll, 1986), described Mintzberg's conceptualization along with the classical functions as descriptions of what managers do but, in no case were these two different perspectives integrated, indicating uncertainty about how they fit together, if at all. In some books only Mintzberg's raw research data was mentioned. Kotter's research was not included in the chapter on managerial work in any text. It seems clear that authors are having some difficulty in handling these diverse perspectives on managerial work. This indicates by their consistent failure to integrate these different perspectives

in a way that is clear to the reader, Carroll 1986).

Mintzberg (1970,1971,1973,1975,1980) criticized the validity and usefulness of the classical managerial functions in describing managerial work. He described the classical functions of Fayol and others as "folklore" (Mintzberg, 1975). In addition, he felt that viewing the manager simply as a decision maker or a motivator of subordinates is not very helpful in disentangling the complexity of managerial work (Mintzberg, 1973). Nevertheless, in the management textbooks evaluated rarely was any criticism of Mintzberg's typology found (Carroll 1986). Some articles favored his perspective, indicating that his is the only valid one (Bickerstaffe, 1981). Other writers have commended the realism of his approach when compared to the abstract description of managerial work painted by the classical writers.

Mahoney, Jerdee, and Carroll (1963,1965) reported that managerial time can be allocated to a set of eight basic managerial functions which can be called the "PRINCESS" factors (Planning, Representing, Investigating, Negotiating, Coordinating, Evaluating, Supervising, Staffing). In Carroll's study,(1986), Fayol's functions were expanded to eight because preliminary pilot studies indicated that five functions missed managerial work activities as "representing the organization to outside groups." (Mintzberg, 1971, also pointed out this problem.) Carroll's 1986 study of 452

managers indicated that there appeared to be a minimum core of time spent in each of these functional responsibilities but managers in various job and level categories had different time patterns with respect to these responsibilities.

The findings of Mahoney, Jerdee, and Carroll (1963, 1965) were replicated in a study by Penfield (1975) and they are congruent with the results of a study by Haas, Porat, and Vaughan (1969). Furthermore, a work sampling study carried out by Mahoney, Jerdee, and Carroll (1963) indicated that it is quite possible to relate the specific observable task activities of managers to these more fundamental managerial functions simply by asking the managers why they are carrying out each particular activity. Carroll (1986), in his study of 21 managers were signalled at a random minute of every half hour for each work day for a two-week period. Each time they completed a brief questionnaire describing what they were doing at that time, and also required managers to indicate which of the PRINCESS basic responsibilities was involved in each work activity sampled. The observed time allocations related fairly accurately to previous estimates by these managers of such time allocations (Mahoney, Jerdee, & Carroll, 1963).

Furthermore, other empirical evidence indicates that such sampling observational approaches provide the same information as previous time estimates and other work

observational approaches using an outside observer. In a study by Carroll and Taylor (1968, 1969) estimates of time spent in various activity categories were compared to self-observations made at random times when individuals were signalled to do so and to observations made at a different set of random times surreptitiously by an outside observer. This study showed that self-observation by work sampling produced about the same results as previous time estimates and the observations made by an outside observer.

Data relevant to this issue have been presented by Allen (1981) and Hughes and Singler (1985) on the activities carried out by managers on the job. In the Allen study, 932 managers surveyed by questionnaire reported a variety of planning and controlling activities, although Carroll (1986) did not report on the percentage of time spent in these ways. The Allen study indicated that more than 80 percent of the sample of managers were involved in formal planning activities such as developing forecasts and preparing budgets; 70 percent in maintaining written objectives and goals; and 60 percent in maintaining performance standards and evaluating and correcting performance relating to those standards. The Allen study indicated that 70 percent of the 932 managers had specific objectives; however, only 32 percent had worked out specific steps for these objectives.

In the Hughes and Singler (1985) study, more that 700 managers were surveyed about the relative importance of the

various functional areas to first line, second line, and general managers. They found that the importance of directing, controlling, and organizing was fairly constant from one level to another, but the importance of planning increased and the importance of staffing decreased, as managers progressed from the first level of management to top management. These results were very similar to those found in the Mahoney, Jerdee, and Carroll study (1963).

The research data on the actual observable activities of managers gathered by Mintzberg (1973) and others, points out that managers, like organizations, have resource dependencies. Managerial work is interdependent; besides requiring information, managers need the time and energy of other managers and their subordinates in order to plan and to implement such goals and plans. This interdependence requires a continuous probing of tentative possibilities and mutual adjustment given the commitments of theirs to other goals and plans. Often, the information needed by managers is usually in the minds of others and oral communication provides the quickest and most efficient way to give such information. This is especially so in light of the time pressures and other restraints that all managers face as indicated in the research of Stewart (1976). Furthermore, oral communication may provide clues as to the validity of the information and how the managers involved feel about the subject. Given these factors, there appears to be no real

alternative to managers making contacts in person or by telephone (an activity which studies show to be so common).

Kotter (1982) studied 15 successful general managers in a variety of industries in depth (more than forty hours with each subject). Like Mintzberg, and Mahoney, Jerdee, and Carroll, Kotter found that managers spend a great deal of time interacting with others--often outside their unit or organization. These meetings provided needed information to managers and gave the managers a chance to give others information they needed. In addition, a wide range of topics was covered during such meetings with the focus on those relevant to the manager's concerns and responsibilities. In such meetings, a large number of items were handled in brief periods of time. Kotter referred to many of these contacts as network building--responding to needs of other managers rather than only satisfying one's needs. Networks are used not only to gather information relevant to the manager's mental agenda but also to implement that agenda. Agenda items are attended to in an invisible (mental) way and the agenda is revised constantly. Kotter (1982) believed the quality of managers' networks influenced the managers' performance through contribution to and implementation of an agenda.

Kotter's (1982) description of the actions of general managers is congruent with other studies of higher-level managers. For example, Peters (1979) pointed out that

managers (especially higher level) have goals that they attempt to move the organization or unit toward in addition to any specific scheduled activities. CEOs had basic goals or thrusts that they were committed to based on their strategic evaluations of the organizations and their environments, and they acted as "consummate opportunists" taking advantage of every situation to move others in the organization toward their basic goals or thrusts.

Peter's observations are supported by Elliott's (1959) study of 200 top managers that indicated that such managers have a list of concerns they are constantly trying to obtain action on as they move through a typical work day. This list may be mental or physical. He described IBM's Tom Watson's constant reference to a list of problems and goals that he wanted to take action on as he worked. He described how managers often rose very early in the morning to work on company plans and problems. He validated Mintzberg's picture of the "harried" executive communicating with many people by phone or in person while facing constant pressure from the clock.

Quinn (1980) studied higher-level managers in various U.S. companies (e.g., General Mills, Pillsbury, EXON, General Motors, Chrysler, and Volvo). He also described such managers as having strategic planning thrusts they are pushing organizations toward and how they spend much of their days overcoming resistance to such thrusts, motivating

people to accept these thrusts through participation, and building organizational awareness of the need for strategic change. Quinn (1980) found that managers had a framework of broad goals which they attempted to get their subordinates to accept through daily contacts.

In still another relevant study, Bower (1970) studied the involvement of a chief executive and his primary subordinates in four investment projects over a two-year period from inception to end. This particular study showed that the projects of many managers compete for time, attention, and resources. There were difficulties in getting managers to appreciate the importance (to themselves, their units, and the organization) of certain projects. Also, the narrowness of the job responsibilities of individual managers prevented them from seeing the implications of particular projects until they were revealed in a dynamic setting. These case studies also showed the importance of timing--how one time might not be appropriate but another time might be appropriate to obtain acceptance and commitment. Finally, the case studies showed organizations are constantly changing which adds to the managers' problems implementing their personal goals. Managers must gather information from others in order to understand the organization and to test their own perceptions of organizational functioning. All this illuminates the actual conditions under which managers and

units pursue their goals. Reality is far messier than the descriptions of managers' problems found in textbooks.

Summary

A review of published research related to the nature of managerial work, job characteristics, and behavior revealed that, while models have many shortcomings in terms of adequately defining what managers really do, Mintzberg's framework has been generally accepted as fairly useful for describing the nature of managerial work and for examining similarities and differences between managerial jobs.

In several of the studies reviewed, the authors stated they used different operationalizations of Mintzberg's managerial roles but all concluded that either hierarchical level or functional areas influence the relative importance of the roles. Other studies have used this framework to examine similarities in managerial jobs in the public and private sector..

Most of the discussion of Mintzberg in textbook chapters on managerial work focuses on his conceptualization of the manager's job in terms of ten work roles, not simply the number of activities a manager carries out in a day. In his typology, Mintzberg formulated three interpersonal roles, three informational roles, and four decision-making roles. He indicated that managers in different types of jobs and at different levels vary in the relative importance of these roles to their overall responsibilities.

Others have supported Mintzberg's hypotheses that sales jobs require more interpersonal roles than production manager's jobs and information roles are especially important on staff jobs, such results appear obvious and do not require documentation.

Only a handful of studies have used Mintzberg's roles to predict managerial success. Those authors found significant relationships between promotion rates and six of Mintzberg's roles. Another study on a small sample of managers indicated that only two of the roles were related to performance evaluations. Other found that successful executives engage in more leader and monitor activities than non-successful executives.

Mintzberg criticized the validity and usefulness of the classical managerial functions in describing managerial work. He described the classical functions of Fayol and others as "folklore". Additionally, he felt that viewing the manager simply as a decision maker or a motivator of subordinates is not very helpful in disentangling the complexity of managerial work. Writers have commended the realism of his approach when compared to the abstract description of managerial work painted by the classical writers.

The work of Mintzberg and those taking similar approaches has illuminated the specific ways the functional responsibilities are carried out and has provided realism to studies about managerial work.

CHAPTER THREE

Method

In order to accomplish the objectives of this study, the managerial attitudes and perceptions of the survey respondents were measured. This was accomplished through a research design which involved sampling a high-technology marketing management population working in a large aerospace industry company. The study participants all were engaged in high-technology marketing work. The data were collected using a structured questionnaire. The collected data were analyzed statistically in order to determine the existence of significant trends in the survey respondents' attitude and perception patterns.

Specifically, the current study was designed to explore the nature of complex managerial work attitudes and perceptions of high-technology marketing managers, both engineers and non-engineers, performing high-technology marketing work within the context of the aerospace organizational setting. In order to provide the basis for an empirical evaluation of these attitudes and perceptions, the research design featured the application of a survey instrument based on Mintzberg's (1973) theoretical framework of managerial work.

In an effort to determine the nature and extent of the attitudes to Mintzberg's various managerial roles by a selected group of high-technology marketing managers, the following research questions were formulated:

1. To what extent are Mintzberg's managerial roles regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing management work in aerospace companies?

2. To what extent are Mintzberg's managerial skills and work characteristics regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing managerial work in aerospace companies?

3. To what extent do engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers?

4. What similarities and significant differences between engineers and non-engineers are evident from comparisons of the responses to the twelve demographic items of the questionnaire?

5. What significant relationships between demographic characteristics of the respondents and other variables of the study are evident in each of the two groups, and in the combined group of engineers and non-engineers?

Collection of Data

The data source strictly conformed to the established criteria.

Data Source

The criteria for the data source specified that the respondents be managers/executives employed by a major aerospace firm located in southern California. Each participant was involved in high-technology marketing work at the time the study was conducted and agreed to complete and return the survey instrument in accordance with the requirements established for the data collection procedures. The data source criteria further specified that respondent qualifications, for purpose of segregating engineers from non-engineers, include a formal education in engineering, chemistry, physics or other related engineering or scientific discipline. Respondents with a formal education in business or liberal arts were subsequently identified from the demographics part of the returned questionnaires as non-engineers and were segregated from the engineer category for the purpose of the current study.

One-hundred potentially qualified participants were selected from the firm's current organization manual. The selection was based on the depicted appropriate job title and functional organization as shown on the official company's organization charts.

The questionnaire (Appendix A), along with a transmittal letter of instruction (Appendix B), was sealed and sent to the targeted 100 respondents through their aerospace firm's internal mail system.

Of the 100 survey instruments distributed, 83 (83%) were returned. Thirteen of the 83 respondents were disqualified based on the data source criteria requirements in that they claimed non-affiliation with marketing activities. Six were eliminated for incomplete data. The remaining 64 (64%) questionnaires obtained were considered as qualified sources for purpose of the current study. From the demographic section of these 64 questionnaires, 32 engineers and 32 non-engineers were identified and qualified as marketing managers and fit the criteria for purpose of the current study. The data source was standardized on the basis of each participant's employment by a major aerospace firm as a high-technology marketing manager.

For purpose of the current study, those determined as qualified marketing managers were selected from three separate company divisions of the major high-technology aerospace company participating in this study. It was anticipated that this similarity in the employment status for the population which constituted the data source would result in a consistency in the data and serve as a valuable measure for the empirical evaluation based on Mintzberg's (1973-1980) theoretical framework.

Formal authorization to conduct the current survey of selected managers within the designated company was obtained by the researcher prior to contacting any of the potential participants. The senior director of human resources provided his support with a memo to the various applicable senior directors and vice-presidents, who in turn expressed their support by co-signing the transmittal letter of instruction to pre-selected participants.

Instrumentation

The data for this study were obtained using a questionnaire (Appendix A). The instrument utilized by Pavet and Lau (1980) for similar studies was modified slightly in format and demographic content to conform with the current study. This method was selected on the basis of the availability of the data required to answer the research questions. The researcher was a member of the aerospace company which employed the potential respondents. Since the potential respondents were aware of the researcher's company relationship, the use of an anonymous questionnaire was specified in the research method adopted for the study. This was done in order to avoid bias in the participants' responses.

The questionnaire which was designed to examine high-technology marketing managers (engineers compared to non-engineers) and how they view their jobs in terms of Mintzberg's theoretical model of managerial roles, required

skills, and work characteristics, consisted of four parts which were titled as follows:

Part I - Demographics

Part II - Job Activities (Managerial roles)

Part III.- Managerial skills and abilities

Part IV - Managerial work characteristics

Part I consisted of twelve questions related to selected demographics factors. These twelve direct questions required the participants to indicate the appropriate response choice provided on the survey instrument or to fill in the proper number in a blank provided for that purpose (questions 1 through 12).

Part II consisted of forty-seven questions (13(1) through 13(47)) requiring the participant to indicate the importance of each of the listed activities required for the successful conduct of his/her work. The importance of each item was rated on a Likert-type four-point scale ranging from 1=(of no importance) to 4=(extremely important).

Part III consisted of thirty questions (14(1) through 14(30)) and required the respondent to indicate the importance of the listed managerial skills and abilities as they applied to his/her job. The importance of each item was rated on a four-point Likert-type scale ranging from 1=(of no importance) to 4=(extremely important).

Part IV consisted of two sub-parts. Sub-part one required that the respondent indicate his/her agreement to

nine questions (15(1) through 15(9)) relating to perceptions of the listed managerial work characteristics as they relate to his/her organization. The importance of each item was rated on a four-point Likert-like scale ranging from 1=(disagree fully) to 4=(agree fully). Sub-part two (questions 16(1) through 16(5)) required that the respondent check the one statement most appropriate in relation to his or her work involvement. The five statements were: 1=(not involved at all), 2=(somewhat involved), 3=(involved), 4=(very involved), and 5=(extremely involved).

Pilot Study

In conducting the pilot study to check on the clarity of the questionnaire developed for the current study, the instrument was first administered to three respondents who conformed to the criteria specified for the data source. The pilot study participants were instructed to answer the questionnaire and were requested to make notes regarding any of the survey items which were in any way ambiguous.

The participants were told that they were participating in a pilot study and that their comments were critical in providing the basis on which the format and content of the instrument would be evaluated for data collection purposes. The pilot study participants provided opportunities for regular and frequent contact with the researcher between the time the questionnaire was distributed and when it was returned. The comments obtained as a result of the pilot

study did not indicate the need for major changes to the instrument. The only recommendations received, which were considered minor in nature and related to the numbering of the various parts, were incorporated in the final version.

Procedure

When the questionnaire was distributed to the potential respondents, each was instructed by the researcher in the cover letter provided with the survey instrument that: (1) participation in the study was voluntary, (2) the identities of the study participants would not be revealed, (3) the effort and time involved in completing the questionnaire must be on their own time (which conforms with the company's policies regarding non-company-related effort) and not chargeable to company time, and (4) the completed questionnaires were to be returned to the researcher in the enclosed stamped envelope addressed to the researcher's home. The respondents were encouraged to complete the questionnaires and to return them to the researcher as quickly as possible.

Analysis of Data

Each returned questionnaire was checked for completeness and conformity with the criteria for data source. Data were initially tabulated by category, which included identifying and segregating engineers from non-engineers for the purpose of developing the stated comparisons.

Means and percentages were used to group the data into tabular form according to the variables and relationships being analyzed.

Statistical comparisons of the data collected to answer the research questions posed for the current study were performed by Student's t-tests for differences between uncorrelated means, as described by Issac and Michael (1981) for small sample statistics.

The implied statistical hypotheses, as noted in the research questions, were tested in the null form at the .05 level of significance. This test was considered as appropriate to determine whether a significant difference existed between two means based on continuous interval-scaled variables. Chi-square and the Spearman Rho were used to test for the existence of relationships. The Pearson r correlation test was also used to determine relationships between the various demographics characteristics of the respondents and other variables of the study.

Research Assumptions and Delimitations

Research Assumptions

The current study was based on the assumption that Mintzberg's (1973-1980) framework of managerial work descriptions were applicable to the conditions existing in a high-technology aerospace marketing management environment. The statements included in the survey instrument, which also were modeled on those which formed the basis for earlier

studies, were assumed to be appropriate and meaningful in work-related terms, and were relevant to the research design and accurately represented the desired elements.

The questionnaire and the research method developed for the study were assumed to have been adequate to assure data required in order to answer the research questions posed for the study.

The responses recorded on the study questionnaire were assumed to have represented accurately the participants' choices since the guaranteed anonymity of respondents provided no motivation for answering otherwise.

Although the data collection was limited to three major company divisions of a large corporation in Los Angeles, the respondents were reasonably representative of those who might be found in any one of the other aerospace industry companies which operate in the greater southern California area.

Delimitation

The sample population was limited to those individuals who were employed as marketing managers by a major multi-division aerospace corporation located in the greater Los Angeles area. The designated members of the group which constituted the data source were engaged in performing high-technology marketing related work. All managers of the target company who conformed to this requirement were regarded as potential participants in the current study. The

data source was restricted further to include only those respondents who completed and returned the questionnaire in accordance with the requirements specified in the criteria for the data source.

Summary

The current study compared and measured managerial attitudes and perceptions of engineers and non-engineers performing high-technology marketing work in an aerospace organization environment. This was accomplished through a research design requiring a population sampling of managers and executives employed in a major multi-division southern California aerospace corporation. The research method employed a survey instrument based on Mintzberg's (1973, 1980) theoretical/model framework of managerial work. The questionnaire, featuring demographic information and Likert-type items was distributed to 100 respondents.

The research design specified that the statistical analysis of the survey data was based on the application of Student's t-tests, chi-square tests, Spearman's Rho, with a level of significance set at or beyond .05, and the Pearson r correlation test with a level of significance set at or beyond .001.

CHAPTER FOUR

Findings

This chapter presents the findings which resulted from the application of the questionnaire to the study participants. The chapter has been subdivided into six sections and includes the presentation of the data obtained in response to each of the five research questions formulated for the study and a summary of the research findings.

The questionnaire was administered to a preselected group of managers--engineers (E's) and non-engineers (NE's) performing high-technology marketing management work in a large, multi-division, major aerospace firm in southern California. The questionnaire served as the vehicle to collect data from the participants concerning the importance placed by them on Mintzberg's various managerial roles, skills, and work characteristics.

Question One

The first research question is repeated as follows: To what extent are Mintzberg's managerial roles regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing management work in aerospace companies?

Similarities and differences were identified through responses obtained from the selected group of engineers and non-engineers. Significance of similarities in perceptions by engineers and non-engineers concerning the significance of Mintzberg's ten managerial roles plus the eleventh (technical) role was statistically determined through computation of the Spearman Rho correlation for rank-ordered data. Table 4 presents data comparisons of the eleven managerial roles by the participant groups providing the basis for a comparison of perceptions of engineers performing marketing management work with those of non-engineers performing the same type of marketing management work. The results indicated significant similarities between engineers and non-engineers at the .05 level of significance. These data indicate relatively close similarities between the two sets of rankings of Mintzberg's managerial roles by the respondents. The rank order of means indicated especially close similarities in perceived importance of the following roles: "Resource Allocator," (E=1/NE=2); "Entrepreneur," (E=3/NE=3); "Disseminator," (E=4/NE=5); "Figurehead," (E=8/NE=6); "Disturbance Handler," (E=9/NE=10); and "Negotiator" (E=11/NE=11).

A comparison of the two groups in terms of differences in perceived importance of Mintzberg's ten managerial roles plus the eleventh (technical) role is presented in Table 5.

Table 4

Spearman Rho Between The Ranks Of Means For Perceived Importance Of Mintzberg's Managerial Roles As Reported By Engineers and Non-Engineers Performing High Technology Marketing Management Work In Southern California Aerospace Firms

Managerial Roles	Engineer Rank (N=32)	Non-Engineer Rank (N=32)
Resource Allocator	1	2
Technical Expert	2	8
Entrepreneur	3	3
Disseminator	4	5
Monitor	5	1
Leader	6	9
Liaison	7	4
Figurehead	8	6
Disturbance Handler	9	10
Spokesperson	10	7
Negotiator	11	11

Rho = +.61 $p<.05$

The results indicated significant differences in three of Mintzberg's managerial roles as perceived by engineers and non-engineers performing marketing management work. The significance level was statistically determined through

Table 5

Comparison Of The Perceived Importance To Engineers And Non-Engineers Of Mintzberg's Managerial Roles
(Higher values indicate greater importance)
(N=64)

	Engineers (N=32)		Non-Engineers (N=32)			
Managerial Roles	Mean	S.D.	Mean	S.D.	t	Signif.
Resource Allocator	3.269	.671	3.150	.680	.705	p>.05(NS)
Technical Expert	3.075	.573	2.687	.649	.536	p<.02
Entrepreneur	2.984	.666	2.898	.650	.523	p>.05(NS)
Disseminator	2.945	.576	2.965	.466	.153	p>.05(NS)
Monitor	2.923	.531	3.262	.533	2.549	p<.02
Leader	2.756	.827	2.550	.784	1.023	p>.05(NS)
Liaison	2.734	.512	2.914	.563	1.340	p>.05(NS)
Figurehead	2.648	.511	2.867	.840	1.260	p>.05(NS)
Disturbance Handler	2.594	.653	2.375	.582	1.417	p>.05(NS)
Spokesperson	2.414	.616	2.851	.682	2.689	p<.01
Negotiator	2.341	.546	2.268	.595	.511	p>.05(NS)

application of Student's t-test to be below the .05 level of significance. Engineers performing marketing managerial work perceived the "Technical Expert" managerial role as more important than non-engineers did ($p<.02$). Non-engineers, on the other hand, perceived the "Monitor" role

($p<.02$) and the "Spokesperson" role ($p<.01$) as more important than the engineers did.

Question Two

The second research question is repeated as follows: To what extent are Mintzberg's managerial skills and work characteristics regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing managerial work in aerospace companies?

In order to test separately the results of both managerial skills and work characteristics as defined by Mintzberg, question number two was divided into two parts. The first part of the question relating to managerial skills is represented by Table 6, which presents importance ranks of the four skills as seen by both engineers and non-engineers. Similarities between engineers and non-engineers concerning the perceived importance of Mintzberg's managerial skills was determined through calculation of Spearman's Rho. Although the value of Rho suggests strong agreement, it is not significant due to the small numbers of categories.

Table 6

Spearman Rho Between The Ranks Of Perceived Importance Means For Mintzberg's Managerial Skills As Reported By Engineers and Non-Engineers Performing High Technology Marketing Management Work In Southern California Aerospace Firms (N=64)

Managerial Skills	Engineers Rank (N=32)	Non-Engineers Rank (N=32)
Conceptual Skills	1	2
Human Skills	2	1
Technical Skills	3	3
Political Skills	4	4

Rho = + .98 $p>.05$ (N.S.)

Student's t-tests indicated that no significant differences exist between the engineers' and non-engineers' perceptions of each of Mintzberg's four Managerial skills ($p>.05$) (Table 7). This indicates that engineers and non-engineers performing marketing management work in high technology aerospace industries are in general agreement concerning the importance to be placed on Mintzberg's various managerial skills. The level of that importance averaged approximately 3 on the response scale, meaning that both groups generally reported the importance of these four

Table 7

Comparison Of Importance Of Mintzberg's Managerial Skills As Perceived By Engineers and Non-Engineers Performing High Technology Marketing Work In Southern California Aerospace Firms
(Higher values indicate greater importance)
(N=64)

	Engineers (N=32)		Non-Engineers (N=32)			
Managerial Skills	Mean	S.D.	Mean	S.D.	t	Signif.
Conceptual Skills	3.363	.316	3.263	.377	1.149	p>.05(NS)
Human Skills	3.438	.397	3.590	.232	1.870	p>.05(NS)
Technical Skills	2.961	.516	3.117	.622	1.092	p>.05(NS)
Political Skills	2.859	.381	2.987	.358	1.385	p>.05(NS)

skills to be moderately important.

The second part of the question concerns Mintzberg's managerial work characteristics. Data are shown in Table 8 which presents the ranks given by engineers and non-engineers to the items assessing managerial work characteristics, and reports the Spearman Rho value of the correlation. The results indicate significant similarities between engineers and non-engineers at the .001 level of significance. These data indicate strong similarities and agreement between the two sets of rankings of Mintzberg's nine managerial work characteristics by the respondents.

Table 8

Spearman Rho Between The Ranks Of Perceived Importance Means For Mintzberg's Managerial Work Characteristics (N=64)

Job Characteristics	Engineers Rank (N=32)	Non-Engineers Rank (N=32)
1 The majority of information comes from sources other than formal Management Information System (MIS)	1	2
2 The job is present-oriented, precluding time for self-development.	2	4
3 The daily work routine is fragmented with interruptions and unscheduled events.	3	1
4 The greatest block to doing the job is the constant barrage of "fire drills."	4	3
5 Meetings burn up an unnecessary amount of time.	5	5
6 It is virtually impossible to set and stick to a work schedule.	6	6
7 Managers who have a technical/ professional background are generally more loyal to the organization than to their profession.	7	8
8 Socializing constitutes an important part of a manager's job	8	7
9 Briefings and official tours interfere with ability to do an effective job.	9	9

Rho = + .90 $p<.001$

The rank order of means indicated especially close similarities in perceived importance of the following characteristics: "Meetings burn up an unnecessary amount of time," (E=5/NE=5); "It is virtually impossible to set a work schedule and stick to it," (E=6/NE=6); "Giving briefings and tours to official visitors interferes with a manager's ability to do his job effectively," (E=9/NE=9).

A comparison of the two groups in terms of differences in perceived importance of Mintzberg's nine managerial work characteristics is presented in Table 9. Table 9 indicates that no significant differences were found between engineers and non-engineers in their views of the importance of each of Mintzberg's nine work characteristics ($p>.05$).

Question Three

The third research question is repeated as follows: To what extent do engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers? The extent of similarities and significant differences was statistically determined through application of the Chi square test at the .05 level of significance. Table 10 presents data for the participant group providing the basis for a comparison of factors determining the entry into high technology marketing management work.

Table 9
Comparison Of The Importance of Mintzberg's Managerial Work Characteristics For Engineers And Non-Engineers Performing High-Technology Marketing Work In Southern California Aerospace Firms
(Higher mean values indicate greater perceived importance)

Managerial Work Characteristics	Engineers (N=32) Mean	S.D.	Non-Engineers (N=32) Mean	S.D	t.	Signif.
1. A manager gets most of the information required to do his job from sources other than formal management.	3.250	.672	3.063	1.045	.279	p>.05 (NS)
2. Managers place a major emphasis on getting the present job done and therefore devote insufficient time to self-development activities.	3.188	.738	2.906	.893	.872	p>.05 (NS)
3. A managers daily work routine is fragmented with interruptions and unscheduled events.	2.906	.995	3.156	.628	.800	p>.05 (NS)
4. The greatest block to a manager doing his or her job is the constant barrage of "fire drills".	2.844	.767	2.906	.995	.307	p>.05 (NS)
5. Meetings burn up an unnecessary amount of time	2.781	.870	2.844	.769	1.161	p>.05 (NS)
6. It is virtually impossible to set a work schedule and stick to it.	2.250	.107	2.750	.880	1.202	p>.05 (NS)
7. Managers who have a technical/professional background are generally more loyal to the organization than to their profession.	2.250	.803	2.000	.916	.852	p>.05 (NS)
8. Socializing constitutes an important part of a manager's job (e.g.,cocktail parties, dinner parties, business lunches).	1.594	.837	2.094	1.058	1.459	p>.05 (NS)
9. Giving briefings and tours to official visitors interferes with a managers ability to do his job effectively.	1.563	.759	1.875	.942	1.376	p>.05 (NS)

Table 10

Factors Determining Entry Into Marketing Work
As Reported By High Technology Marketing Managers
In Southern California Aerospace Firms
(N=64)

	Frequencies			
	Engineers		Non-Engineers	
	Observed	Expected	Observed	Expected
Promoted	4[a]	6.5	9[b]	6.5
Transferred from within the company at own request	7	7.5	8[c]	7.5
Company requested assignment	9	6.0	3	6.0
Hired from another company	1	4.0	7[d]	4.0
Life's ambition	3	2.0	1	2.0
Stepping-stone to ultimate goal	8	6.0	4	6.0
N =	32	32	32	32

Chi square = 11.824 (df=5) $p<.05$

[a] Engineers promoted from within the organization.

[b] Non-engineers promoted when hired-in from outside the organization.

[c] Non-engineers transferred from other divisions of the company.

[d] Non-engineers hired and promoted into marketing management from another aerospace company.

The results indicate significant differences between engineers and non-engineers in the factors determining the entry into marketing management work ($p<.05$). The data

indicate that engineers are more likely to enter marketing management as a result of company requested assignment than are non-engineers. Non-engineers, on the other hand, are more likely to be hired into marketing management from another company.

Question Four

The fourth research question is repeated as follows: What similarities and significant differences between engineers and non-engineers are evident from comparisons of the responses to the twelve demographic items of the questionnaire?

Demographic Question #1 asked respondents to "identify their organization position." Table 11 summarizes the data relating to the current management position level within the organization as reported by engineers and non-engineers. The responses from the participants provided a basis for a statistical comparison through application of the Chi square test at the .05. The results indicate that no significant difference was found in the organizational position management level of engineers and non-engineers in these samples performing marketing management work ($p>.05$). Of the engineer respondents (N32) and non-engineer respondents (N32), it appears that engineers and non-engineers are at essentially equal level organizationally.

Table 11

Current Management Position Level Within the Organization As Reported By High Technology Marketing Managers In Southern California Aerospace Firms (N=64)

Position Level	Frequencies for Engineers	Frequencies for Non-Engineers
Director, Product or Regional Manager	14	6
Manager	16	21
Section Head/Supervisor	2	5
N =	32	32

Chi square = 5.16 (df=2) p>.05 (N.S.)

Demographic Question #2 asked that respondents identify the nature of their positions--"line managers or staff managers." Table 12 presents the results of the responses and findings presented through statistical application of the Chi square test at the .05 level of significance. The results indicate no significant difference between engineers and non-engineers in positions of "line managers and staff managers" (p>.05).

Demographic Question #3. asked respondents to indicate which one classification best described their function of responsibility within the organization. All qualified

Table 12

Best Description of Current Position Within The Organization As Reported By High Technology Marketing Managers In Southern California Aerospace Firms (N=64)

Position Description	Frequencies for Engineers	Non-Engineers
Line Manager	17	14
Staff Manager	15	18
N =	32	32

Chi square = .563 (df=1) p>.05 (N.S.)

respondents without exception, checked "marketing/business development.

Demographic Question #4 asked that respondents identify the "length of time they have worked for the current company." Table 13 summarizes the data relating to length of time worked in the current company as reported by engineers and non-engineers. The reported data were statistically tested by application of the Chi square test at the .05 level. The results indicated no significant difference between engineers and non-engineers in length of time worked in the current aerospace company (p>.05).

Table 13

Length of Time Worked In The Current Company (Organization) As Reported By High Technology Marketing Managers in Southern California Aerospace Firms (N=64)

Time Duration	Frequencies for Engineers	Non-Engineers
Less Than 5 Years	0	4
5+ To 15 Years	9	8
15+ To 20 Years	4	5
Over 20 Years	19	15
N =	32	32

Chi square = 4.706 (df=3) p>.05 (N.S.)

Demographic Question #5 requested that participants state the "length of time in their present position."

Table 14 summarizes the length of time worked in the current position as reported by engineers and non-engineers. The collected data were statistically tested through application of the Chi square at the .05 level. The results indicate no significant difference in length of time worked in the current position by engineers and non-engineers

Table 14

Length Of Time Worked In The Current Position
As Reported By High Technology Marketing Managers
In Southern California Aerospace Firms
(N=64)

Time Duration	Frequencies for Engineers	Non-Engineers
Less than 2 Years	16	8
+2 To 5 Years	12	13
+5 To 15 Years	3	8
Over 15 Years	1	3
N =	32	32

Chi square = 6.042 (df=3) p>.05 (N.S.)

performing high technology marketing work in southern California aerospace firms (p>.05).

Demographic Question #6 asked respondents to report how they obtained their first management position. Table 15 shows the results of how the first management position was obtained by high technology marketing managers (N64) in southern California aerospace firms. The input data was statistically tested through application of the Chi square at the .05 level. Three factors were identified in the

Table 15

How First Management Position Was Obtained As Reported By High Technology Marketing Managers In Southern California Aerospace Firms (N=64)

Variables	Frequencies for Engineers	Frequencies for Non-Engineers
Promoted From Non-Management Position	31	23
Employed Directly From College	0	3
Hired From Another Company	1	6
N =	32	32

Chi square = 7.757 (df=2) $p<.05$*

*Not considered a valid rejection of the null hypothesis due to a large proportion of small expected frequencies. (Four of the six expected frequencies were below 5).

questionnaire for response--"promotion from non-management," "employment directly from college," and "hired-in from another company."

Although the Chi-Square statistical test results indicated significance at the .05 level, it was not considered a valid rejection of the null hypothesis due to a large proportion of small expected frequencies. Four of the six expected frequencies were below five. However, when the

Table 16

Job Position Desired In 5 Years As Reported By High Technology Marketing Managers in Southern California Aerospace Firms (N=64)

Job Desired	Frequencies for Engineers	Frequencies for Non-Engineers
My Boss's Job	17	15
Any Higher-Level Management Job	10	12
A Better Job In Another Company Or Organization	0	2
The Same Job	0	1
Retirement	5	2
N =	32	32

Chi square = 4.593 (df=4) p>.05 (N.S.)

two lower categories were collapsed, the resulting chi-square was 7.59 with 1 degree of freedom. This is significant at $p<.01$ and reveals that a higher proportion of engineers are promoted from non-management positions than are non-engineers.

Demographic Question #7, asked respondents to indicate the primary factor determining their entry into their current work function, (Marketing) and was used to answer study question

Table 17

Years of Formal Education As Reported By High Technology Marketing Managers In Southern California Aerospace Firms (N=64)

	N	Mean	S.D.	t	Significance
Engineers	32	17.6	.556	1.999	p<.05(df=62)
Non-Engineers	32	16.9	.541		

number 3.

Demographic Question #8 asked respondents to "identify the job which they desire five years from now." Table 16 shows the "job position desired in 5 years" as reported by high technology marketing managers in southern California aerospace firms. The data received were statistically tested through application of Chi square at the .05 level. Results indicate no significant difference between engineers and non-engineers in "the job position desired in five years" (p>.05).

Demographic Question #9 asked that respondents indicate their "years of formal education." Table 17 shows the years of formal education as reported by high-technology marketing managers in southern California aerospace firms. The data obtained were statistically measured through application of

Table 18

Mean Age Of High Technology Marketing Managers
In Southern California Aerospace Firms
(N=64)

	N	Mean	S.D.	t	Significance
Engineers	32	52.44	7.21	2.735	p<.001(df=62)
Non-Engineers	32	47.28	7.87		

Student's t-test at the .05 level of significance. The results indicate a significant difference in the level of education between engineers and non-engineers performing high technology marketing management work in southern California aerospace firms ($p<.05$), with the mean score being 17.6 years of education for engineers as compared to a mean score of 16.9 years of education for non-engineers.

Demographic Question #10, which asked for college major area of study, was used as one of the criterion for screening respondents for qualification as participants for the current study.

Demographic Question #11 related to gender. All respondents to the questionnaire were male.

Demographic Question #12 asked for the respondent's age on the last birthday. Table 18 shows the mean ages of the high technology marketing managers. Input data received were statistically tested through the application of Student's t-test at the .05 level of significance. The results indicate a significant difference in the mean ages of engineers and non-engineers performing high technology marketing management work in southern California aerospace firms ($p<.001$), with the engineers averaging 52.44 years of age as compared to 47.28 years of age for the non-engineers.

Questionnaire questions #13, 14, and 15 related primarily to Mintzberg's roles, skills and characteristics, and were used principally to answer the stated study questions.

Demographic Question #16 asked respondents to indicate "how involved they are in their present work." Table 19 shows the degree of personal involvement in their present work as reported by these marketing managers. The data were tabulated and statistically tested through application of Chi square at the .05 level of significance. The results indicate no significant difference between engineers and non-engineers in the degree of "involvement in their present work" ($p>.05$).

Table 19

Degree Of Personal Involvement In Present Work As Reported By High Technology Marketing Managers In Southern California Aerospace Firms (N=64)

Degree Of Involvement in Present Work	Frequencies for Engineers	Non-Engineers
Somewhat involved	0	1
Involved	2	8
Very Involved	23	19
Extremely Involved	7	4
N =	32	32

Chi square = 5.80 (df=3) p>.05

Question Five

The fifth research question is repeated as follows: What significant relationships between selected demographic characteristics of the respondents and other variables of the study are evident in each of the two groups, and in the combined group of engineers and non-engineers? This question was designed to identify significant relationships between selected demographic characteristics of the respondents and other variables of the study which were evident in each of the two groups, and in the combined group

Table 20

Significant Correlations Between Selected Demographic Variables And Perceived Importance of Various Managerial Roles For Engineers and For Non-Engineers (N=64)

Demographic Variables	Importance of the Managerial Role of: Scale: Important=4 Unimportant=1	Engineers (N=32) r	Signif.	Non-Engineers (N=32) r	Signif.
Managerial Level (Q1) (Highest=7) (Lowest=1)	Figurehead •Entertaining/ briefing customers	-.206	p>.01(NS)	-.583	p<.001
Nature of Position (Q2) (Line=2) (Staff=1)	Leader •Directing the subordinates	-.556	p<.001	-.166	p>.01(NS)

of engineers and non-engineers.

Demographic questions on (1) Managerial level, (2) Nature of position, (3) Years in present position, (4) Years with present company, and (5) Age were used in this section. A total of 1566 correlations were performed, 522 each for engineers, non-engineers, and combined engineers and non-engineers. Fewer than two correlations spuriously significant at p<.001 were to be expected. However, eleven significant correlations were identified at or less than p<.001, and these have been reported.

Table 20 lists significant correlations between selected demographic variables and extent of agreement with importance of various managerial roles for engineers and for non-engineers performing marketing managerial work, and are reported as follows:

Engineers:

Those engineers identifying themselves as line managers generally considered "Directing the work of subordinates" to be less important than did engineers identifying themselves as staff managers ($r=-.556$ $p<.001$). For non-engineers, however, there was no significant relation between the same two variables.

Non-Engineers:

Those non-engineers in higher managerial levels generally considered "Entertaining and briefing customers" to be less important than did non-engineers in lower managerial levels ($r=-.583$ $p<.001$). For engineers, however, there was no significant relation between the same two variables.

Table 21 lists significant correlations between selected demographic variables and extent of agreement with importance of various managerial skills for engineers and for non-engineers performing marketing managerial work, and are reported as follows:

Table 21

Significant Correlations Between Selected Demographic Variables And Perceived Importance of Various Managerial Skills For Engineers and For Non-Engineers (N=64)

Demographic Variables	Managerial Skills (Scale: Important=4 Unimportant=1)	Engineers (N=32) r	Signif.	Non-Engineers (N=32) r	Signif.
Years in Present Position (Q3) (Highest=4) (Lowest=1)	Conceptual Skills •Time management ability	-.132	p>.01(NS)	-.628	p<.001

Non-Engineers:

Those non-engineers with more seniority in their present position generally considered "Time management ability" to be less important than non-engineers with less seniority in their present position (r=-.628p<.001). For engineers, however, there was no significant relation between the same two variables.

Table 22 lists significant correlations between selected demographic variables and extent of agreement with importance of various managerial roles for engineers and for non-engineers combined, and are reported as follows:

a. Those engineers and non-engineers in higher managerial levels generally considered "Authorizing plans for new projects/proposals" to be less important

Table 22

Significant Correlations Between Selected Demographic Variables And Perceived Importance of Various Managerial Roles For Engineers And For Non-Engineers Combined (N=64)

Demographics Variables	Importance of the Managerial Role of: (Scale: Important=4 Unimportant=1)	r	Signif.
Managerial Level (Q1) (Highest=7) (Lowest=1)	Resource Allocator		
	•Authorizing plans for new projects/ proposals	-.431	p<.001
Nature of Position (Q2) (Line=2) (Staff=1)	Leader		
	•Attend to staffing requirements	-.471	p<.001
	•Integrating subordinates' goals	-.429	p<.001
Years in Present Position (Q3) (Highest=4) (Lowest=1)	Figurehead		
	•Working with appropriate people to assure contracts are negotiated	+.438	p<.001
Age (Q5)	Monitor		
	•Gathering intelligence about customers. and competition	-.419	p<.001
	•Snooping for information on company plans	-.423	p<.001

than did engineers and non-engineers in lower managerial levels (r=-.431 p<.001).

b. Those engineers and non-engineers identifyingthemselves as line managers generally considered "Attending to staffing requirements" to be more important than did engineers and non-engineers

identifying themselves as staff managers (r=-.471 p<.001).

c. Those engineers and non-engineers identifying themselves as line managers generally considered "Integrating subordinates' goals" to be less important than did engineers and non-engineers identifying themselves as staff managers (r=-.429 p<.001).

d. Those engineers and non-engineers with more seniority in their present position considered "Working with appropriate people to assure contracts are negotiated" to be more important than did engineers and non-engineers with less seniority in their present position (r=+438 p<.001).

e. Those engineers and non-engineers in higher age brackets considered "Gathering intelligence about customers and competition" to be less important than did engineers and non-engineers in lower age brackets (r=-.419 p<.001).

f. Those engineers and non-engineers in higher age brackets considered "Snooping for information on company plans" to be less important than did engineers and non-engineers in lower age brackets (r=-.423 p<.001).

Table 23 lists significant correlations between demographic variables and extent of agreement with importance of various managerial skills for engineers and

Table 23

Significant Correlations Between Selected Demographic Variables And Perceived Importance of Various Managerial Skills For Engineers And Non-Engineers Combined (N=64)

Demographic Variables	Importance of the Managerial Skill of:	r	Signif.
Years in Present Position (Q3)	Conceptual Skills •Time management ability	+.476	p<.001

non-engineers, combined, and are reported as follows:

a. Those engineers and non-engineers with higher seniority in their present position generally considered "Time management ability" to be more important than did engineers and non-engineers with less seniority in their present position (r=+.476 p<.001).

Table 24 lists significant correlations between selected demographic variables and extent of agreement with importance of various managerial work characteristics for the combined group of engineers and non-engineers. The categories were as follows:

a. Those engineers and non-engineers with higher seniority in their present position agreed more to the statement, "Giving briefings and tours to official

Table 24

Significant Correlations Between Selected Demographic Variables And Extent Of Agreement With Statements About Various Managerial Work Characteristics For Engineers And Non-Engineers Combined (N=64)

Demographic Variables	Managerial Work Characteristics (Scale: Agree fully = 4 Disagree fully = 1)	r	Signif.
Years in Present Position (Q3)	•Giving briefings and tours to official visitors interferes with ability to do your assigned job.	+.525	p<.001

visitors interferes with ability to do your assigned job" than did engineers and non-engineers in lower age brackets (r=+.525 p<.001).

Summary

The Spearman Rho and Student's t-tests were applied to the survey data in order to answer the first research question. The results indicated a significant overall similarity and several significant differences between engineers' and non-engineers' perceptions of the importance of Mintzberg's managerial roles as perceived by engineers and non-engineers. These comparisons revealed that engineers and non-engineers are in close agreement concerning the importance of five of Mintzberg's managerial roles. Those

roles were "Resource Allocator," "Entrepreneur," "Disseminator," "Disturbance Handler," and "Negotiator."

Significant differences in the eleven roles were reported. Engineers perceived the technical expert role as more important ($p.<.02$). Non-engineers, on the other hand, perceived the monitor and the spokesperson roles as more important ($p<.01$).

Data gathered and measured in response to question number two, designed to identify the extent to which Mintzberg's managerial skills and work characteristics are regarded as similar or significantly different in importance by engineers and non-engineers, revealed that engineers and non-engineers are in general agreement concerning the importance placed on Mintzberg's various managerial skills. However, the results indicate strong similarities and agreement between engineers' and non-engineers' perceptions and views concerning Mintzberg's managerial work characteristics. A comparison of the two groups in terms of differences in perceived importance of Mintzberg's nine managerial work characteristics indicates that no significant differences were found between engineers and non-engineers in their views of the importance of each of Mintzberg's nine work characteristics.

Results of findings relating to question number three indicated significant differences in the factors determining the entry into high technology aerospace marketing

management work. The data indicated that engineers are more likely to be promoted into marketing management positions from within the organization than are non-engineers. Non-engineers, on the other hand, are more likely to be hired and promoted into high-technology aerospace marketing management from outside the organization.

Responses to question number four revealed various significant differences relating to the demographic aspects of the research data. Engineers reported promotion to their first management position from within the company more than non-engineers did. Non-engineers reported being hired into their first management position from another company more than non-engineers did. The engineers showed a significantly higher level of formal education than non-engineers.

Age data revealed a significant difference in mean ages: 52.44 years for engineers compared to a mean age of 47.28 years for non-engineers.

The results relating to the degree of personal involvement by engineers and non-engineers in their present work environment indicate no significant difference between engineers and non-engineers.

Significant relationships between selected various demographic characteristics of the respondents and other variables of the study were evident in each of the two groups, and the combined group of engineers and non-

engineers. A total of 1556 correlations were performed, 522 each for engineers, non-engineers, and combined engineers and non-engineers through application of the Pearson r statistical test. Although, fewer than two correlations spuriously significant at $p<.001$ were to be expected, eleven significant correlations were identified at or below $p<.001$.

CHAPTER FIVE

Summary, Conclusions, and Recommendations

The current study sampled and tested the managerial work attitudes and perceptions of high-technology marketing managers, both engineers and non-engineers, performing high-technology marketing work within the context of the aerospace organizational setting.

This chapter presents a summary of the research conducted, with conclusions and recommendations based on the findings. The summary section provided an overview of the basic research problem, the specific research approach adopted for the study, and the criteria established for identification of the data sources employed. Relevant prior research was described in Chapter 2, which addresses the review of selected literature.

The research method outlined for the study and the procedures employed for the collection and analysis of the data have been discussed to answer the research questions formulated for the study.

The findings provide a summary of the extent to which the current study provided empirical support for the managerial roles, skills, and work characteristics as defined by Mintzberg (1973,1975,1980). The conclusions

feature the answers drawn from this study and point out relationships between its findings and those reported for related research. Possible implications and applications of the findings also are explored, and the observed strengths and weaknesses in the research are noted. The chapter concludes with recommendations for further research.

Summary

The purpose of this study was to compare the managerial work attitudes and perceptions of high-technology aerospace marketing managers from two backgrounds, engineering and non-engineering. The research utilized Mintzberg's framework of managerial roles, skills, and work characteristics in order to provide answers to the first two research questions.

The third question was specifically designed to determine the extent to which engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers.

The fourth study question uses the twelve demographic items of the questionnaire to investigate the demographic characteristics in an attempt to identify similarities and significant differences between the surveyed engineers and non-engineers.

The fifth question was designed to identify the significant relationships between demographic

characteristics of the respondents and other, non-hypothesized variables of the study that are evident in each of the two groups as well as in the combined group of engineers and non-engineers.

The Research Problem

Five research questions were addressed in this study. The five questions were:

1. To what extent are Mintzberg's managerial roles regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing management work in aerospace companies?

2. To what extent are Mintzberg's managerial skills and work characteristics regarded as similar or significantly different in importance by engineers and non-engineers performing high-technology marketing managerial work in aerospace companies?

3. To what extent do engineers and non-engineers identify similar or significantly differing factors as the determining reasons for entering high-technology marketing management careers?

4. What similarities and significant differences between engineers and non-engineers are evident from comparisons of the responses to the twelve demographic items of the questionnaire?

5. What significant relationships between demographic characteristics of the respondents and other variables of the study are evident in each of the two groups, and in the combined group of engineers and non-engineers?

The Research Approach. The research approach employed to obtain the data required to answer the research questions was specified as descriptive-correlational. This approach was selected based on similar studies conducted by Alexander (1979), Kurke and Aldridge (1979), Lau and Pavett (1980, 1983), McCall and Segrist (1980), Morse and Wagner (1978), and Paolillo (1981). In general, these studies indicate that Mintzberg's managerial framework is useful for examining the similarities and significant differences of his various managerial roles as they are perceived by managers from different functional specialities and backgrounds.

Criteria for Data Source. The criteria for the data source identified to form the basis for the findings reported in the current study specified that the participants be employed in a major high-technology aerospace firm located in southern California. In addition, the individuals who were administered the questionnaire developed for the study were required to have been employed in a marketing managerial position at the time the study was conducted.

Review of Selected Literature

A review of published research related to the nature of managerial work, job characteristics, and behavior revealed that, while models have many shortcomings in terms of adequately defining what managers really do, Mintzberg's framework has been generally accepted as fairly useful for describing the nature of managerial work and for examining similarities and differences between managerial jobs and functions.

In several of the studies reviewed, the authors stated they used different operationalizations of Mintzberg's managerial roles but all concluded that either hierarchical level or functional areas influence the relative importance of the roles. Other studies have used this framework to examine similarities in managerial jobs in the public and private sector.

Most of the discussion of Mintzberg in textbook chapters on managerial work focuses on his conceptualization of the manager's job in terms of ten work roles, not simply the number of activities a manager carries out in a day. In his typology, Mintzberg formulated three interpersonal roles, three informational roles, and four decision-making roles. He indicated that managers in different types of jobs and at different levels vary in the relative importance of these roles to their overall responsibilities.

Others have supported Mintzberg's hypotheses that sales

jobs require more interpersonal roles than production manager's jobs and information roles are especially important on staff jobs, such results appear obvious and do not require documentation.

Only a handful of studies have used Mintzberg's roles to predict managerial success. Those authors found significant relationships between promotion rates and six of Mintzberg's roles. Another study on a small sample of managers indicated that only two of the roles were related to performance evaluations. Others found that successful executives engage in more leader and monitor activities than non-successful executives.

Mintzberg criticized the validity and usefulness of the classical managerial functions in describing managerial work. He described the classical functions of Fayol and others as "folklore". Additionally, he felt that viewing the manager simply as a decision maker or a motivator of subordinates is not very helpful in disentangling the complexity of managerial work. Writers have commended the realism of his approach when compared to the abstract description of managerial work painted by the classical writers.

The work of Mintzberg and those taking similar approaches has illuminated the specific ways the functional responsibilities are carried out and has provided realism to studies about managerial work.

Method

In order to accomplish the objectives of this study, the managerial attitudes and perceptions of the survey respondents were measured. This was accomplished through a research design which involved sampling a high-technology marketing management population working in a large multi-division aerospace industry company located in southern California. All the study participants were engaged in high-technology aerospace marketing work. The data were collected through the application of a structured questionnaire and were analyzed statistically to determine the similarities and significant differences reported in the group's perceptions of Mintzberg's managerial roles, skills, and work characteristics.

Collection of Data. The data were collected from thirty-two engineers and thirty-two non-engineers. The data were obtained through the application of a questionnaire which collected data considered as a valuable measurement for the empirical evaluation based on Mintzberg's (1973-1980) theoretical framework. The questionnaire also included items designed to provide demographic data reflective of the participants' professional and educational backgrounds and length of tenure in their present company and positions.

The questionnaires, along with a transmittal letter of instruction and a pre-addressed stamped return envelope, was

sent to the targeted respondents through their aerospace firm's internal mail system.

Analysis of Data. Statistical comparisons of the data collected to answer the research questions posed for the current study were performed by Student's t-tests for differences between uncorrelated means. The implied statistical hypotheses, as noted in the research questions, were tested in the null form at the .05 level of significance. This test was considered as appropriate to determine whether a significant difference existed between two means based on continuous interval-scaled variables. Chi-square and the Spearman Rho were used to test for the existence of relationships. The Pearson r correlation statistical test was also used to determine relationships between the various demographics characteristics of the respondents and other variables of the study. Tables were prepared to illustrate the data which formed the basis for each of the comparisons. Results of the comparisons were examined to answer the research questions.

Findings

A review of demographic data provided by the survey participants indicated that the sample was taken from a homogeneous group. Although the data collection was limited to three major company divisions of a large aerospace corporation in southern California, the respondents were

considered reasonably representative of those who might be found in any one of the other aerospace industry companies which operate in the greater southern California area. The assumption is that most large aerospace corporations situated in southern California tend to be similarly organized and managed. The data, therefore, should be viewed as applicable to other aerospace companies operating under similar conditions.

Managerial Roles--The results of the comparison of the rankings reported for each of the two groups showed significant overall similarities and several significant differences between the participants' perceptions of the importance of Mintzberg's managerial roles as perceived by engineers and non-engineers performing high-technology aerospace marketing management work. The rank order of means at the .05 level of significance indicated especially close similarities in perceived importance of the following roles: Resource Allocator, Entrepreneur, Disseminator, Disturbance Handler, and Negotiator.

A comparison of the two groups in terms of differences in perceived importance of the various managerial roles indicated significant differences in three of the managerial roles.

Engineers rated the importance of the Technical Expert role significantly higher than non-engineers ($p<.02$). This role involves such activities as directing, identifying or

solving complex engineering or scientific problems, consulting with others over technical matters, providing technical quality control through the review process, and judging the accuracy of technical approach and utility of technical programs and proposals.

These findings agreed with Pavett and Lau (1980) where R and D managers in the public and private sector also rated the technical role higher than the non-R and D managers.

Non-engineers rated the importance of the Monitor role significantly higher ($p<.02$). This role involves such activities as continually seeking information to understand what is taking place in the organization and its environment, seeking information in order to detect changes, to identify problems and opportunities, to build up knowledge about the environment, to be informed when information must be disseminated and decisions made.

Non-engineers also rated the Spokesperson role significantly higher ($p<.01$). This role involves such activities as keeping sponsors, customers or others informed, and act as experts in those activities in which their organization engages.

Managerial Skills--Importance ranking of Mintzberg's four managerial skills was not found to be significant in agreement ($p>.05$). Although the value of Rho suggested strong agreement, it was not considered significant due to the small numbers of categories.

There were no significant differences between the two groups in the perceived importance of Mintzberg's four managerial skill areas for successful job performance ($p>.05$). For example, the mean score for engineers on technical skills was 3.0, whereas the non-engineers rated the skill as 3.1. Both groups reported that human skills (E's: M=3.4; NE's: M=3.6) and conceptual skills (E's: M=3.4; NE's: M=3.3) were very important for performing their jobs effectively.

Both groups agreed that the most important set of skills for effective job performance were the human skills (e.g. verbal and written communication, flexibility, persuasiveness, listening carefully to others, and coolness under stress). Conceptual skills were ranked as second most important, followed by technical skills and, lastly, political skills. This indicates that the two groups are in general agreement concerning the importance to be placed on Mintzberg's managerial skills.

Managerial Work Characteristics--The groups' ranking of the items assessing Mintzberg's managerial work characteristics indicated strong significant similarities in agreement with the two sets of rankings ($r_S=.90, p<.001$). With the exception of the importance of self-development activities, and interruptions and unscheduled events, the results indicate that the respondents rate the work characteristics in a fairly similar manner. Engineers agree

more strongly than non-engineers that they rely on the formal management information system for the information they need.

A comparison of the two groups in terms of differences in perceived agreement about the importance of Mintzberg's managerial work characteristics indicated that no significant differences were found between engineers and non-engineers in their agreement with the importance of each of the nine work characteristics ($p>.05$).

These findings agreed with the perceptions expressed by R and D and non-R and D managers as reported by Pavett and Lau (1980).

Reason For Entry Into High-Technology Aerospace Marketing Work--Findings relating to a comparison of factors determining the entry into high technology aerospace marketing management indicate significant differences ($p<.05$). The results indicate that engineers are more likely to be promoted and assigned into high-technology aerospace marketing management positions from within the company as a result of requests from company officials. Non-engineers, on the other hand, are more likely to be hired and promoted into marketing management positions from outside the organization.

Demographic Variables--Various significant differences were found. There was a significant difference in the level

of education between engineers and non-engineers ($p<.05$). Findings showed that engineers have 17.6 years of formal education as compared to 16.9 years for non-engineers. In the matter of age, results indicated a significant difference in the mean ages with the engineers averaging 52.44 years as compared to 47.28 years of age for the non-engineers ($p<.001$).

No significant difference was found in the organizational management level of the respondents ($p>.05$). Findings showed that engineers and non-engineers are at essentially equal levels organizationally.

Findings of the data relating to length of time worked in the current aerospace company indicated no significant difference between the respondents ($p>.05$). No significant differences between the respondents were found in the length of time worked in the current position.

The job position desired in 5 years as reported by the respondents indicated no significant difference between the two groups. Fifty three percent of engineers as compared to forty seven percent of non-engineers indicated they desired their boss's job.

Significant relationships between selected demographic characteristics of the respondents and other variables of the study were evident in each of the two groups, and in the combined group of engineers and non-engineers. Eleven significant correlations were identified with significances

at or less than $p<.001$. The demographic questions considered for this study were the following: (1) Managerial level, (2) Nature of position, (3) Years in present position, (4) Years with present company, and (5) Age.

Two significant correlations between the demographic variables and extent of agreement with importance of various managerial roles for the respondents were found: (1) Engineers in upper level aerospace marketing management positions generally considered directing the work of subordinates to be less important than did engineers in lower level marketing management positions. No significant relation was found for non-engineers between the same two variables; (2) Non-engineers in higher managerial levels generally considered entertaining and briefing customers to be less important than non-engineers in lower managerial levels. No significant relation between the same two variables was found for engineers.

One significant correlation between the demographic variables and extent of agreement with importance of the various managerial skills was found. Non-engineers with higher seniority in their present position generally considered time management ability to be less important than for those with less seniority in their present position. No significant relation between the same two variables was found for engineers.

Six significant correlations between the demographic variables and extent of agreement with importance of the various managerial roles for engineers and for non-engineers combined were experienced; (1) Respondents in higher managerial levels generally considered authorizing plans for new projects/proposals to be less important than it was for respondents in lower managerial levels; (2) Respondents in upper aerospace marketing manager positions generally considered attending to staffing requirements to be less important than it was for respondents in lower marketing management positions; (3) Respondents in higher marketing manager positions generally considered integrating subordinates' goals to be less important than it was for respondents in lower marketing management positions; (4) Respondents with more seniority in their present position considered working with appropriate people to assure that contracts are negotiated to be more important than it was for respondents with less seniority in their present position; (5) Respondents in higher age brackets considered gathering intelligence about customers and the competition, and (6) snooping for information on company plans to be less important than it was for respondents in lower age brackets.

One significant correlation between the demographic variables and extent of agreement with importance of various managerial skills for engineers and non-engineers, combined, was found. Respondents with higher seniority in their

present position generally considered time management ability to be more important than for those with less seniority in their present position.

One significant correlation between the demographic variables and extent of agreement with importance of the various managerial work characteristics for respondents combined was found. Those respondents with more seniority in their present position agree more that giving briefings and tours to official visitors interferes with the ability to do their assigned job than did those respondents in lower age brackets.

Conclusions

The Research Questions

Five research questions were addressed by the study as follows:

Research Question One. It was found that both groups generally tend to rate the relative importance of the eleven managerial roles in much the same way. However, there were a number of significant differences between the two groups. Engineers perceived the technical expert role as more important for successful job performance than did non-engineers. The monitor and spokesperson roles were rated higher by non-engineers than engineers. Non-engineers reported that monitor and spokesperson activities of seeking and receiving a wide variety of special information helping them emerge as the nerve center of internal and external

them emerge as the nerve center of internal and external information about the organization and the industry were the most important behaviors for successful job performance.

Research Question Two. Although no significant differences existed between engineers and non-engineers in terms of degree of importance placed on each of the four managerial skill factors, it was found that both groups are in general agreement concerning the importance to be placed on the four skill factors tested. The level of that importance averaged approximately three on the response scale of one to four, meaning that both groups generally perceive the skills to be of moderate importance. The current study found strong agreement between engineers and non-engineers in that meetings tend to burn up an unnecessary amount of time, that it is virtually impossible to set and stick to a work schedule, and that briefings interfere with their ability to do an effective job.

Research Question Three. The study findings suggest that engineers are more likely to progress into aerospace marketing management positions from within the organization because of their technical background influence and encouragement by upper company engineering managers and officials. On the other hand, non-engineers are less likely to be promoted into marketing management positions from within the high-technology aerospace organization.

Research Question Four. The only significant differences found between the two groups were in terms of years of formal education and the mean age of the respondents. Engineers in high-technology marketing managerial positions tend to be older and have a higher level of education than their counter-part non-engineers in aerospace companies. Possibly this is because aerospace companies may tend to provide better incentives and encouragement for engineers than for non-engineers to remain with the organization. Because of the ever advancing state-of-the-art and the need for continual technical upgrading of engineers in high-technology work, in-house company-sponsored technical training, and enticing advanced degree reimbursement programs may tend to encourage and attract more engineers then non-engineers. Consequently, engineers tend to remain longer with the high-technology aerospace company. Non-engineers, on the other hand, may be compelled to move more frequently between companies in search of career enhancement opportunities in high-technology aerospace marketing.

Question Five. Significant relationships between demographic characteristics of the respondents and other variables of the study were evident in each of the two groups, and in the combined group.

(a) Entertaining and briefing customers (figurehead role) was considered less important to non-

engineers in higher aerospace marketing managerial positions than for those in lower marketing management levels. A possible reason is that top level non-engineers in aerospace marketing may consider more fully that socializing and briefings interfere with their ability to do their assigned job and may prefer to delegate these tasks to the lower positions.

(b) Engineers in the higher marketing manager positions considered the importance of directing subordinates (leader role) to be more important than did those in lower managerial staff positions. A possible reason is that higher level engineer managers may be more engrossed in the company technical and engineering commitment and consider themselves more as leaders than do lower level engineers who, naturally, are more totally involved in the every-day detail tasks of design and analysis.

(c) Time management ability (conceptual skills) was considered to be less important by non-engineer marketing managers with higher seniority in their present position. Possibly more longevity in a position results in the incumbent being better organized and may feel less need to conceivably consider time management ability.

(d) Authorizing plans for new projects/proposals (resource allocator role) was considered to be less

important by both engineers and non-engineers in the higher aerospace marketing managerial levels than it was for engineers and non-engineers in the lower marketing managerial levels. The conclusion is that those marketing managers in higher level positions may consider the top planning aspects to be more important and consequently defer the authorizing roles to the lower level marketing managers who may consider this role to be significant.

(e) It was found that those Engineers and non-engineers in the higher aerospace marketing management positions considered attending to staffing requirements (leader role) to be less important than it was for respondents in the lower marketing manager positions. Lower level marketing managers may be more involved with staffing responsibilities and may consider this role to be significant.

(f) Integrating subordinates' goals (leader role) was found to be of less importance to engineers and non-engineers in the higher marketing management positions than to those in the lower marketing management positions. It would appear that the higher level marketing managers are more involved and concerned with the aspects of the marketing roles than they are with the leader role of handling subordinate needs.

(g) Working with appropriate people to assure that contracts are negotiated properly (figurehead role) was found to be more important by engineers and non-engineers with higher marketing management seniority in their current position. It seems reasonable that those marketing managers with higher seniority are more liable for and thus feel more obligated to assure that contracts are handled appropriately.

(h) Gathering intelligence about the customer and the competition (monitor role) was found to be of less importance to those aerospace marketing managers in higher age brackets. Intelligence gathering is often considered the domain of younger and more energetic marketing managers.

(i) Snooping for information on company plans (monitor role) was found to be of less importance to those respondents in the higher age brackets. Possibly the older aerospace marketing managers are routinely kept apprised of company happenings by their upper management and naturally devote less energy to this role than do the younger marketing managers.

(j) Time management ability (conceptual skills) was found to be of less importance to those respondents with higher seniority in their present position. Possibly because of more experience and longevity in a

position may result in the incumbent being better organized and therefore does not overtly consider time management ability to be of any significance.

(k) Both engineers and non-engineers with higher seniority in their present marketing management position were in more agreement that giving briefings and tours to official visitors interferes with ability to do their assigned job than those with less seniority. Seniority in the position probably creates a greater sense of responsibility and personal involvement in everyday tasks and duties. Senior marketing managers consequently feel torn away from accomplishing those necessary tasks when they are asked to become involved in tours and briefings.

Findings Related to Context and Literature

The findings of the study were observed to have implications related to prior research which focused on research and development managers and executives employed in a variety of southern California service and manufacturing firms, and on an executive population in the federal government. The findings of the present study were noted to have agreed with those reported in the literature describing Mintzberg's managerial roles, skills and job characteristics. There were, however, a number of significant differences as follows:

Managerial Roles--In the current study, significant similarities were found between engineers and non-engineers ($p<.05$). In their study which compared Research and Development managers to non-Research and Development managers across two sectors, public and private, Pavett and Lau (1980) reported that public sector R and D managers tend to rate the relative importance of the eleven roles in much the same way as non-R and D managers ($p<.01$).

In the current study, engineers performing marketing managerial work also perceived the technical expert role as more important than non-engineers. There was a tendency for non-engineers to rate the monitor and spokesperson roles higher than non-engineers. Pavett and Lau (1980) reported that managers in R and D rated the importance of the technical expert role significantly higher than non-R and D managers. Conversly, Pavett and Lau reported that, while not statistically significant, R and D managers tended to rate the monitor and spokesperson roles somewhat higher than non-engineers.

In the current study engineers rated the technical expert role higher than non-engineers. Pavett and Lau reported that R and D managers also perceived the technical expert role as more important for successful job performance than did non-R and D managers. In the current study, engineers tended to view the leader role as more important than non-engineers. Conversly, non-R and D personnel

reported that the leadership activities of guiding, directing training, developing and evaluating subordinates were the most important behaviors for successful job performance.

Managerial Skills - The findings in the present study indicated that no significant differences exist between the respondents' perceptions of each of Mintzberg's four managerial skills. This indicates that engineers and non-engineers in aerospace marketing management positions are in general agreement concerning the importance to be placed on the four skill factors.

Both groups of aerospace marketing managers rated human skills, technical skills, and power skills in much the same manner. Private sector R and D managers rated all of the skill areas in much the same way as did the non-R and D managers. There were no significant differences between the two groups in the perceived importance of the four skill areas for successful job performance. Both groups in the Pavett and Lau study and the non-engineers in the current study reported that human skills and conceptual skills were very important for performing their jobs effectively. Respondents in both sectors agreed that the most important set of skills for effective job performance were the human skills (e.g. verbal and written communication, flexibility, persuasiveness, listening carefully to others, and coolness under stress). Conceptual skills were ranked as second most

important followed by technical skills and, lastly political skills. The only difference concerning the engineers in the current study was the importance placed on conceptual skills as most important and human skills as second place.

Unfortunately, the Pavett and Lau study did not include demographic information such as organization and management level, education, age, and specific background and experience from which to make a more reliable comparison to the present study of engineers and non-engineers performing high-technology aerospace marketing management work.

Managerial Work Characteristics--With the exception of the importance of the job as being present-oriented, precluding time for self-development and interruptions and unscheduled events due to fragmented daily work routine, both engineers and non-engineers rated the work characteristics in a similar manner. Pavett and Lau (1980) reported that, with the exception of the importance of socializing activities, both groups of public sector managers rated the work characteristics in a similar manner. In the present study, engineers agreed strongly that the majority of information required comes from the formal management information system. Private sector R and D managers agreed more strongly than non-R and D managers that they do not rely on the formal management information system for the information they need.

Findings: Implications and Applications

This research, using the managerial frameworks put forth by Mintzberg (1973-1980) and Katz (1974), implies that engineers and non-engineers, as high technology aerospace marketing managers, are not very different. The perceived relative importance of the roles, skills, and characteristics necessary to successfully manage human and material resources appear to be similar across both groups.

Despite the similarities, there were significant group differences. Engineers viewed the technical expert role significantly higher than non-engineers. This stands to reason where having being trained in "hard" sciences, where exact measurement is one of the natural characteristics of the scientific method, engineers and scientists are more comfortable working with things that they can objectively control and measure. These perceived characteristics of the engineer may be the reason they rely more strongly than non-engineers on the formal management system (MIS) for the information they need.

The functions performed by and the skills required of a successful high-technology aerospace marketing manager go beyond competence in the technical arena. All too often, the technically competent engineer or scientist is promoted to a managerial position because of demonstrated technical ability. The present study suggests that using technical competence as the sole criterion for promotion or selection

of high-technology aerospace managers may be counter-productive and may contribute to incompetency as marketing managers. Successful technical aerospace marketing managers need to possess the same sorts of marketing skills and managerial competence as non-technical marketing managers. Hence, the ability to manage time, manage people, and manage all resources in a job that is described by Mintzberg (1973) as present-oriented and fragmented is crucial to managers in all career fields. Consequently, marketing training and promotion criteria need not differ significantly for engineers and non-engineers in aerospace marketing management work.

The study findings also revealed that marketing management positions are almost non-existent for non-engineers within the high-technology aerospace companies. Non-engineers currently filling the relatively few high-technology aerospace marketing management positions were hired and promoted from outside the organization. In-house marketing-oriented career development training and promotional opportunities are now virtually non-existent for seemingly bright and ambitious non-engineering employees aspiring to find their position as high-technology aerospace marketing managers and executives. It seems probable that the institution of a special marketing training program for non-engineers would take advantage of a pool of potential

marketing talents which might otherwise be lost to the company.

The significantly higher level of formal education for engineers revealed in the study is assumed to be a fallout of encouragement and upper management emphasis placed by the high-technology aerospace industry on continued engineering and scientific education and technical training.

This study indicated also that engineers performing marketing management work were found to be significantly older than non-engineers. This could be due to perceived closer ties by engineers to the organization, that they may feel more dedicated and thus tend to remain with the organization.

On the basis of his familiarity with aerospace organizations and his reactions to the study's findings, the researcher suggests that 1) Engineers, although highly trained and qualified in their technical and scientific disciplines, may be less effective as high-technology aerospace marketing managers than non-engineers possessing a greater amount of education and training in marketing; 2) Because of the perceived non-availability or limited career development opportunities in high-technology marketing in the aerospace business arena, non-engineering business and liberal arts graduates with specialization and experience in marketing are systematically forced into the less technology oriented industries outside of the aerospace business. The

potential benefit to the organization of these normally well-trained professional marketing individuals may not be recognized by the engineering-oriented top aerospace marketing leaders. A much needed change in the perceived way engineer leaders view non-engineers is overdue.

Many major American high-technology aerospace companies have long been highly dependent on the programatic needs of the National Aeronautics and Space Administration (NASA),Department of Defense (DOD), and various other governmental agencies for their major product base. Today, the aerospace business and its spin-off technology developments is becoming highly competitive in the world's technology markets. This is partly due to the United States government contractual requirements and changes which continue to evolve from cost-plus to fixed-price with incentive features, and as governmental programatic controls move from total government needs and controls to government/industrial-share; and subsequently to private commercialization - domestic and multinational.

Overall increased marketing activity, necessitated by domestic and the developing multinational aerospace companies, will generate not only more data but a greater awareness of its need. In addition to the growing needs for greater marketing skills, major changes in the quantity and type of information needs (MIS), there will be a growing demand for continuous sources of marketing information. In

short, those aerospace companies will have a greater need for a worldwide marketing management information system (Kotler, 1980). Consequently, the role of the aerospace marketing manager will change and his activities greatly expanded in overall number and scope.

Marketing Managers (specialists), trained and experienced in high-technology marketing methodology and skills could prove to be an invaluable asset to the highly competitive aerospace business organization. These market oriented individuls could assume the leadership role from a business development standpoint and provide the impetus to the aerospace economic progress. Engineers and scientists not versed in marketing technology could participate as the technical experts who would accompany and support the marketing manager on technical interface situations dealing directly with his customer counter-part engineer or technical person while the marketing executive integrates the common interests of the company and the customer.

Most aerospace companies are aware of the need for formal marketing training programs, but they are not doing much about it. Training for inside marketing staff is mostly by osmosis

Rapidly evolving marketing processes and a continually changing environment point to the critical need for well trained marketing managers. Current trends in the aerospace market environment show that the practioners of the

functions of marketing will be expected to carry an even greater share of the responsibility of the aerospace business in the future. The development of marketing executives who can improve the effectiveness of high-technology aerospace marketing and meet the challenges of tomorrow, has become more important than at any other time in history.

High-technology aerospace companies should make every effort to assist the current or aspiring marketing executive in the acquisition of the skills and knowledge that he will need to equip himself to successfully meet the challenges of the future. At the very least, companies should provide the proper climate for development by encouraging the recognition of the necessity for continuing self-development among the junior executives in marketing. This climate should emanate from top management and permeate down through each of the levels of management. In this way, management will be able to give this training the importance it deserves. The executives of the company must be kept constantly apprised of the necessity for current and aspiring executives to acquire new marketing skills and knowledge to meet the changing trends.

Depending upon its resources, each aerospace company should provide development opportunities within as well as outside the organization. The nature of these opportunities will vary, of course, depending on the size of the company,

the number of employees, the physical and financial resources of the company, and many other factors. For example, a large company may provide an extensive formal training program within the organization.

Many institutions of higher learning offer a variety of executive development programs. Several of these programs may be of interest to firms as aids in developing marketing managers and executives.

There are programs that dovetail almost exactly with the needs of certain executives for marketing education. For example, they offer courses in Marketing research; Business, Government, and the marketing systems; Marketing planning and analysis; Management information systems in marketing; Future critical marketing problems; Marketing management at the policy level; Nature and scope of the job; Design and implementation of effective marketing programs; Managing innovation in marketing; New Techniques for Marketing management; Financial management; and Business policy, to name a few.

Suggested Problem Resolution - Professional technical marketing development programs providing opportunities for high-technology marketing management internships could be developed and offered to potential managers, engineers and non-engineers alike. In establishing and implementing an effective high-technology aerospace marketing manager

development program, the following requirements and criteria should be met:

1. There should be a perceived need for the program by management, technologists, and non-technologists. It should be created to fill a void or a gap which is assumed to exist.

2. The value, objectives, and expectations of training should be clear. The following questions must be squarely faced: What are we looking for? What objectives are expected to be achieved by going through this program? What kinds of changes can be expected?

3. The program should be relevant. It should be tied closely to the needed changes in the trainee's knowledge, skills, and attitudes.

4. There should be a close relationship between what is taught in this program and what is actually done later on the job. The focus and thrust of training should not only be the development of marketing knowledge, but also skill development. The program content, therefore, should be tailored to fit the actual technical marketing job content for which the training is undertaken.

5. The program should not be viewed as a spare-time activity. High-caliber, qualified instructors, modern training facilities, and relevant and strong management support will help create a favorable image

and incentive for program participation.

6. The program should not be developed in a vacuum. It should rather be carefully integrated into the total organizational goals, objectives, management, and marketing system. An appropriate organizational climate, management policies, task orientations, organizational rewards, and so on must be provided to give the marketing manager candidates the opportunity to practice what they were taught (or trained for) and, thus, reinforce their learning experience.

7. The program should become a top corporate concern, receiving a strong management commitment through supportive relationships and structured programs in human resources development.

Ultimately, the burden of assisting the high-technology aerospace marketing executive and manager to equip himself with the knowledge and skills that will be needed to meet the challenges of the future is a joint responsibility of the individual himself and the company. While company action must be initiated whenever possible, the individual - through personal action - must pace his own self-development.

Evaluation of the Research

The observed strengths of the current research were centered on the implementation of the research design on site at a large aerospace company in Southern California.

Generally, it was the researcher's view that the specified design, the data source, instrumentation, and procedures were adequate in the study setting and yielded data that were appropriate to the research questions posed. A further strength was the fact that the researcher and respondents for this study were employees of the aerospace company at the time of this research.

Possible weaknesses inherent in the research design were: limiting the scope of the study to a single company as the major data source. The study may have provided a broader base for comparison of the relative importance of Mintzberg's managerial roles, skills, and work characteristics had another industry been included which would represent a less highly technologically oriented population. Contrasts could then be observed between the more high-technology conscious aerospace industry employees and the proposed less technologically oriented alternate sample population.

Recommendations For Future Research

Future research should be conducted which would enhance the findings of the current study and provide for a more comprehensive assessment of the impact of Mintzberg's managerial roles, job characteristics and required skills on objective performance criteria. The methodology in the present study allowed each manager to define successful job performance in his own way. Future studies should be aimed

at identifying objective criteria of managerial success to insure definitional consistency across respondents.

The present study design should also be extended to collect additional data to compare various functional departments such as engineering with non-engineering, finance and administration in various industries such as the High-Technology Management Information, Automobile, Petro Chemical, and Nuclear Plants, to name a few.

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APPENDICES

APPENDIX A

DATA COLLECTION INSTRUMENT

PART I. Tell us first about your job and yourself.

1. Which of the following best describes your position within the total organization? (check one)

(7) _____President or Chief Executive Officer
(6) _____Vice President
(5) _____Division Director, Product or Regional Manager
(4) _____Director
(3) _____Manager
(2) _____Section Head
(1) _____Supervisor

2. Which of the following best describes the nature of your position?

(2) _____Line manager (directly responsible for overall operations, production, distribution, sales, etc.)
(1) _____Staff manager (responsible for providing information, assistance, recommendations or advice to one or more line managers.)

3. Which one classification best describes your function of responsibility within the organization?

(1) _____accounting/finance/program control
(2) _____customer service
(3) _____data processing
(4) _____engineering/design
(5) _____general administration
(6) _____industrial relations/human resources
(7) _____logistics
(8) _____marketing/business development
(9) _____material
(10) _____production/manufacturing
(11) _____quality assurance
(12) _____research and development
(13) _____technical service or support
(14) _____other _____

4. How long have you worked for the company (organization) you work for now?

(1) _____under 2 years
(2) _____2+ to 5 years
(3) _____5+ to 15 years
(4) _____15+ to 20 years
(5) _____20+ to 25 years
(6) _____over 25 years

5. How long have you been in your present position?

(1) _____under 2 years
(2) _____2+ to 5 years
(3) _____5+ to 15 years
(4) _____over 15 years

6. How did you get your first management position?

(1) _____promoted from non-management job
(2) _____employed directly from college
(3) _____hired into this position from another company

7. What primary factor determined your entry into your current work function?

(1) _____promoted
(2) _____transferred from within the company (own request)
(3) _____company requested assignment
(4) _____hired from another company
(5) _____life's ambition
(6) _____stepping stone to ultimate career goal
(7) _____other (please specify)_____

8. What kind of job do you want to have five years from now?

(1) _____the same job
(2) _____my boss' job
(3) _____any higher-level management job
(4) _____a better job in another company or organization
(5) _____retirement
(6) _____other (please specify)_____

9. Years of formal education? Circle last year completed.

high school: (9) (10) (11) (12) college: (13) (14) (15) (16) (17) (18) (19) (20)

10. (1) College undergraduate major area of study?_____

(2) Post graduate major area of study?_____

11. Your sex?

(1) _____male (2) _____female

12. State your age on your last birthday _____

PART II. Now tell us about the job activities that may be required in your current job.

13. Use an"X" to show the importance to you of each activity in the successful conduct of your current work

	Of No Importance 1	Of Little Importance 2	Of Moderate Importance 3	Extremely Important 4
(1) entertaining /briefing customer and associate/ subcontractor personnel as an official representative of your company	____	____	____	____
(2) attending to staffing requirements in your department, such as hiring, firing, promoting, and recruiting	____	____	____	____
(3) making yourself available to "outsiders" (such as customers, suppliers, the public) who want to go to "the person in charge"	____	____	____	____
(4) attending to the training and development needs of employees	____	____	____	____
(5) keeping customers and other important potential new business groups informed about your department's and company's activities and capabilities	____	____	____	____
(6) joining boards, organizations, clubs, or doing public service work which might provide useful work-related contacts	____	____	____	____
(7) keeping professional colleagues informed about your department	____	____	____	____
(8) taking immediate action in response to a crisis or "fire-drill"	____	____	____	____
(9) negotiating labor-management agreements or dealing with union representatives	____	____	____	____
(10) staying attuned to what is going on in the competitor's organization	____	____	____	____
(11) escorting official visitors	____	____	____	____
(12) keeping the general public informed about your department's activities, plans or capabilities	____	____	____	____
(13) establishing friendly relationships with customers and subcontractors	____	____	____	____
(14) handling formal grievances	____	____	____	____
(15) assigning people to work on new projects	____	____	____	____
(16) reading trade journals to get information on what is happening in the industry	____	____	____	____

	Importance of Activity in your current work			
	Of No Importance 1	Of Little Importance 2	Of Moderate Importance 3	Extremely Important 4
(17) keeping up to date with the information relevant to a new project or assignment	____	____	____	____
(18) developing new contacts by answering requests for information	____	____	____	____
(19) authorizing plans for new projects or proposals	____	____	____	____
(20) answering letters or inquiries about your department/company	____	____	____	____
(21) formulating budgets	____	____	____	____
(22) determining the long-range plans and priorities of your department	____	____	____	____
(23) gathering information (intelligence) from or about your customers and competitors	____	____	____	____
(24) participating in defining organizational strategies and policies	____	____	____	____
(25) keeping members of your department informed of relevant information through meetings, conversations, and written information	____	____	____	____
(26) serving as technical expert to people outside of your immediate organization	____	____	____	____
(27) talking to different people to find out unofficially about the company's plans or top management decisions	____	____	____	____
(28) keeping up-to-date on customer needs and requirements	____	____	____	____
(29) judging the accuracy of approach and utility of technical programs and proposals	____	____	____	____
(30) providing new employees with adequate training and introduction to the job	____	____	____	____
(31) directing the work of your subordinates	____	____	____	____
(32) keeping up with market changes and trends that might have an impact on your department or organization	____	____	____	____
(33) distributing budgeted resource	____	____	____	____
(34) monitoring output of formal management information systems, including productivity measures and cost accounting records	____	____	____	____
(35) evaluating the outcomes of internal improvement projects	____	____	____	____

	Importance of Activity in your current work: Of No Importance 1	Of Little Importance 2	Of Moderate Importance 3	Extremely Important 4
(36) directing a technical project or subproject	____	____	____	____
(37) negotiating with groups outside your organization for necessary materials, support, commitment, etc.	____	____	____	____
(38) allocating your own time	____	____	____	____
(39) integrating subordinate's goals (e.g., career goals, work preferences) with the organization's goals and work requirements	____	____	____	____
(40) programming work for your department (what is to be done, when, and how)	____	____	____	____
(41) identifying and solving complex engineering or scientific problems yourself	____	____	____	____
(42) negotiating with groups internal to your organization for necessary materials, support, commitments, etc.	____	____	____	____
(43) working with the appropriate people to see that necessary contracts get negotiated	____	____	____	____
(44) providing technical quality control through the review process	____	____	____	____
(45) attending outside conferences or meetings	____	____	____	____
(46) consulting with others on technical matters	____	____	____	____
(47) transmitting ideas and information from your outside contacts to appropriate people inside the organization	____	____	____	____

PART III. Tell us about the skills and characteristics required of your current job.

14. Use an "X" to show the importance to you of the following managerial skills and characteristics as they apply to your job.

	Of No Extremely Importance 1	Of Little Importance 2	Of Moderate Importance 3	Important 4
(1) technical ability in your specialty (e.g., science, engineering, marketing,personnel, financial management)	____	____	____	____
(2) working long hours	____	____	____	____
(3) ability to sell one's ideas; persuasiveness	____	____	____	____
(4) ability to undertake systematic planning	____	____	____	____
(5) good memory for facts	____	____	____	____

Importance of skills and characteristics required in your job:

	Of No Importance 1	Of Little Importance 2	Of Moderate Importance 3	Extremely Important 4
(6) ability to create an environment in which subordinates work effectively	____	____	____	____
(7) listening carefully to others	____	____	____	____
(8) mathematical skills	____	____	____	____
(9) ability to communicate verbally	____	____	____	____
(10) ability to communicate in writing	____	____	____	____
(11) ability to reach conclusions with a minimum of information	____	____	____	____
(12) critical thinking; questioning methods and techniques that others take for granted.	____	____	____	____
(13) willingness to take risks	____	____	____	____
(14) willingness to question directives or orders from above	____	____	____	____
(15) keeping up-to-date in your technical specialty	____	____	____	____
(16) friendships and connections with superiors	____	____	____	____
(17) survival skills, being able to protect one's self and one's position from others	____	____	____	____
(18) building a power base	____	____	____	____
(19) crisis management ability	____	____	____	____
(20) time management ability	____	____	____	____
(21) patience	____	____	____	____
(22) building and maintaining a network of contacts	____	____	____	____
(23) diagnosing problems	____	____	____	____
(24) ability to evaluate the feasibility of new projects	____	____	____	____
(25) ability to get the information you need to do your job	____	____	____	____
(26) analyzing financial data	____	____	____	____
(27) budgeting skills	____	____	____	____
(28) flexibility	____	____	____	____
(29) developing and maintaining social relationships with work associates	____	____	____	____
(30) coolness under stress	____	____	____	____

PART IV. Now tell us about your perception of the following managerial work characteristics as they relate to your present organization.

15. Indicate how much you agree with each of the following statements:

	Disagree Fully 1	Disagree More Than Agree 2	Agree More Than Disagree 3	Agree Fully 4
(1) The greatest block to a manager doing his or her job is the constant barrage of "fire drills".	____	____	____	____
(2) Socializing constitutes an important part of your job (e.g., cocktail parties, dinner parties, business lunches).	____	____	____	____
(3) In your job it is virtually impossible to set a work schedule and stick to it.	____	____	____	____
(4) Meetings burn up an unnecessary amount of time.	____	____	____	____
(5) Managers who have a technical/professional background are generally more loyal to the organization than to their profession.	____	____	____	____
(6) Your daily work routine is fragmented with interruptions and unscheduled events.	____	____	____	____
(7) You get most of the information required to do your job from sources other than formal management information systems.	____	____	____	____
(8) Giving briefings and tours to official visitors interferes with your ability to do your job effectively.	____	____	____	____
(9) Managers place a major emphasis on getting the present job done and therefore devote insufficient time to self-development activities.	____	____	____	____

16. How involved are you in your present work? (check the one statement most appropriate to you)

(1)_____ not involved at all - I treat my job only as a way to make a living

(2)_____ somewhat involved - I do a good job but don't get worried about it

(3)_____ involved - I take my work quite seriously

(4)_____ very involved - I take my work very seriously but put energy into other parts of my life

(5)_____ extremely involved - my job is the most important part of my life

THANK YOU VERY MUCH FOR YOUR COOPERATION IN COMPLETING THIS QUESTIONNAIRE.

A. L. Padilla

APPENDIX B

THE TRANSMITTAL LETTER

June 31, 1986

Dear Participant,

Your help is requested in completing the attached question- naire. The purpose of this questionnaire is to provide original data for doctoral research. The researcher is a doctoral candidate at United States International University, San Diego, California.

The reason you have been requested to participate is that you are a member of management and in an important leadership position. The questionnaire is strictly anonymous, and no attempt has been made to identify the respondents.

Because of the uniqueness of persons such as yourself, the number of available participants is limited. Your completion of the attached questionnaire, while voluntary, is very important to the success of the study and to furtherance of knowledge in the field of management.

Please take a few minutes to complete the questionnaire, seal it in the enclosed stamped self-addressed envelope and mail it today. It is also important to emphasize that your effort involved in completing this questionnaire be on your personal time.

Your assistance in this research effort will be greatly appreciated.

Sincerely,

/s/ A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

I CONCUR:

/s/ A. B. Smith

A. B. Smith
President
Division-Able

Attachment: (questionnaire)

June 31,1986

Mr. A. B. Smith, President
Division-Able
A Major Aerospace Company, Inc.
Southern, California 90010

Dear Mr. Smith

Participation by a pre-selected number of your direct-report members of management and their managers in the completion of the attached survey questionnaire is ardently solicited. The purpose of this questionnaire is to provide original data for doctoral research. The questionnaire is strictly anonymous, and no attempt will be made to identify the respondents.

Because of the uniqueness of those pre-selected persons within your department, the number of available participants is limited. Completion of the questionnaire, while voluntary, is very important to the success of the study and to furtherance of knowledge in the field of management.

Specifically, the primary purpose of the study is to empirically compare the similarities and difference of the managerial roles, skills, and individual characteristics of engineer/scientists to non-engineer/scientists performing high-technology aerospace marketing functions. Therefore, in order to maintain a high level of validity of the research data, it is important that the primary purpose of the study not be divulged to the participant respondents.

Respondents will be advised that this effort be accomplished on their personal time and that completed questionnaires be sealed in the attached self-addressed stamped envelope and mailed. All materials have been prepared on the researcher's personal time and at his own expense.

Your assistance in this research effort will be greatly appreciated.

Sincerely,

/s/ A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

Attachment: (questionnaire)

June 31, 1986

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Your assistance in this research effort will be greatly appreciated.

Sincerely,

/s/ A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

I CONCUR:

/s/ I. M. Brown

I. M. Brown
President
Division-Bravo

Attachment: (questionnaire)

June 31,1986

Mr. I. M. Brown, President
Division-Bravo
A Major Aerospace Company, Inc.
Southern, California 90010

Dear Mr. Brown

Participation by a pre-selected number of your direct-report members of management and their managers in the completion of the attached survey questionnaire is ardently solicited. The purpose of this questionnaire is to provide original data for doctoral research. The questionnaire is strictly anonymous, and no attempt will be made to identify the respondents.

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Sincerely,

/s/ A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

Attachment:(questionnaire)

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Your assistance in this research effort will be greatly appreciated.

Sincerely,

/s/ A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

I CONCUR:

/s/ R. U. Jones

R. U. Jones
President
Division-Charlie

Attachment: (questionnaire)

June 31,1986

Mr. R. U. Jones, President
Division-Charlie
A Major Aerospace Company, Inc.
Southern, California 90010

Dear Mr. Jones,

Participation by a pre-selected number of your direct-report members of management and their managers in the completion of the attached survey questionnaire is ardently solicited. The purpose of this questionnaire is to provide original data for doctoral research. The questionnaire is strictly anonymous, and no attempt will be made to identify the respondents.

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Your assistance in this research effort will be greatly appreciated.

Sincerely,

/s/A. L. Padilla

A. L. Padilla
Doctoral Candidate
School of Business and Management
United States International University
San Diego, California

Attachment: (questionnaire)