

EMERGENT REQUIREMENTS FOR PROJECT  
MANAGEMENT EDUCATION IN THE AEROSPACE  
INDUSTRY OF THE 21<sup>ST</sup> CENTURY

By

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In partial fulfillment of  
the requirements for  
the Degree of  
DOCTOR OF EDUCATION  
December, 2010

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## ACKNOWLEDGEMENT

I would like to acknowledge all those who assisted, guided, and supported my effort during this process, thank you. Without your assistance this study would not have been possible. I especially want to thank the professional project managers who made time in their incredibly busy schedules to be interviewed for this study and to my colleague who freely gave his time to participate in the verification and triangulation of data. I truly appreciate the depth of information and insight willingly offered by all, thank you.

To my academic advisor and dissertation committee chairperson Mary Kutz, EdD thank you for all that you have done to insure my success, your involvement in the process, and dedication to student advancement. And to my dissertation committee members, Steve Marks, EdD, Fred Hansen, PhD, and Lynna Ausburn, PhD, thank you for your insight, feedback, and time graciously provided throughout this effort.

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## CHAPTER I

### INTRODUCTION

Project management is a term common to the business lexicon of today. That was not always the case. Project management has become a discipline that has gained wider popularity in recent years. The public has been exposed to this term more frequently in job advertisements, news reports, and even popular television shows. Adoption of project management principles by the business community at large has seen a steady rate of growth over the past 25 years (Kerzner, 2009). Corresponding demand for skilled project managers has experienced similar growth. Business organizations in nearly every sector in industry are recognizing the importance of implementing project management concepts as a means of improving organizational performance (Kerzner, 2009). Project management techniques and tools are considered effective in controlling and managing costs, schedules, and customer satisfaction in an array of market segments (Kerzner, 2009).

Broader acceptance of the principles of project management has increased the demand for trained project managers. The Project Management Institute (PMI®) published the first edition of *Project Management Book of Knowledge (PMBOK®)* in 1987 (Haugan, 2006, p.5). The *PMBOK® Guide* contains knowledge about project



management gained over the years since the post World War II defense and space program buildup (Haugan, 2006). Subsequent editions of this text are used by project management practitioners as a reference and study guide for those preparing to sit for the PMI® certification exam.

Currently, the title of Project Manager is recognized as a professional position in most fields and sectors of industry (Kerzner, 2009). Project management certifications provide a benchmark of fundamental knowledge and have gained growing international recognition (Kerzner, 2009). “In the twenty-first century, second and third world nations will come to recognize the benefits and importance of project management (Kerzner, 2009, p.53).”

Technology oriented organizations, such as those typically found in the aerospace and defense industry, initially adopted project management as a way of controlling the growing complexity of the systems they were producing (Haugan, 2006). The National Aeronautics and Space Administration (NASA) and the United States Department of Defense (DOD) adopted project management during the Cold War in an attempt to control the massive task of producing sophisticated space and weapons systems (Kerzner, 2009). Aerospace companies and subcontractors were at first apparently reluctant to implement the principles of project management (Kerzner, 2009).

During the early years of project management, most aerospace and defense organizations filled project management positions with experienced engineers or technical staff. Requiring an engineering or technical background for project managers was originally thought to be the primary skill set needed because of the highly technical nature of decisions expected of the program manager. Project managers were expected to

function in a lead technical role while managing the other aspects of the program. With many non-aerospace organizations and industries utilizing project management today, the primary professional knowledge base of a project manager has changed. Currently, the logic behind staffing critical project leadership roles with technologists possessing no business skills is in question. Business acumen is among the primary qualities of project managers sought to fill open positions today. Project management job descriptions typically specify knowledge and experience in financial management. Team leadership, demonstrated through interpersonal and communication abilities is also considered a high priority. Essential skills of a project manager are evolving. Evolution in the fundamental skills of a project manager may mirror changes taking place in society. This notion suggests the educational preparation of a project manager may need to change as the environment around them changes, raising many questions.

Many individuals assume the role of project manager by default with little or no formal project management training, functioning successfully in the position for years (Wysocki and Lewis, 2001). Frequently these people step into the role already holding a professional degree and years of experience. Offering a masters degree in project management might serve this population's educational needs well. However, increased demand for trained project managers raises the question of educating students in project management in an undergraduate setting while bypassing an underlying professional "content" such as engineering or other technical areas.

How can academic institutions who are typically steeped in tradition respond with agility to the growing diversity of skills and knowledge needed to be a successful project manager? How can students be prepared to face the challenges of a changing world after

an extensive education based on a curriculum centered on requirements from an earlier decade?

Demand for skilled project management candidates continues to grow. The trend toward global team partnerships increased subcontracting, and the relentless pressure of competition to reduce costs and increase financial returns in the aerospace industry indicate a need to better understand the issues facing project managers of the future. How should the education and training organizations respond? What skill set will be required of future project managers?

### Statement of Problem

It is imperative that educators and trainers understand what the latest skills, knowledge, and experience requirements are to successfully manage projects in the current project environment. Educators need to understand the trends and changes taking place in the practice of project management so they can update curricula to better prepare students who will assume the role of project manager in the workplace. Without updated knowledge incorporated into preparatory education programs, graduates could be ill equipped to effectively address realities currently emerging in the project management workplace. The result could be devastating if project performance suffered to the point of a call for the removal of the project manager. Removal from the position early in a project manager's career could end any hope for tenure in this role. With updated knowledge, academia could modify project management education programs to address needed skills, knowledge, and experience, better preparing future project managers with the latest information, enhancing the likelihood of project and career success.

## Purpose of the Study

The purpose of the study was to describe the perceptions of project managers regarding the skills, knowledge, and experience necessary for success of entry-level project managers in the 21<sup>st</sup> Century. This qualitative study was based on interviews conducted with veteran project and program management practitioners in the aerospace industry to obtain their perceptions of emerging trends in the discipline. The intended outcome of this research study is to develop information which could be incorporated into future training and education programs used to prepare project managers to face the challenging environment of aerospace project management.

## Significance

In medicine, extensive research is constantly being undertaken to find cures for the afflictions of the human body. Progress towards the abolishment of life-threatening disease is usually marked by incremental changes in the protocols prescribed by practitioners. When considering the performance of today's practitioners utilizing the latest research ideas, techniques, and tools compared to physicians of only a few years ago, progress in medical research community can be appreciated.

Improvements in project management may not hold the same life-saving urgency as medical advancement, yet the discipline of project management is becoming a more emphasized and critical component of many organizations' financial health. And in some organizations project management could have life saving implications. Obtaining the very latest information about changes to the skills and knowledge practice of project

managers should be a priority for educators and researchers. This is especially true when considering changes occurring in organizations (Wysocki and Lewis, 2001). Improving performance of future project managers begins with a comprehensive understanding of demands experienced in project management today. Results of this research could influence curriculum development, possibly influencing performance of project teams in the future.

### Research Questions

The following questions were posed in this study:

1. What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?
2. How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?
3. What skills and knowledge areas do entry-level project managers most often display as deficiencies?
4. How can education and/or training better prepare project managers for the changing demands of the aerospace industry of the future?

### Definitions

The following terms are used in this study:

## Operational Definitions

Program – “A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of the discrete projects in the program” (PMI, 2008, p. 434).

Program Management – “The centralized coordinated management of a program to achieve the program’s strategic objectives and benefits” (PMI, 2008, p.434).

Project – “A temporary endeavor undertaken to create a unique product, service, or result” (PMI, 2008, p. 434).

Project Management – “The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (PMI, 2008, p.435).

Stakeholder – “Person or organization (e.g., customer, sponsor, performing organization, or the public) that is actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project. A stakeholder may also exert influence over the project and its deliverables” (PMI, 2008, p. 434).

Virtual Teams – “A group of persons with a shared objective who fulfill their roles with little or no time spent meeting face-to-face” (PMI, 2008, p.444).

## Acronyms

A & D – Aerospace and Defense

DACUM – “Developing A CuriculUM” (Finch & Crunkilton, 1989, p. 139)

DOD – Department of Defense

EVM – Earned Value Management (PMI, 2008)

IRB – Institutional Review Board

IT – Information Technology

NASA – National Aeronautics and Space Administration

PgMP<sup>®</sup> – Program Management Professional (PMI, 2008)

PMBOK<sup>®</sup> - Project Management Body of Knowledge (PMI, 2008)

PMO – Program Management Office (PMI, 2008)

PMP<sup>®</sup> – Project Management Professional (PMI, 2008)

### Limitations

Researcher personal bias may be a potential limitation on this study. Working as a project manager, program manager, and a manager of program management may influence the study in unknown ways. However, the study may benefit from this professional experience which should offset any negative bias. Awareness of the potential bias was considered at each step of the research design process.

Bias on the part of the participants is another limitation to be considered. Participants may be personally affected by the interview process (Patton, 2002). They may be experiencing personal situations at the time of the interview or could be affected by the inability to recall relevant information (Patton, 2002). Participants in the interview process may alter their perceived reality with self-serving responses or may simply lack adequate situational awareness necessary to provide rich responses (Patton, 2002).

Limitations were minimized in the following ways (a) the research design was reviewed and approved by the IRB, (b) the research design and questions were reviewed

by an academic committee, (c) the interview process was conducted in a semi-structured format, (d) the interview questions were reviewed by a peer, (e) and the audio recording and textual transcriptions were reviewed multiple times by the researcher.

### Delimitations

This research study limited interview participation to highly experienced project and program managers primarily from the aerospace and defense industry. The purpose of establishing these particular selection criteria was to obtain participant perspective on entry-level project managers' preparedness. The assumption was, that entry-level participants would not recognize or freely admit skill and knowledge deficiencies if interviewed.

This study focused on project managers with complex technical project experience typically found in the aerospace and defense industry and did not include project managers from other industry sectors, (e.g., construction, health care, education or publishing). Response from participants in other industry sectors might be significantly different because of the uniqueness found in that industry.

The Research Questionnaire Guide (Appendix E) contains 11 open-ended questions. A large number of other questions were originally developed which would have generated equally interesting responses. The questions selected were limited to obtain only information related to the four primary research questions.

The study was limited to 12 participant interviews. Responses generated by each interview produced many rich data points.



The study was not designed to limit participation to employees of organizations within a geographical area.

### Assumptions

For purposes of this research study the terms project manager and program manager will be used interchangeably representing the same skills and knowledge requirements. Actual industry use of the terms project manager versus program manager can represent separate and distinctly different levels of responsibility as described in the definitions section of this chapter. The level of management responsibility of a program manager is often considered greater than the level of management responsibility of a project manager. However, the concepts, skills, and knowledge necessary to perform both positions are essentially the same as described in the following passage.

The government sector tends to run efforts as programs, headed by a program manager. The majority of the industrial sector, on the other hand prefers to describe efforts as projects, headed by a project manager. Whether we call our undertaking project management or program management is inconsequential because the same policies, procedures, and guidelines tend to regulate both (Kerzner, 2009, p. 55).

## CHAPTER II

### LITERATURE REIVEW

#### Introduction

Much has been written about project management over the past 30 years. Common project concepts and techniques fill countless textbooks occupying considerable real estate in many libraries. Electronic journal articles can be found that provide the latest in academic research (Ridley, 2008).

The purpose of the study was to describe the perceptions of project managers regarding the skills, knowledge, and experience necessary for success of entry-level project managers in the 21<sup>st</sup> century. Literature to address the research questions of the current study fall into four categories (a) textbooks, (b) journal articles, (c) dissertations, and (d) Internet (Ridley, 2008). The University library electronic database system was accessed to search for pertinent information. The key words used to search several databases are listed in Table 1.

Table 1

*Key Search Words Used in Literature Review*

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Practitioner development	Competencies in project management
Complex project practice	Career Advancement in project management
Project management	Training & education for project managers
Educating project managers	Aerospace project and program management
Change in project management	Project management higher education

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Project Management

Basic concepts of project management may have been practiced during the construction of man's ancient wonders, such as the pyramids of Egypt (Burke, 2006). Consumption of large quantities of mental, physical, and natural resources necessary to construct these extraordinary monuments, would have been just as daunting a task as sending man into space in the 1960s, which did require project management techniques to accomplish (Kerzner, 2009). The same constraints imposed on most projects today must have also been imposed on the builders of the pyramids, including control of (a) cost, (b) time, and (c) performance (Haugan, 2006). The definition used to describe project management today would have applied just as well back then: "Project management is applicable for any ad hoc (unique, one-time, one-of-a-kind) undertaking concerned with a specific end objective" (Kerzner, 2009, p. 56).

History of modern-day project management can be traced back at least 100 years. The fundamental management process outlined by Henri Fayol in 1916 describes the rudimentary steps of project management including (a) planning, (b) organizing, (c) commanding, (d) directing, and (d) controlling (Burke, 2006). Today, the *PMBOK*<sup>®</sup> states that project management includes five process groups (a) initiating, (b) planning, (c) executing, (d) monitoring and controlling, and (e) closing (PMI<sup>®</sup>, 2008). The similarities are evident.

A project is defined as any “...temporary endeavor undertaken to create a unique product, service or result” (PMI<sup>®</sup>, 2008, p. 5). The project manager therefore is “...a person who is responsible for completing a defined piece of work within an established budget, by a specific date, and with a defined set of resources (people, equipment, and facilities)” (Wysocki and Lewis, 2001, p.50). The project manager is the single person responsible for managing a broad range of potential issues in the process of project execution requiring that s/he possesses considerable knowledge and skill to successfully complete any temporary endeavor.

Techniques commonly used in today’s project management profession were developed in the United States aerospace and defense (A&D) industry during the 1950s and 1960s (Burke, 2006). Complexity of systems during this period necessitated National Aeronautics and Space Administration (NASA) and Department of Defense (DOD) to develop innovative project management techniques and tools to manage the design and construction of projects (Burke, 2006). Project management techniques gained greater utilization when the United States federal government procurement process mandated project management as a contract requirement (Kerzner, 2009).

Refinement and growth of the discipline of project management continued during 1970s and 1980s (Burke, 2006). Project management was becoming formalized in organizations as a means of dealing with project complexity and an increasing volume of work labeled as project activity (Kerzner, 2009).

By the 1990s project management was considered as a way of combating escalating costs and staying competitive with foreign companies (Burke, 2006). “The old ways of working are too slow, too convoluted, too hard to grab hold of—and the value is too hard to capture” (Peters, 1999, p.116). Demand for skilled project managers increased. Professional organizations dedicated to the practice of project management experienced growth in response to the demand. Wysocki and Lewis (2001) in, *The World Class Project Manager* respond to questions about project management merely being a fad or trend destined to fade away, by offering these factors as evidence of project management value (a) proven contributions, (b) results with fewer head count, and (c) provides order in a complex global market. The authors listed several examples of popular business trends which faded once business performance results did not live up to publicized claims. Project management, on the other hand, shows no signs of fading away. The Wow Project article, published in *Fast Company* by Peters (1999), stated “all white-collar work is project work” (p.116).

Engineers and highly technical individuals filled many of the leadership roles in early projects because of the highly technical nature of the efforts (Kerzner, 2009). If a technical person wanted to advance in their career, project management was considered a viable option. However, the best technical experts who become project managers may not always possess crucial interpersonal skills needed to manage project teams (Wysocki

& Lewis, 2001). As the discipline of project management gained in favor, the profile of an ideal project manager also changed. Kerzner (2009) states that “the program manager rarely has all the technical, administrative, and marketing expertise needed to direct the program single-handedly” (p. 151).

Mueller and Turner (2010) concluded that successful project leaders present different profiles depending on the project type they are managing. Depending on the industry segment and product being managed, organizations still require project managers to possess technical competency. However, higher priority is often placed on candidates with excellent people skills able to communicate effectively with project team members in matrix structured organizations (Wysocki & Lewis, 2001).

Several project management professional organizations exist worldwide that offer standards and certification programs in project management (Cagle, 2005). Certification by an organization usually requires demonstrated mastery of a body of knowledge and documented field experience (Cagle). Pant and Baroudi (2008) describe the body of knowledge as “explicit” technical skills necessary for project success, but that the “tacit” or soft skills should also be addressed (p.126). Results of Crawford’s (2005) “...research suggests that there is no statistically significant relationship between performance against the standards selected for study, in their entirety, and the perceived effectiveness of workplace performance” (p. 15). Yet, project management standards and certification programs have spurred the growth of this profession by providing potential project stakeholders with an established benchmark for project management knowledge, practice, and experience.

Worldwide growth of project management can be gauged using many indicators. One indicator of the acceptance of project management can be seen in the dramatic rise of membership in professional project management organizations. Wysocki and Lewis (2001) reported in January of 2000, that PMI® membership had reached 54,000, with greater than 15,000 members obtaining Project Management Professional (PMP®) certification. In a ten year period, membership numbers jumped from 54,000 to 314,721 and certified project managers grew from 15,000 to 367,619 active members (PMI®, 2010). Growth in the discipline of project management has shown a steady increase since the inception of these professional project management organizations.

The U.S. Bureau of Labor Statistics does not forecast job outlook for project managers in the aerospace industry. However, they do report job outlook for Information Technology (IT) project managers and Construction project managers, which could be used as a growth indicator for the overall project management discipline. Both IT project managers and Construction project managers predict a 17% increase between 2008 and 2018 (Bureau of Labor Statistics, 2010).

Growth in this profession might also be gauged by the demand for educational programs in colleges and universities. “In 1994, only two bachelor and nine master’s level project management degrees, primarily in construction management, were recognized. By 2008, more than 386 degree programs at 277 institutions worldwide have been identified” (PMI, 2008, Supplement p.4).

## Changing Business Environment

The present conditions in business today are substantially different than those experienced in past decades. Advances in technology and the Internet have changed the method, speed, and even location of business communications, adding to the complexity of projects (Crawford, Morris, Thomas, and Winter, 2006). Global competition and new technology have changed the way business looks at the world. Constant cost reductions and creative global strategies must be employed by organizations to stay viable.

Customer expectations for superior service force suppliers to continuously innovate, cut costs, and improve product quality to stay competitive. Shortage of skilled workers in the United States threatened by expected baby-boomer retirements creates serious knowledge management issues for many organizations. And younger generations of project managers with disparate work ethics, ideas on corporate loyalty, and career expectations create challenging social dynamics when managing project teams (Crawford, Morris, et al., 2006).

Many companies routinely employ distributed project teams in the execution of technically complex projects. Technology has enabled project team members to be located around the globe while still be connected to the project (Crawford, Morris, et al., 2006). The project managers are expected "...to communicate, negotiate, lead, influence, manage conflict, and deal with politics" (Wysocki & Lewis, 2001, p.47) while delivering a quality project under budget and on time to a satisfied customer. Virtual teams, despite the added administrative burden, offer new opportunities to business while outperforming co-located project teams (Siebdrat, Hoegl, and Ernst, 2009). Effectively managing global project teams represents a challenge to project manager's interpersonal communication



skills (Crawford, Morris, et al., 2006). Managing virtual teams successfully requires considerable practitioner experience (Siebdrat, et al., 2009). If virtual teams are to become commonplace, then project managers will need to have the knowledge, skill, and experience described by Siebdrat et al. (2009) that are necessary for success.

### Change in Project Management

Kloppenborg and Opfer (2002) conducted a systematic review of project management research articles published between 1960 and 1999 with the purpose of identifying trends in project management. The literature review covered 3,554 data records with analytical support provided by academics and field practitioners to provide a pragmatic perspective. The reviewers found a paucity of project management research literature, specifically during the 1960s and 1970s, and a substantial increase in number of publications in the following decades. According to Kloppenborg and Opfer, the acceptance of project management as a profession spurred the increase in number of publications in the 1980s. Kloppenborg and Opfer predicted that in future trends “advanced training for project managers will be offered through companies, universities, and professional organizations” (p. 13). The researchers also asked project executives to identify needed research topics within the discipline. One of the responses indicated a greater need for collaboration and information sharing between universities offering project management majors (Kloppenborg & Opfer, 2002).

In a keyword analysis study of project management literature spanning a ten year period, Crawford, Pollack, and England (2006) concluded that the significance of particular project topics tends to change with time, representing a continuous demand on

project managers to change. “Synthesis of results revealed that Relationship Management, Resource Management, Time Management, Cost Management and Risk Management all displayed consistent significance throughout the study period” (Crawford, Pollack, et al., 2006, p. 183). Some topics listed were found to be increasing in significance over this same period, including “Project Evaluation and Improvement and Strategic Alignment” (Crawford, Pollack, et al., 2006, p. 183). “As a field, project management is regularly facing new challenges, as the tools, methods and approaches to management that comprise the discipline are applied to different areas, for different ends, in different cultures” (Crawford, Pollack, et al., 2006, p. 176). Research by Crawford, Pollack, et al. (2006) suggests that some project management skills might remain consistent while others change as trends in the industry change.

Wirth (1992) described four trends in the “...socioeconomic and technological environments of project management” (a) international focus, (b) specializations within organizations (c) quantity of ongoing projects at a given time (d) greater computerization supporting project management (p. 50). According to Wirth the skills profile of a project manager would change as a result of the trends identified in the study. Four primary instructional methods of delivering project management education were offered, such as “lectures, case studies, simulation and on-the-job training (OJT)” (Wirth, 1992, p. 51). The Wirth study concluded that more in-depth study by the academic community is necessary to elevate the field of project management education.

Berggren and Söderlund (2008) stated that there was a heightened interest in the practice of program management by a growing number of higher-education institutions. The authors detailed the use of “Mode 2 society” which is “...a conception that spurs the

idea of closer links and tighter relationships between industry and academia, between research and practice, and which highlights the need of knowledge co-production” (Berggren and Söderlund, 2008, p. 295). Berggren and Söderlund, described significant collaborative efforts between academia and organizations where the students who were employed by a sponsoring company directly benefited from studies involving the wider organization in a reflective educational process.

Wearne (2008) contends that common concepts in project management across differing sectors of industry may not be applicable to all project management students sitting in a classroom. These differences provide “...a clear argument for linking teaching, research and communities of practice” (Wearne, 2008, p. 328). This study further supports the need to gain the latest field perspective from project managers.

Ojiako, Ashleigh, Chipulu, and Maguire (2010), surveyed project management students who recommended student perspective be considered in the design of project management education programs in an attempt to make the information more relevant to the students experience. Instructors should function in a learner centered role, mentoring students to develop knowledge through individualized learning methods (Ojako, et al., 2010). Change, they suggest, is necessary, not only in the structure of academic institutions but, also in the primary methods of instructional delivery to expand the learning experience and shift the student focus from passive to active learning (Ojiako, et al., 2010).

Thomas and Mengel (2008) described how much of the training conducted in the United States and Europe is based on the published knowledge standards. The authors stated that, “...this level of education fails to prepare project management students to deal

with the increasing complexity that they face in today's working environment nor does it make full use of existing innovative learning environments and techniques [51]" (Thomas & Mengel, 2008, p.305).

Thomas and Mengel (2008) asserted that project management education programs must expand beyond the existing published knowledge standards, allowing project managers to develop the skills and competencies needed to manage complex, chaotic projects. The need to link the practical experience of project managers with the learning process when developing learning objectives was further supported by Cicmil (2006).

Project management training program designs should consider student performance paradigms based on contextual qualitative performance considerations rather than solely on quantitative parameters of the sponsor, such as number of students trained (Thiry, 2004). Student feedback while in the learning process could be used to modify educational process based on measurement of performance to locally established criteria (Thiry, 2004).

Pant and Baroudi (2008) questioned whether "...project management programs offered by various universities are equipping students with the appropriate knowledge/skills in respect to their preparation for entry into the workforce" (p. 127). They concluded that educational institutions should incorporate soft skill concepts into existing programs so students could be informed of the possible contribution soft skills might make to project success (Pant & Baroudi, 2008). Pant and Baroudi also suggested that many institutions may be teaching technical skills primarily because of the simplicity of delivery as compared to teaching soft skills, which is more challenging in the educational process (Pant & Baroudi, 2008). Zielinski (2005) stated that many

companies have heightened the priority placed on soft skills training, suggesting that the best way to teach soft skills is in a classroom setting using active participant learning strategies.

Training the reflective project management practitioner was described by Crawford, Morris, Thomas, and Winter (2006), when they outlined changes taking place in the environment of project management. Crawford, Morris, et al. stated that project management no longer fits neatly into a single job description, given the proliferation of positions described as project manager. Many variables must be considered and accommodated when designing training and educational programs to a wider range of project management practitioners (Crawford, Morris, et al., 2006).

The researchers stated that the current role of project practitioners may involve managing multiple complex projects simultaneously and they described how the lines separating projects can easily become less obvious adding to the complexity of the task (Crawford, Morris, et al., 2006). The authors described how project complexity has greatly expanded the definition of project management, resulting in a greater need for new skills not currently addressed by education and training programs (Crawford, Morris, et al., 2006). Development of reflective project managers, according to Crawford, Morris, et al., 2006, will require more substantial academic educational program design options.

Knowledge transfer to entry-level project managers was also raised as a reason to address the educational needs of project practitioners, especially as the current workforce progresses towards retirement (Crawford, Morris, et al., 2006). Much of the existing project management training focuses primarily on published bodies of knowledge offered

by professional associations, which contain minimal information about managing the diverse, complex projects existing today (Crawford, Morris, et al., 2006).

Instruction designed around short-duration learning events like weekend courses, facilitated by non-practitioners, offer students limited opportunity to develop real-world reflective learning (Crawford, Morris, et al., 2006). Academics and researchers should prepare and test an effective strategy to advance the profession (Crawford, Morris, et al., 2006). The authors believe education should be provided with ample time for student reflection while applying learned concepts to specific work context, based on the sponsoring organizational agency strategy (Crawford, Morris, et al., 2006). One of the main propositions presented by Crawford, Morris, et al., 2006, was the need for project management education to be able to teach practitioners to be "...reflective practitioners in touch with the best and newest theory and research and their day to day practice of managing" (p.728).

The basic concepts and techniques of project management described by bodies of knowledge are rudimentary to the practice of project management in many different industries and sectors. The aerospace and defense (A&D) industry is no exception. Aerospace and defense industries historically relied on project management techniques to manage complex system developments in the 1950s and 1960s, similar to today's A&D organizations. Anselmo (2006) concluded that project management is an integral part of the A&D industry, and yet the performance of projects in this sector may have tarnished the disciplines reputation. The environment in which the A&D projects operate may account for part of the reported performance deficiencies (Schenhar, 2007). Schenhar (2007) suggested that program leadership within A&D companies needs to look

externally for the latest information about the practice of project management. In the *CSC 2010 Aerospace and Defense Market Survey*, 44% of the executives surveyed responded that project managers were expected to be either their first, second, or third greatest human resource shortage in the next five years, second only to qualified engineers (Computer Sciences Corporation, 2010). A potential shortage of project managers along with project execution performance issues in the A&D industry are compelling reasons to investigate needed improvements in the process of educating future project managers.

Many of the articles reviewed in this current research study have suggested that educational designers should take into consideration local context of the practicing project managers while developing educational programs. Much of this literature dates back 20 years. Considering the significance of change purported by the research to be taking place in technology and society, more recent and updated information about the environment project managers operate in should be collected. By collecting the unique perspectives of the experienced field project management practitioner, this current research study intends to add to the existing knowledge. As stated by Thomas and Mengel (2008), "...new project management education needs to help learners to identify and cope with various [current] levels of complexity, change and chaos" (p.312).

## CHAPTER III

### METHODOLOGY

#### Introduction

The purpose of the study was to describe the perceptions of project managers regarding the skills, knowledge, and experience necessary for success of entry-level project managers in the 21<sup>st</sup> Century. The perceptions of highly experienced project managers could provide valuable information, aiding the design of educational programs targeted at preparing individuals for careers in project management.

This chapter describes details of the research methodology used to study the socially-constructed realities of experienced practitioners including (a) the research design, (b) selection of participants, (c) method of data collection, (d) process used to analyze data, (e) ethics associated with the research, and (f) reliability and validity of the study.

#### Research Design

The theoretical framework used in the current qualitative research study is outlined in Figure 1.



Figure 1.

*Theoretical Framework*

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Epistemology	→	Constructionism
Theoretical Perspective	→	Constructivism
Methodology	→	Grounded Theory
Population Sample	→	Purposive
Data Collection	→	Interviews
Analysis Method	→	Comparative Analysis

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The epistemology, constructionism, of the current study was based on the inductive need to gather up-close perspectives from the purposive sample of project managers (Creswell, 2007). Constructionism allowed the different experienced social cultural realities of participants to be examined and interrupted in their natural context at the time of the interview (Bloomberg & Volpe, 2008).

Social constructivism was applied to this study as the paradigm or worldview (Creswell, 2009) of the study to allow investigation of the broader complexities of project management constructed from how project managers interact and what they say in the most updated context (Creswell, 2007). “Thus, constructivist researchers often address the ‘processes’ of interaction among individuals” (Creswell, 2007, p. 21).

Grounded theory methodology, as used in this study, attempts to describe and expand existing knowledge by examining perceived differences in reality experienced by participants (Bloomberg & Volpe, 2008). As a methodology, grounded theory allowed

different realities of practice to generate new theory out of operational environments and defined a “framework for future research” (Creswell, 2007, p. 63).

Building theory rather than testing theory is a primary objective of grounded theory (Rubin and Rubin, 2005). Grounded theory analysis coding method provides a means for the interview data to generate rich explanations by considering every line of text rather than fitting text into an existing set of parameters (Rubin and Rubin, 2005). Development of theory in this research method seeks to generate explanations based on data gathered from experienced field practitioner interviews (Creswell, 2007).

Grounded theory investigators do not undertake research with pre-established theories; they use collected data to inductively produce generalizations (Fraenkel and Wallen, 2006). In the current study the researcher used a constant comparative approach to interact with the data and interviewees, resulting in the generation of new discoveries or theories (Fraenkel and Wallen, 2006). Explanations or theory resulting from this methodology are said to be “grounded in the data” (Fraenkel and Wallen, 2006, p. 438).

The questions being asked in this research study could only be answered using open-ended one-on-one interviews, making grounded theory the most logical research method to employ.

### Selection of the Sample

The current study utilized a purposive sample comprised of ( $n = 12$ ) informed and consenting adults. A purposive sample ensured participants possessed the contextual experience necessary to contribute rich insight to the data (Bloomberg & Volpe, 2008).

A non-probability sampling strategy was also used because of a paucity of qualified and available participants.

Inclusion criteria were designed to maximize social context data collection resulting in rich explanations and understanding of conditions. A minimum of five years experience in project or program management along with at least three years experience managing field project managers were specified in this study to ensure participants could provide adequate collaborative or conflicting data. The investigator arbitrarily chose five years as the minimum contextual experience necessary to answer comparative questions. Supervisory experience was a critical selection criterion because the researcher wanted participants who could identify educational deficiencies in entry-level project managers. The inclusion criteria for participation in this study can be found on Table 2.

Table 2.

*Basic Inclusion Criteria for Participants*

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Project/Program Management overall experience	5 or more years
Complex technical or aerospace project experience	3 or more years
Management of Project, Program, or PMO staff	3 or more years
Education - Masters Degree or higher	Preferred
PMP® / PgMP® Certification or equivalent	Preferred
International project or program experience	Preferred

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Exclusion criteria were the following: non-project or program managers, those without experience in aerospace or other technical industries, those without adequate functional experience as a supervisor or manager, and anyone under the age of 18 years.

## Methods for the Collection of Data

Project managers were initially identified for the current research study through business contacts within aerospace industry. Individuals who were directly contacted to participate in the study were also asked to recommend additional professionals who might meet the selection criteria, in an attempt to “snowball” or “network” the sample needed to generate validity in the study.

Participants were enlisted from a variety of organizational settings including government agencies and commercial/industrial settings. Participants were recruited using the approved Institutional Review Board (IRB) Participation Letter (Appendix C) or Participant Telephone Script (Appendix D). Involvement in this research study was strictly voluntary. When interest in the study was indicated, verification of the person’s professional experience was checked against the basic inclusion criteria (Table 2).

Each interviewee was informed of the purpose of the study, informed of participant rights, and requested to read and sign the informed consent document (Appendix B). They were also informed of the expected time duration of the interview and about the use of digital audio recording equipment. Interviews did not start until the informed consent document was signed by both parties.

When an individual agreed to participate, coordination of an interview time and location were then arranged. Once an appointment had been established for the face-to-face interview, a packet of information was sent via email to the participant including a participation letter (Appendix C) and the informed consent letter (Appendix B).

During the face-to-face interview meeting the session started with the researcher reviewing the informed consent form (Appendix B) and then asking for the participant’s

signature. The document was also signed by the researcher and a copy with signatures was offered to the participant. Original signed informed consent forms are securely maintained in the researcher's office separate from identifiable data. The strictly voluntary nature of the study was stressed along with the rights of the participant to end the session at any time.

Redundant digital audio recording equipment was used to capture the private interview process. This involved the use of a portable digital recording device and the recording capability of the researchers' laptop computer. Both methods were employed to insure no data would be lost due to equipment malfunction.

Only one interview was conducted via telephone with the preferred method of interviewing being individual face to face meetings. The same audio recording equipment was utilized when conducting the telephone interview. The quality of the audio recording was adequate to transcribe the data.

Each interview recording was transferred from the digital recording equipment to the researchers secure computer where the de-identified files were used to transcribe the conversation from audio to textual format. The researcher personally transcribed all the interviews from audio to text files, which were also securely stored on the researcher's computer for data analysis. Digital backup copies of electronic data were made to protect against inadvertent loss due to equipment failure or file corruption.

#### Instrumentation for Data Collection

The instrument used for this qualitative research study was the Research Questionnaire Guide (Appendix E) containing open-ended probing questions used during

the one-on-one participant interviews (Gay, 1992). The open-ended interview questions were designed to gather participant's perspective and insight on the study topic (Gay, 1992).

The individual interviews were conducted in a semi structured process utilizing the established interview guide as a way to draw out information from the participant (Berg, 2007). The interview questions directly related to the four research questions are depicted in Table 3.

Table 3.

*Relationship of Research Questions to Interview Guide Questions*

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<u>Research Question</u>	<u>Interview Guide Questions</u>
1	1, 10
2	2, 3, 4
3	5, 6
4	7, 8, 9, 11

---

The open-ended interview questions were intended to extract pertinent data along with other information the participant deemed relevant. Depending on the participant's perspective, the responses were comprised of information perceived as contextually relevant by the participant.

Validation of the questions developed for the interview guide was accomplished by reviewing the questions with members of the academic committee. The questions were also checked by a peer to validate the relevance of the questions to field of study.

## Analysis of Data

The following protocol was used in the analysis of the resulting data from the current study (a) interview results were considered in preparation for subsequent interviews (b) audio recordings were transcribed (c) researcher studied audio and text data repeatedly to gain cognition and write notes (d) notes were used to generate broad categories (e) data were open-coded using NVivo 8 (QSR, 2008) (f) summations were generated (g) categories were reduced and a central phenomena emerged (h) interrelated categories were identified (i) and propositional conclusions were developed. Constant comparison methods were used throughout the systematic development of the propositional framework (Patton, 2002).

Analysis started after the first interview was complete. Content of each interview was reviewed prior to the start of the next interview as a way of preparing for the next interview. As subsequent interviews were conducted, reference to earlier interview discussions were used to frame the researcher's awareness of key concepts. Field observations were also possible with two participants. This included attending a unit meeting conducted by the research study participant. This individual chaired the discussion with subordinate project and program managers. The discourse allowed the researcher to observe the program manager in action, discussing several in-process activities and relevant issues with the larger team. The second participant conducted a facility tour after completing the interview with the researcher describing steps, stages, and complexities of activities while relating the process program managers follow to complete a project.

Once the data were transcribed, organized, and examined, the researcher continued the analysis process by reading each transcript completely. Any references which could identify the interview participants were removed from the transcripts. Transcripts were read repeatedly so insight could be gleaned from the participant. To enhance the process, the researcher listened to each audio file several times while reading the transcripts to pick-up any subtle voice intonations which could help prioritize the coding process. Notes were written beside important passages to describe or classify what was interpreted as valuable insight. These notes provided the first attempt towards sorting, coding, and establishing basic categories or topics of information.

The next step in the process was to reduce the noted data by writing up individual summations of each transcript in responses to the four research questions. The summations included all the data deemed germane to the research questions. Results of this process are described in the text of Chapter Four as participant findings.

Categories were formed from the data which reflected the participants' perspectives. These categories were then compared across all the participants. A large number of categories resulted which were then further reduced by identifying patterns in the data in Chapter Five. Careful attention was paid to data that could be used to support the findings, by separating phrases used as quotations in the text.

The data were also analyzed utilizing NVivo 8 (QSR, 2008), a Computer Assisted Qualitative Data Analysis (CAQDA) software tool. Complete transcripts of each interview were loaded into NVivo 8 (QSR, 2008) as source data with the text open coded. The output of this coding process was cross-checked against the hand coded data to identify differences. Then the individual written summary text from the hand-coding



process was loaded into Nvivo 8 (QSR, 2008) for separate coding. The resulting code frequency counts were tallied and compared to the full database coding counts as an additional cross-check of the categories.

A model of the central phenomenon emerged from the data, which was used to explore relationships between other defined categories. The concluding propositions were produced as a result of the participants' perspectives as interpreted by the researcher.

### Ethics

The protocol used in the current research study was approved by the IRB for the protection of human subjects (Appendix A). During this research study every attempt was made to avoid any action which might introduce a bias to the results. However, researcher bias cannot be discounted because of the researcher's professional experience in project management as described in Appendix F.

All possible precautions were taken to protect the identity of the participants in this research study and no compromises existed. Textual transcripts were abbreviated when identifying information was discussed by individual participants eliminating any identifiable references for the final transcripts. Participant demographic information was purposely muted to protect the identity of participants.

All material resulting from the interview process was secured according to the IRB-approved protocol. Digital audio recording and resulting transcripts were stored in a password-protected computer with electronic media backup data stored in a secure file by the researcher to ensure the privacy of participants. Upon completion of the final

research study, the audio recording and any other identifiable information will be destroyed to further protect the privacy of the participants.

### Validation of the Instrument

Data collected in this qualitative study were assessed for validity and reliability using several methods. In qualitative research, validity and reliability of findings are often brought into question because the data collected are based on individual participant and researcher perceptions at the time of data collection (Fraenkel & Wallen, 2006). The qualitative validity in this study was supported by the process used by the researcher to verify the results (Creswell, 2009). Reliability was established by the consistency of the approach used to generate the data (Creswell, 2009).

Research validity was addressed through the use of several procedural methods during data collection, analysis, and reporting (Creswell, 2007). Two types of triangulation have been used to test the credibility and consistency of the data a) investigator triangulation and b) methodological triangulation (Denzin and Lincoln, 1994).

Multiple independent evaluators were used to triangulate the findings in this study as a way of discovering any inconsistencies (Patton, 2002). One participant interviewee was enlisted to review the study findings to determine if any additional information should be considered in the findings. A second evaluator, one member of the academic committee, also reviewed the data for comparison purposes.

Methodological triangulation was accomplished using several approaches, including overlapping interview questions concerning participants' demographics,

experience, perspectives, opinions, and beliefs (Table 2). Coding and analyzing data were first completed by hand and then by computer aided software (QSR, 2008) with results of both methods compared. Additionally, depth was considered by reviewing contradictory or dissenting perspectives found in the data, further supporting validity.

Research validity was further supported in this study by including direct interviewee quotations in evidence of the results. Well developed descriptions of findings along with multiple collaborating perceptions were used to provide depth to the findings adding validity to the conclusions (Creswell, 2009).

To ensure reliable results in this research study, several methods were employed during data collection and analysis (Creswell, 2009). Reliability was enhanced by cross-checking in detail all transcripts for accuracy and comparing collected data with established codes (Creswell, 2009). Reliability was further enhanced when the data were open coded first by hand and then confirmed by coding the data again, using NVivo 8 (QSR, 2008). Individually reported findings in Chapter Four serve as a method of verifying the central and interrelated conditions by providing a data audit trail. Reliability should also be evident, based on the detailed explanation of the data collection design and analysis process followed in the research study.

Due to the qualitative nature of this study, the results are not intended to be generalized to the larger population. Findings depict perceptions of the individuals who participated in this study and can not be generalized beyond their specific context (Creswell, 2009). However, the results of the current research may inform the design of a quantitative survey instrument for a future research study.

## CHAPTER IV

### FINDINGS

#### Introduction

The intent of this study was to describe perspectives of practicing project and program managers regarding recent changes and trends which might alter the skills, knowledge, and experience necessary for practitioners to succeed in the future. To achieve these objectives, 12 experienced project/program managers were individually interviewed using open-ended questions as defined in the Research Questionnaire Guide (Appendix E). The resulting data from the interviews are intended to assist educators and trainers in defining what potential alterations may be necessary to existing curricula to provide students with the latest knowledge necessary to excel in the discipline of project or program management.

There are 11 open-ended questions listed in the Research Questionnaire Guide (Appendix E) used to solicit perspectives from the participants in response to four established research questions, as delineated below:

1. What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?

2. How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?
3. What skills and knowledge areas do entry-level project managers most often display as deficiencies?
4. How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?

Data collected during the interview process which did not fit into one of the established research questions was collected separately and reported at the end of this chapter. This additional section is designated “Other related information.”

Data from the individual interviews were transcribed from audio files into text documents for the purpose of analysis. NVivo 8 computer software was utilized as an administrative aid during data analysis. The following discussion is the outcome from the analysis process.

### Demographics

Two female and ten male participants met the selection criteria for this study. Other demographic information about the participants of this study is presented in tables and figures that follow.

Table 4 represents the area or sector of industry where the participant is currently employed. All participants in this study were employed full-time at the time of the interview in the field or sector of industry depicted in the table. Participants listed in the column labeled commercial manufacturer (58%), are employed by several national A&D companies typically engaged in the design, testing, production, and modification of hardware, software, and services consumed by various government agencies and

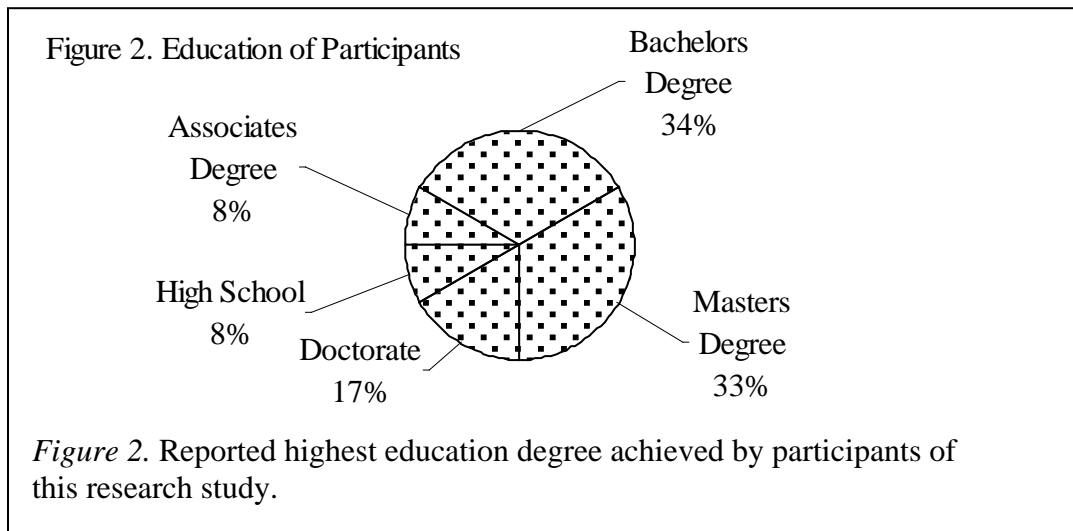
commercial entities. The project management experience these participants possess is diversified covering a wide variety of products, services, and organizations enriching the research data.

Table 4

Participant Professional Background

Aerospace and Defense	Federal Government	Commercial	
		Consultant	Manufacturer
√	√		
√	√		
√		√	
		√	
√		√	
√			√
√			√
√			√
√			√
√			√
√			√
√			√

The pie chart in Figure 2 represents the different educational degrees held by the participants of this research study. This information is reported here to provide a picture of the individuals that participated in the study. The chart depicted that 84% of the participants in this study hold a bachelors degree or higher with 50% of all participants holding graduate degrees.



In Figure 3, a bar chart graphically represents the reported years of experience in project or program management for each participant. The mean years of reported project management experience is 20.75 years whose combined depth of academic and experience backgrounds provide strong support to the quality of the findings of the study.

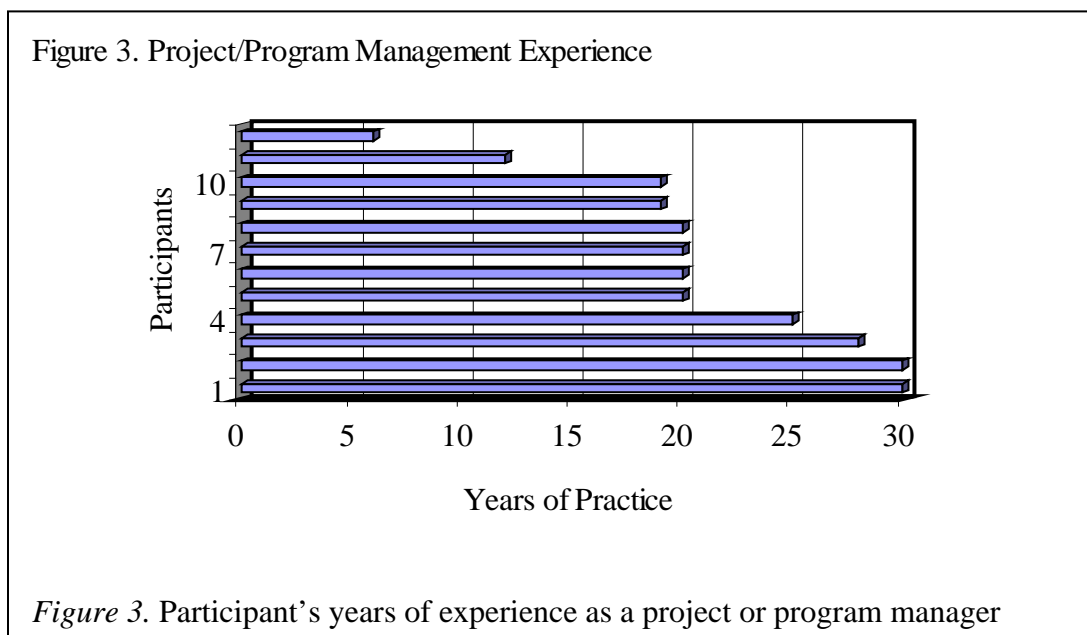


Table 5 presents additional relevant demographic data collected from the participants regarding project management certifications held, the dollar value of the largest project managed, and the depth of international experience, all of which further support the quality of the findings of the study. For example, 66% of the 12 participants described the value of their largest project as over \$100 million. The demographics further revealed that 88% of the total participants had international experience which further attributes to the quality of the findings of the study. Of the twelve participants, eight managed projects over \$100 million. Only three, (25%), of the participants involved in those projects had PM Certification. Four, (33%), of the total participants had PM certification.

Table 5

*Participant - Certification, Project value, and International Experience*

Value of Largest Project	PM Certification	International Experience
\$2.0 Billion	√	Yes
\$1.2 Billion		Yes
\$1.0 Billion		Yes
\$660 Million		No
\$400-500 Million	√	Yes
\$350 Million		Yes
\$200 Million	√	Yes
\$130 Million		Yes
\$50 Million		Yes
\$50 Million	√	Yes
\$27 Million		No
\$5.5 Million		No



Overall, the demographics revealed that participants of the study provided a rich source of data that could add depth and meaning to the study. The following descriptive data provides a paraphrased narrative from the transcriptions of participants. In those cases where the comments were especially significant, the participants' remarks are directly quoted and highlighted with quotation marks or provided in block quote form.

#### Program Manager One (PM #1)

PM #1's response to the interview questions reflect years of project and program management experience, most of which involves managing other project managers in such fields as IT and aerospace, in both government and corporate organizations. PM #1 is a certified project manager and holds several degrees in multiple fields including a graduate degree.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #1 discussed a recent increase in the “realization for the need for project management done well” as the reason for greater interest in program management. This interest might be tied to a desire by organizations for better defined business processes. Organizations are looking for improved financial results of existing business along with a desire to expand their global competitiveness. Project Management techniques along with certification has been “perceived” as a way to

achieve desired results. This interest has likely increased the demand for certified project and program managers. Increased awareness in organizations has translated into job specifications requiring managers be certified in the field. This trend may partially explain the global increase in project management demand.

PM #1 also pointed out that this increased demand for certified project and program managers has created a market-place for short-duration training programs aimed at students interested in expedited learning leading to certification. The results, according to PM #1, are practicing program managers who “hold the certification but in fact don’t really have the skills” necessary to accomplish the objectives of project management. According to PM #1, “there is unfortunately this sort of disconnect between...the ability and the certification.” PM # 1 said that despite a concern for certification reliability, “certifications are important because they are a hallmark.”

The process of project management can improve a company’s financial stability by providing “greater value” through standardized practices and procedures. To do this “we need meaningful certifications and we need better education.”

Another area of change described by PM # 1 was the trend for program teams to be physically and geographically dispersed as compared to centrally located only a few years ago. PM #1 said companies typically organized project teams around customers or product areas compared to the current trend of distributing teams across multiple building, campuses, and countries. This change has caused the organization to adopt collaborative tools and technology such as video conferencing and social media networks to facilitate sustainable information gathering and distribution. This distributed team

environment has resulted in program managers having to alter their team leadership approach.

PM # 1 expects to see a continued “tightening of the definition” of project management in addition to an “increase in the requirement for process and methods based project management.” This includes “a sharp increase in the demand for metrics based and outcome based project management.” PM #1’s perspective on this was: “I just see the need growing.”

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #1 indicated that interest by organizations in improved business performance while reducing costs has also led business to process improvements along with new project management tools designed to increase the efficiency of data handling. The reason cited for this trend was “because the responsibilities are greater.” Businesses and organizations expect greater performance from their organizations because of the application of project techniques. The examples provided by PM #1 included the increasing desire to use Earned Value Management (EVM) and metrics on programs. “ISO 9000, CMMI, and Lean Six Sigma” are all examples of organizations embracing tools to improve outcomes “over time.”

In the opinion of PM #1, training and education institutions will need to keep pace with all the industry changes. Educational institutions should constantly evaluate, update, and expand their programs to meet the knowledge sets needed by students to stay current

with the growing tools available to management. PM #1 believes we will “continue to see the tool bag grow.”

Research Question 3.

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. According to PM #1 entry-level project managers lack an essential ingredient for their success, experience. New project managers should be given “more time to analyze” situations and more time to apply the learned book knowledge and theory to practice. Project Management Institute (PMI®) certification process specifies strict experience requirements as part of their certification process. PM #1 believes that the experience hours and education requirement for certification “should be much higher than it is” and that “the successful project managers get those skills over a longer time than a six day boot-camp.”

Another area of concern is in “soft skills.” Recent graduates with technical experience will often require improvement of their “soft skills.” Entry-level individuals “really don’t have the soft skill concept.” Individuals in technical fields might eventually want to switch career fields from engineering to management requiring people skills training to successfully interface with program teams, customers, and management.

PM # 1 placed emphasis on several key traits of leadership by explaining the importance of a project manager’s ability to interact and communicate with others. Motivating a team of professionals toward a common goal when they technically report to someone else in the organization requires a special ability on the part of the project

manager. PM #1 cited the lack of skill in these areas as a major contributor to project failures, reinforcing the need for good education and training. Additionally, PM #1 spoke about project and program manager ethics when dealing with customers. Project managers must present the truth when talking to customers about project status or prognosis. The importance of good communications skills was referred to as “the lynchpin that breaks, that throws the project off.”

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #1 recommended that project management training should be spread out “over a sixteen week semester” rather than weekend sessions. There was an expressed concern with the use of short-duration training in project management which has to do with the students’ ability to retain and then synthesize the knowledge in real world situations. Longer training cycles as used in higher education would “give them time for a more permanent absorption.” Another recommendation was that students be allowed “some application time” during training sessions as critical step towards knowledge building.

The interviewee suggested that academic institutions should consider including project management training in technical curricula because “regardless of where you fall in the organization you’re going to be a part of a project, you’re going to be running a project, [or] you’re going to be run-over by a project.” To achieve a level of project and program management competency he suggests that project management as a discipline

should be taught in baccalaureate programs, and students should be introduced to the topic in high school. Students in several disciplines should possess baseline knowledge of a project manager along with the common terms and tools used by project management.

PM #1 discussed the value of sharing experience as a valuable learning opportunity in an attempt to improve organizational performance and reduce program failures. Organizations must improve how they “communicate cross organization, intra organization to insure that the successes [along with failures] are well communicated.” PM#1 described some organization where all employees are evaluated on their contribution to and use of an on-line database containing lessons learned experiences.

PM #1 recommended that entry-level project and program managers be guided by a mentor as they gain their early project work experience. Mentors, PM #1 said, should not be someone in the students’ direct line of authority; rather they should be an experienced manager who can coach, guide, and support without concern for judgment. Weekly meetings to review project status would provide mentors the opportunity to assist students with project skills without getting involved. Mentors can also identify areas where students need to invest study time to further enhance their possible success. Mentoring in this situation is “integrated into what they do” by providing project specific support and guidance.

Technical experience according to PM #1 is an important aspect of any project or program manager skill set. Gaining knowledge and hands-on work experience with the products or field being managed allows a project or program manager to quickly draw from prior experiential results when analyzing the feasibility of a suggested action. This

technical knowledge allows a project or program manager to be able to make quicker decisions without first consulting with others, which can be critically important to the success of a project.

Methods of delivery in educating project and program managers are an important factor to consider. PM #1 expressed a negative opinion about the impersonal approach of on-line training for project and program managers and suggested that project and program training should be taught in a classroom with plenty of instructor / student human interaction. Human interaction during training, according to PM #1 “really separate[s] the highly successful from the okay.”

PM #1 believed that educational institutions should team with large corporations to offer meaningful long-term internships where students are completely immersed in the process utilized by a specific organization managing projects. Internships should be arranged in such a way as to allow students to spend part of each academic year with the sponsoring organization providing students with meaningful project work experience. A secondary benefit of this approach is that it allows “the companies the ability to test drive some bright young minds.” Students exposed to this level of internship will eventually graduate with “the skills to take-off when they hit the door, when they hit that first job as opposed to showing up...and saying I’m here, show me what I do next.” Internships with this level of student involvement would benefit both the student and their future employer.

Other related information. PM #1 offered the following important observation based on years of experience: some of the “best project managers are also the ones who started and spent a number of years in very, very technical roles.

## Program Manager Two (PM #2)

PM #2's responses reflect a lengthy career in project management in the field of aviation management, primarily in domestic programs valued in the tens of millions of dollars. PM #2 is not certified.

### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #2 indicated that project and program management is "more prevalent today" than in the recent past and that the process "has become more disciplined." The trend towards greater emphasis on project and program management will continue with demand also increasing. PM #2 believes changes that have taken place regarding project and program management are directly related to the main "administration" in office at any given time. When the management changes, shifts in focus or priority can be expected.

### Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #2 believes that because of the increased demand for program managers additional opportunities for training are needed.



When a department embraces the application of project management, the in-place personnel expected to adopt and implement the new process should be provided adequate training insuring the correct utilization of the tools designed to make the job more efficient. Training has no value if there is no way to apply the knowledge once training has been completed.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #2 has seen an increase in the number of people hired with college degrees. PM #2 believes that a college education can help when working in a program environment.

Newly hired program staff typically need “constant mentoring or leading” when they first join the organization. “Writing skills” were identified by PM #2 as another area of deficiency along with “interpersonal skills” or soft skills. A strong deficiency has also been noted in the ability of new people to work in the “team environment.” They often struggle with “becoming a team player” and with “working with other individuals.” “Good personal skills are mandatory” for success.

PM #2 also emphasized that anyone interested in this field should obtain the appropriate certification.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #2 believes strongly that technical experience plays an important roll in the success of a project manager; and also “believe[s] that education or training can help further that technical skill in the application of it into the work place.” One way of doing this is to “get them out into the work-place” utilizing internships. Internships will allow the student to “see if it’s what they really want to do and also if they have a skill or the potential for it.”

PM #2 believes that politics often get in the way of project performance and recommends that students be apprised of the impact political agendas can have on program performance during the education process of project managers.

Other related information. PM# 2 did not comment about the process of project and program management.

#### Program Manager Three (PM #3)

PM #3’s responses reflect over a decade of military experience managing large projects and other project managers in commercial and government settings, both domestically and internationally, with projects valued in the billions of dollars. PM #3 holds a graduate degree and achieved certification while in military service.

## Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #3 has seen a reduction in the authority afforded program managers due to the litigious environment in which programs typically operate. The authority to make decisions has been moving up the “chain of command.” Managers two to three levels above the program manager are now “getting involved and wanting to know the details of the minutia of the program versus taking a step back and letting the program manager work the individual issues.” According to PM #3 this might be caused by the “wealth of information” now available to upper level managers via enhanced communications technologies. The increased volume and speed of information has caused these upper level managers to desire additional details expanding the likelihood they will also want to be involved in the decision making process.

This trend concerns PM #3 because these executives are typically removed from the everyday program information considered crucial to making sound program decisions. These executives do not have the critical knowledge, understanding or contact with the customer. They lack the “interrelationships between the organizations and potentially why certain decisions are made.” These executives are “now making decisions and trying to direct a program based on the information they have.” The consequences of this condition result in program costs escalating and program schedules slipping out. PM #3 believes this inflation of the decision-making process is “because everybody is risk averse, for various reasons.”

The “focus” of organizations and market segments always seems to be changing. PM #3 has noted a recent increase in some organizations, what might be phrased “expand[ing] their rice bowl” at the expense of the customer or other project stakeholders.

There has also been an increase in international business as an area of change where new project managers need to be prepared. The skills needed to manage international projects are especially different from those needed for domestic programs.

Companies according to Program Manager Three will potentially divide their large program operations into small organizations and smaller companies will potentially grow into larger organizations. Program managers will have to face changing organizational employment and “shouldn’t be afraid to” switch companies. PM #3 suggested that program managers are sometimes considered coordinator, facilitator, and communicator rather than “decision maker and a guiding light” for the program. Change in the size of organizations suggests fewer employees will be responsible for more work which may reverse the trend back towards a time when project and program managers had “more authority and autonomy.”

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #3 believes that because the aerospace industry is technically oriented program managers need to be at least

conversant in the basic technical concepts of the products they are managing. This implies program managers should possess some underlying technical competency.

Because the aerospace industry in the United States is expanding to serve global markets, PM #3 recommends that students should possess knowledge about international business. Specifically, there is a need to have “some understanding of export authority” including the potential “civil and criminal” penalties a company can be exposed to when not managed properly.

PM #3 discussed “political interfacing with your customer that means relating with them, communicating with them, and understanding their constraints.” Serious harm can be done to a program if the manager is “culturally ignorant of whomever you’re working with.” This is especially true when considering the potential difficulties communicating with culturally and linguistically different international customers.

Personal interaction between team members is important to insure the team coalesces into a strong entity. PM #3 believes that “a strong leader that knows how to guide a team” is necessary because the team is often looking for a decision and no decision can lead to chaos. PM #3 believes “personalities play big in that” process. The decision process is much better when there is a strong team leader who can make the necessary decisions. Program managers must not allow excessive discussion over a decision but must seek input, make a decision, and allow the team to move on.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #3 states that entry-level managers need to have the skill necessary to motivate a team and achieve established objectives. Often new program managers “try to do too much” themselves without utilizing the combined experience of the team. This characteristic “sometimes makes new program managers a little hard to work with and that’s where the mentoring needs to come in, helping them understand the constraints that the other members of the team have and have to work within.”

PM #3 also contends that entry-level program managers have “unrealistic expectations as far as advancement in the company.” Even though they are very sharp and could handle greater responsibility, most organizations have “specific advancement criteria” precluding rapid advancement without experience.

To some extent these new program managers also need assistance with understanding the political side of project management such as understanding the “organizational bureaucracy.” Without knowledge about the structure and nuances of an organization “you can get shut down very quickly.”

New program managers need to gain an awareness of the organization’s power structure so they can deal with issues in a politically savvy way to benefit their team and program. New program managers also need to understand how programs fit into the organization especially if the teams are matrixed or report through a Program Management Office (PMO). These structures can have profound impact on the quality of resources, decision authority, and organizational treatment afforded a program resulting in negative impact on a programs cost and schedule.

Personal interactions are “important no matter what project you are working on and it’s probably more important on international programs” according to PM #3. New project managers need to understand the impact their email has on recipients, especially when sent to international destinations. Written communications with other cultures requires awareness of cultural and language differences to avoid misinterpretation. “More and more people are managing by emails” regardless of the distance between team members and customers.

Every program manager should understand how to scope the requirements of a project. They should also know what “discipline” is required within the team and program to maintain an established technical baseline. PM #3 believes that managers should possess the courage to stand up to a team member who insists on adding scope or a customer threatening scope creep which can have the devastating effect on the results of the program.

The basic skills of a project don’t change no matter the size, whether it’s a \$10 thousand project or a \$100 million project; what does change are what the priorities are in a program and what priorities the customer has.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #3 discussed the need for students to understand “the different roles of all the team members” and functions within programs. Students should know what the functional responsibilities are of data

management and configuration management, what the differences are between a performance baseline and a technical baseline, and what is involved in Earned Value Management (EVM).

PM #3 discussed the importance of managers being able to attract good quality people for their teams and broke down this requirement to setting challenging expectations and providing opportunity for the team members to meet or exceed established goals.

Another area where new project managers need guidance and mentoring is with the ability to read politically charged situations with both internal and external customers; know when an aggressive response is warranted; and when to acquiesce to others' ideas. Long term success in program management involves understanding the political undertones of every situation and to be able to articulate "political[ly] savvy" responses at the correct moment. Success can also be attributed to "the ability to get a diverse group of people able to move in a same direction that will get you that next step up." "It's not the technical aspect, [it is] the program management aspect that allows you to advance." Program managers must also be able to demonstrate the ability to celebrate team or individual team member successes without feeling or demonstrating personal insecurity.

The classroom environment for teaching program management, according to PM #3, has limitations because of the abbreviated training scope and "short duration" of most weekend training sessions. "You just can't substitute true real world experience" with sitting in a classroom. "The more the *[sic]* diverse your experiences; the better you are"; exposure to multiple programs will prove invaluable. Rotating people through different



types of programs helps them gain wider experience. The broad experience gives students “a better overall understanding I think of the technical issues, [and] programmatic issues” resulting in a more rounded program manager. This broad experience allows new program managers to have the experience needed to ask the “right questions” at the right time.

Industry, according to PM #3, embraces internships. Academia should consider incorporating into the last few years of their curriculum opportunities for students to experience a live project, “I mean a real project, not a case study, not an academic exercise, but an actual little project.” This “is potentially a win-win” because the student gains actual project experience and the sponsoring company “sees what that individual brings to the company.”

Developing strong internship programs is a way of “preparing candidates for program and project” management. Along with internships, the curricula should include “more courses that cover the different functional aspects of a program like data management, configuration management, [and] financial” management including applicable baseline technical knowledge.

Other related information. PM #3 pointed out that the “young folks [coming into the business] are very sharp, they are very aggressive, and they are very knowledgeable...they can do a lot of things.” Organizations are missing out on real program management talent when they screen out candidates without a college education.

On the topic of leadership, PM #3 believes that “the natural leader does not have to be the person in charge.” The person in charge needs to be able to recognize talent within the team “and utilize that” resource for the benefit of the program.

Another trend mentioned by this participant is an impression that customers are trying to shift “as much risk over to the contractor as possible.” This suggests that program managers must be able “to focus more on a very strong risk management program/process” to protect the program and company from financial uncertainty.

#### Program Manager Four (PM #4)

PM #4’s responses are predicated on years of experience managing other project and program managers in a variety of fields, such as IT, aerospace, and construction, working primarily with domestic projects valued in the billions of dollars. PM #4 is not a certified project manager, but holds a graduate degree.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. The most significant change PM #4 has witnessed has been that “project management merged with business management.” PM #4 believes that business management was eventually going to turn into “project leadership.” Less than expected results from initiatives such as Lean and Six Sigma have caused companies to focus more on project management “because they see it as a way of delivering” better results for the business. PM #4 expressed a concern with the resulting large number of people who “have taken a [certification] test and passed, that are not good project managers.” This is dependent upon the industry, sector, and maturity level

of the program organization. PM #4 has also seen change in the focus placed on risk management and a reduction of procedural management.

A trend that is being experienced in some sectors of the industry is a concern for corporate knowledge retention. Some organizations are addressing the concern with “session planning” or “knowledge management” techniques. Many of the engineers responsible for the development of infrastructure projects in this country are expected to retire soon presenting a concern as to how companies will transfer the knowledge gained over decades of project experience. This can be accomplished with a project management tool called lessons learned.

The final comment about change or trends by PM #4 was pertaining to the emergence of “agile” and “adaptive types of project management.” There is a shift away from command and control management to one of “agile” management, where organizations become adaptive to the demands of the marketplace evolving to meet the needs of the organization, customer, and industry. This does not “change the techniques that are used as a project manager.”

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #4 stated the following position regarding communications and related skills:

What has really changed is the ability of a project manager to understand communications, to really communicate well, to market, not to lie, but to know

that you've got to be ahead and you have to understand with your political savvy, your organization savvy, and your ability to understand the audience you're working with, to present your information that's adequate for that audience and get ahead of it; to be proactive, is key. The aspects around delegation, empowerment and team morale are also huge.

Project managers must be able to clearly communicate to their teams and motivate them to take necessary action to accomplish established project goals and objectives.

"You've got to empower a team" to work toward their greatest potential.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #4 believes the greatest issue with recent graduates going into project management is the lack of actual project management experience. The second issue in his perspective is the skill of managing customer "expectations." Entry-level people may not understand the ramifications of adding scope to a project. PM #4 also discussed "the ability of communicating" as very high on the skills list and summarized communications in this way: "I think their ability of being well read, strong communicators, good writers, and understanding your audience" is paramount. "Their ability to write and to be well read I think is very important." PM #4 suggested that military history can provide the "biggest lessons in experience."

In summary, the skills needed by entry-level project managers include: being able to clearly communicate up and down the organization, having political savvy, being able to establish expectations; and having the courage to tell management and customers the truth. “Project management is common sense; it’s focused around risk mitigation...and managing change.”

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #4 pointed out that education should “be scenario based as much as possible, hands-on.” The best project managers are those who graduated from schools that incorporated real project experience into the curriculum. The traits schools should emphasize are the same as those required for hiring a good project manager: strong analytical skills, communications skills, initiative, and confidence. PM #4 talked about the importance of being “genuine” both on paper and in life.

Additionally, education programs should instruct students on the concept of assigning tasks with accountability to increase success rates. Knowing how to assign accomplishable tasks to team members, executives, and customers is very important to the success of a project manager. Understanding peoples “drivers” is part of being able to assign a task in a way that promotes accountability in others. The new project manager should be able to set clear expectations among all the stakeholders on a project.

PM #4 believes students should be very familiar with the use of technology, particularly when managing virtual teams. Understanding the nuances of managing teams separated by geography, discipline, culture, and organizational structures represent a special challenge to new project managers.

Educational institutions must find a way to expand beyond the academic theory providing greater knowledge retention through concept based “scenario/experiential based” learning experiences. Learning should also be spread over longer time frames. “It is scenarios; to me the experience is about going through the process of project management over and over again, in different types of scenarios.”

PM #4 made a very interesting recommendation with the suggestion that “schools should be taking advantage of community projects, [and] school projects” to provide project and program management students with real project experience. Any type of hands-on project experience where students can make “mistakes in a semi-safe environment” would be ideal. Internships will also provide students with live hands-on project experience. Young engineers coming out of school and into business “have a lot of tools and are extremely smart and high energy and very savvy.” They are missing a crucial ingredient, actual hands-on experience.

PM #4 recommended that academia should consider “less lecture more doing, [and] fewer books.” “Communications and team dynamics” should be stressed as part of the educational experience. Students need to learn the value of being reflective in practice and how making adjustments mid-stream can correct a project that would otherwise end in disaster.

PM #4 suggested that project management “should be taught by practicing project managers or people who have had good experience and want to give back.” Using instructors experienced in the field provides a method of transferring knowledge in the classroom by exposing them to “war-stories.” Discussions by experienced practitioners about situations they encountered in their career; how they resolved issues; and what they learned from the experience could help students comprehend and retain the nuances of program management.

The military services supply industry with new employees that are capable leaders having been taught leadership while in the services. The track record for teaching leadership is not as good on the civilian side. “I’ll tell you what we are seeing out in the market place in corporate is they need project leadership.” “Leadership skills to me have become almost synonymous now with project management by a lot of executives and a lot of corporations.”

Other related information. PM #4 suggested that some companies do not value project management because they feel everyone in the company should be able to accomplish what they are asked to accomplish. Project and program managers offer a way of focusing effort on specific tasks that would otherwise not happen. “You see others in certain sectors that are realizing that you need to look at the risk” and project management is a way of controlling risk and leading a team to accomplish the goals of the company. Some companies “are really starting to embrace project management as a whole idea.”

PM #4 stated that project management is a concept not bound by a single sector of the economy, rather is applicable to a wide variety of industries and that a good project

manager should be able to step into almost any industry, learn the technology, products, and business to be successful. A program manager having technical acumen may actually be a detriment; “I believe a PM is the one [who] should be able to ask questions and to be able to get that information and find the right parties to get it from and communicate it to.”

PM #4 made an interesting analogy about project management in that it is like “running a business...you’re going through the mental process of taking this thing from start to somewhere in a finish.” Given that perspective PM #4 also stated that “entrepreneurial-ism is pretty much project management.”

PM #4 believes “a project manager should never stop learning” and that learning can make the job fun. Project management “is like combat; you go in and you are constantly trying to win a situation; you’re having to change your tactics and adjust...[which] can make it very stressful, [and] it can also be incredibly rewarding.”

Leadership was a recurring theme with PM #4 who suggested project and program management was “really about leadership.” “I don’t think they realize how much leadership is involved in project management.” A new category of super project or program managers may evolve from those who can handle the large intercontinental contracts, especially with municipal construction projects.

#### Program Manager Five (PM #5)

PM #5’s responses reflect several decades of experience managing aviation programs and other program managers, primarily in domestic programs valued in the



millions of dollars. PM #5 holds a college degree and is not certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #5 strongly emphasized that recent developments have resulted in reduction in priority of technical expertise in some organizations. An increased focus on “people skills” has taken higher priority leaving gaps in technical knowledge. The current hiring process also limits candidate selection which only exacerbates the technical experience problem.

The emphasis has been on hiring managers without regard for technical experience. “To be an effective manager with program[s] or people, you must have experience and be familiar with the program and project they are working on.” So, hands-on technical experience is importance to be successful as a project or program manager.

Technological developments are being introduced every day in the aerospace industry requiring project and program managers to stay technically current to be effective in the job. Based on the reduced focus on technical skills for program managers training of existing program staff is not keeping pace with changes being implemented in the industry.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #5 believes continuing education plays a critical role in the process of retaining the technical expertise of individuals. “Technical experience is fundamental” and “on-going technical currency is essential.”

Managers need to be able to “recognize technical expertise” especially if people look to the program manager for direction. This requires a combination of actual experience and education. “I think it is critical for program managers to at least have some rudimentary skills, hands-on skills.”

## Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. According to PM #5, “people skills” are lacking in many new project managers. The ability to recognize and acknowledge superior performance by other members of the team is important. If education could combine management training with the technical field experience in a good mentoring program, that would be excellent. Managers today do not have the luxury of dedicating time solely to mentoring new staff because of the volume of information they must process every day. This will become a more serious issue for managers as expected staff retirements over the next five years will precipitate significant new staff training.

PM #5 believes future “budgetary constraints” will also impact the number of available program managers. The demands placed on program managers are “going to substantially increase as the number of program managers are decreased.”

Program managers of tomorrow will have to be able to accomplish considerably more with fewer resources than in the past. Compounding this concern are anticipated changes in program managers’ supervisory responsibilities causing span-of-control to go from a current 10 to 20 staff to as many as 50 to 100 people.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #5 mentioned that the “technology that younger folks have today is good but, let’s supplement that with the physical hands-on experiences.” Internships, unfortunately, are not utilized well by management resulting in students gaining little usable knowledge. Another idea discussed was the possibility of extending the existing new hire probationary periods from one year to as many as three years allowing this time to be used as “developmental program” time instead. This would allow adequate time for a comprehensive training program to be administered.

Partnerships with industry would be another way to improve students’ hands-on experience. A government and industry partnership would allow students to be exposed to a variety of work experiences benefit all involved.

Other related information. PM #5 was also concerned with the current approach to training in some organizations. Mandatory training programs are a “blanket approach” to training rather than targeted to specific audience’s needs. That approach to training is disruptive and is “not accomplishing what you need to accomplish.” Training should be tailored to each level of the organization with managers determining what training is required.

#### Program Manager Six (PM #6)

PM #6’s responses to the interview questions reflect several decades of military experience managing large projects and programs and other project managers in commercial and government settings, both domestically and internationally. The projects managed were valued in the billions of dollars. PM #6 holds a graduate degree and is not certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #6 quickly said that the flow of information is much faster now than in the past and cited the use of social networks as part of routine business today whereas a few years ago these did not exist. New technology has increased the flow of information resulting in a greater number of people involved in almost every decision. The discipline of communications is allowing “too much

information flowing prematurely to the wrong people.” PM #6 compared the speed of business today to twenty years ago and pointed out that back then correspondence was routed via regular mail and there usually was an office full of people to help develop and manage routine communications. Today program managers must be proficient in using presentation software, developing business models, and managing financial databases on their own. “Indirect labor is evil. To be competitive” in the current business environment you must learn; “you can not carry weak people.”

PM #6 believes a result of the current business conditions has been an increase in “span of control” resulting in the need for greater trust. He said, “I’ve really got to trust them to do their job.” “I can’t micro-manage them” because there are too many. PM #6 stated a concern that program managers are as busy as their managers are with the day to day “tactical” issues and don’t have “strategic thinking time.” The speed of business is only going to get quicker, which means program managers will need to think with agility to keep pace. The program manager of today must be a “jack of all trades.”

“Geographic location isn’t as critical as it used to be” according to PM #6, who also said that the application of new technologies in the everyday office requires program managers to be technologically savvy. Face-to-face meetings occur less frequently today than in the past, said PM #6 who also expects there to be fewer such meetings in the future requiring greater reliance on the technology.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM# 6 believes “higher education is a critical piece partly because of the discipline it takes to get the higher education.”

Besides the need to multi-task, another skill necessary for job performance as a program manager is the ability to communicate through writing and public speaking. “The new generation doesn’t write anymore.” Written communication is an area that needs serious attention. A program manager must also be computer literate and “not just a little bit.” PM #6 believes that training program students should be rotated through many different program settings to gain a perspective on a variety of different product-lines, contract types, and management styles as they are groomed for the job.

“Great leaders and captains of industry are making decisions with imperfect information because if you wait for the perfect information it is too late.” PM #6 believed that program managers must have the courage to make decisions, “if you don’t have the courage you then draw in and you don’t reach your full potential.” That courage, he said “comes from experience, education, and...time to think.” The “strength of character to make hard decisions” is important. A program manager must be able to “stand tough against their customer when the customer is clearly wrong.” Program managers need to have bureaucratic courage to stand up to the customer and their boss.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. One criticism PM #6 had of the younger work-force is that they do not appear to think long term or strategically; they are

“too reactionary; they live for today.” “Often they are so afraid of failing that they don’t reach.” “They struggle with eight-to-five; the culture now is minimum hours.”

Weekends are usually out of the question. As a program manager they should expect to work a lot of stressful hours, yet there has to be a balance between personal and work life otherwise their “professional performance” will be negatively impacted.

PM #6 pointed out that new program managers need to appreciate the collective skill and knowledge available in a team. They should rely on those within the team who possess technical expertise to make technical decisions in their area of expertise.

Practitioners of program management in the aerospace industry must stay current with the market and profession. One way of doing this is through personal reading. Another is by participating in industry trade events where the latest developments are often presented. An industry or trade event is an excellent way of interacting with other people interested in similar issues. A great deal of information can be gained through formal or informal personal exchange at events such as trade shows. Communications skills are more critical today than in the past.

Aggressiveness in moderation is another trait that PM #6 believes is important, “you’ve got to be tough and these young kids aren’t coming in tough.” Teaching students how to appropriately apply aggression in a business setting will be difficult.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #6 believes continuing education and training should be offered in short segments because “it’s a sound-bite generation; if you can’t feed it to them in a day or two, you’re going to lose them.” The use of multimedia is preferred by the new generation, therefore training and education should utilize this format. “Curriculum developers are going to have more agility” in the future because of the fast pace of business today. Changes will need to be incorporated into the education much quicker in response to changes taking place in market conditions. They may need “to have the agility almost over night to tailor make a lesson plan.” Then there will need to be “after action evaluation[s]” and surveys to measure the effectiveness of the education and training provided. Results from the training effectiveness evaluations should be used to mandate changes in the training curriculum with speed and agility necessary to stay current with the trends in the industry.

PM #6 recommends that schools monitor student progress through internships more closely by asking post internship students “what were your gaps” and did the curriculum adequately prepare you for the task of managing a program? “There ought to be a constant exchange between industry and education” to insure education is providing the correct training needed by industry.

Ethics is another area PM #6 recommends schools emphasize because without “an ethical base it will compromise your ability.” Ethics falls under the category of “Soft Topics.”

Other related information. PM #6 discussed the need for practitioners to stay current in their field and pointed out that “now-a-days, I don’t have the luxury of taking a lot of time to train, so it’s got to be quick and targeted.” “I think any professional will



tell you, you've got to have continuing education. You've got to keep current, you've got to read, [and] you've got to continue to educate." Reading biographies was recommended by PM #6. A closing comment stressed by PM #6 was that program managers have "got to have fun" in the process.

#### Program Manager Seven (PM #7)

PM #7's responses are based on decades of domestic and international experience managing large commercial and government aerospace projects and project managers, with projects valued at approximately one billion dollars. PM #7 holds a college degree, but is not certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #7 believes the biggest difference noted recently has been with the way we communicate. Next would be a change in physical distribution of project teams. Technology has changed the way we communicate. Internet access and electronic mail has increased the efficiency of communications, speeding the process. Managers "demand to know everything and they want to be part of the decision process on everything." With nearly instantaneous communications, project teams no longer need to locate within a single office or building. Project teams are now geographically distributed across numerous facilities, countries and continents. "Centers

of excellence” have emerged providing specialized services to intra company customers such as program teams. According to PM #7 this new approach requires considerably greater discipline up-front during the planning or system engineering phase of a project. Careful task definition and effort planning is required as programs become more complex to manage.

Distributed teams require a different approach when managing; in the past you could visually see the people working at their desks compared to the situation today with project teams spread out, some team members working from home offices. Project teams according to PM #7, will continue to experience team dispersal over times with project and program managers looked upon as the “glue” holding the teams together. This new distributed team structure will challenge managers’ skills in “leadership, soft skills,” and “agility” dealing with the nuances of multiple locations, cultures, and organizations.

Other challenges created by distributed teams are the disparate goals, objectives, and financial requirements each physical location operates under. Decisions made by different locations may favor the physical location rather than the team or program objectives creating significant challenges for the program manager. The program manager “really [has] got to be quite well connected with your teams out there and they’ve got to be willing to share why they are making certain decisions.”

PM #7 believes we will “see continual break up of large groups....into smaller groups.” An example of this is taking place when centers of excellence are created to provide superior specialized services and organization. Distributed centers of excellence are one of the ways of overcoming the “weakness in technical skills across the world.” The worldwide distribution of teams and centers of excellence also highlights the

increased demand, according to PM #7 for project and program managers to be able to “understand cultural differences.”

In the past when teams were not distributed, new staff would be assigned a mentor and they would shadow their mentor learning “by osmosis - just listening, watching, [and] observing.” The new hire staff of today “are all bright, they are smart, they are technically savvy; but they need somebody to ask [and answer] questions” because they cannot walk down the hall and get information. Training new staff presents a problem with distributed teams.

Another challenge raised by PM #7 is the perceived “mentality” of newly hired junior staff. They often believe they are “ready to be CEO ...a couple of years after they’re out of college.” Even though junior staff can multi-task well, are very good at their jobs, and display confidence; they “need a little more seasoning” before they can move into the main role of managing a large project or program.

The chain of command according to PM #7 has become bifurcated in many cases, “most of us have three, four, [or] five different bosses” as compared to the military environment where you know precisely who you work for.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #7 points out that the project staff must have “good communication skills, good people skills and be willing to work outside your visual comfort zone.” This primarily means they must be comfortable with

technology to be able to efficiently “communicate with a distributed process team.” This is a particular problem when new project staff first begin because they may be separated from other team members presenting a challenge for getting them up to speed. PM #7 recommends new people ask plenty of questions to compensate.

Knowing “how much information to up-channel” is a difficult decision new program managers must make because too much or too little information reflects poorly on the individual. PM #7 believes the constant demand for details and desire to make decisions by upper management will eventually subside when the current upper management is eventually replaced with program managers who experienced up-channel decision making. Program managers must be able to stand up to management and say “I’ve got this...if I need your help, I will come get you.”

PM #7 pointed out that anyone entering project management should be “flexible” because distributed teams cross many time zones resulting in job demands significantly greater than 8 to 5 Monday through Friday. “Basically, your work day is 24 hours a day.”

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #7 stated that schools need to provide “more projects, group projects, [and] getting group dynamics involved” in the academic process. Team dynamics need to be stressed in school. Providing

opportunities for students to interact as a member of a team allows them to learn important lessons for their work life.

Experience listed on a resume is valuable, PM #7 recommends students “get involved in campus organizations” so they can experience “parliamentary procedures” while gaining experience working with teams of peers. Capstone projects provide similarly valuable experience because they often have real deadlines and real issues to solve in a mentoring way. “Co-ops, internships anything that helps them correlate life after college with life in college I think is a good thing.”

PM #7 explained that experience and judgment are why companies compensate program managers. Their ability to make “snap decisions” under pressure knowing that their decision might affect “a lot of people’s lives” is why a new program manager needs to gain field experience.

Being “agile” is also “essential” in business today according to PM #7 because the distributed nature of programs does not allow you to see or know everything that is going on. The program manager must be able to respond quickly with agility to problems as they arise. Understanding the resource available for quick response involves knowing who to call.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #7 believes students should be allowed to experience the pressures of financial conditions on projects through simulation

such as preparing annual reports, providing profit and loss statements, and meeting with share holders and executives to discuss project status. “Any of those things that can get them involved in how the machinery really works outside of school, I think, would be a great thing for the students and would really be helpful for the industry.” Students with this type of experience “would be a lot better prepared” for the world of project management.

Students coming out of school today are “brighter than they have ever been [and] they’re savvy” but they lack hands-on experience according to PM #7. Academic institutions could offer students simulations as a means of providing real project experience. Capstone projects in their freshman or sophomore years could be a great educational benefit rather than waiting until their last year in school.

Up front project planning is an important step of any project considering the potential financial risk associated with poor planning. PM #7 believes project managers need to know the up-front system engineering process very well to be successful. This is an area education can assist students by preparing them for the field of project and program management.

Other related information. PM #7 points out that “there’s a weakness in technical skill across the world. There’s just not enough technical skills for everything that is going on” which causes organizations to utilize subcontract technical support from around the globe. The up front design engineering effort necessary to complete a large program today mandates the use of subcontractors. “No company can handle the [human resource] bow-wave up front” because the company would be severely over staffed in later phases of a program creating unnecessary financial burden.

PM #7 commented that students in school are often provided key information when asked to solve problems, but that may not always be the case in real life.

So the key is, in college you tend to get everything you need or you can assume it in a way. In real life you can't do that and that's the hard transition people have that says: *I can't get an answer that the computer can calculate it's going to have to come from my brain and that's a very difficult thing.*

#### Program Manager Eight (PM #8)

PM #8's responses reflect several decades of military and commercial experience managing large commercial and government projects, both domestic and international in scope and valued at several billion dollars. PM #8 holds a graduate degree and a project management certification.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #8 has seen a shift to a more adversarial relationship between the government contracting community and contractors. This may have to do with several events which took place a few years ago between certain civilian contractors. PM #8 believes that trends are cyclical, moving between a good working relationship and an adversarial relationship. PM #8 also believes that the most recent

political elections may have caused some of the difficulties being experienced by civilian contractors because of elected preference for specific types of contracts.

Nearly 10 years ago, there was a shift away from established “standards” which has caused the government to move “away from just carbon-copying the previous bid that they had done.” The increased demand for certified program managers in both the government and civilian sectors is good according to PM #8 because it shows that people with certifications have baseline knowledge about the process.

PM #8 has seen the government place greater emphasis on cyber security and the control of information which has caused an increase in video conferencing. PM #8 believes teleconferencing will never replace face to face meetings.

PM #8 also believes “the process is getting faster” and offered examples of how steps in the past which took days are now completed in hours or even minutes. “If you know what you are doing, you’re going to get to do it a lot faster” because the process continue to speed up resulting in decisions being made faster as well.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #8 has seen an increase in demand for certified program managers both related to government employers and civilian contractors. PM #8 has also seen “more benchmarking” which is reflected in the demand for certification.



According to PM #8 there is a “bias towards the basics” in the industry with less importance being placed on the soft skills. This situation is unfortunate because soft skills positively enhance the performance of teams and programs.

Leadership skills, management skills, and interpersonal skill were categorized by PM #8 as “the softer end of program management.” “When you’re dealing with people you can cause all kinds of problems if you don’t have the leadership...skill set that you need to move people into...a job that they may not at that particular time want to do.”

This practitioner suggested that program managers must be “agile;” they need to find ways of building short cuts into the process which can be used when situations present themselves. Along with the speed of process, there may be new software tools available in the near future which will help streamline some of the steps currently taken by project and program managers.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #8 believes a strong “background in one of [the following] three areas” is necessary to be successful in program management: experience running an organization as the leader, experience as an engineer, or business/finance administration experience. “All three of those processes are essential in program management.” Program managers also need to have a basic knowledge or set of tools to manage projects, a current set of “best practices” for managing projects.

Students interested in program management as a “vocation” should make a “firm commitment to the process.” “Program management is tough.” Part of that process according to PM #8 is that “the program baseline is your key metric to success.” By managing the baseline correctly, a program manager should be able to deliver a committed product or service as contracted.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #8 believes hands-on leadership classes taught in a play-acting environment would help overcome the common difficulty of teaching leadership. A leadership lab may be necessary to teach leadership. The military has been able to teach leadership but the commercial industry has not mastered this capability. Leadership is important because “the power of persuasion and convincing people to do a job” is still the quickest track to a completed project.

PM #8 believes academic institutions should offer a “career track” certification for entry-level project managers. This type of educational study should be followed by rigorous student evaluations before the school issues a certification of completion. Students completing this type of program should have the knowledge and experience to “show up at any facility, aerospace or even a ship yard for that matter” with the ability to assess the status of a program, pick up the effort from the last action, and complete the project successfully. “I don’t think that kind of rigor totally exists anywhere in the industry I am aware of.”

Academic institutions should partner with large firms to offer special internship programs for project managers where students would spend time learning the steps in a real organization and then follow them through to completion of the project or program. An additional comment made by PM #8 predicts that we are “going to have a lot better education for program managers [in the future] because it’s a very lucrative career field.”

#### Program Manager Nine (PM #9)

PM #9’s response reflects several decades of military and industry experience including international and domestic experience managing large commercial and government projects valued in the millions of dollars. PM #9 holds a graduate degree and is certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #9 believes there has been a change in relationships between procurement agencies and the military services in an effort to reduce military spending. This has resulted in “internal conflict” within the contracting agencies which is adding time and costs to the procurement cycles. A system of “performance based logistics” has increased the amount of oversight rather than decreasing oversight.

PM #9 has seen a steady increase in processes put in place to manage the volume of data handled. PM #9 believes these processes have been regimented to the degree “that no one can do it right, even guys with ten years experience in the company.” Trying to adhere to the process has become more difficult. This focus on process is significantly increasing the amount of time needed to generate responses to customer questions.

PM #9 discussed other organizational changes related to the chain of command when “no one directly works for anybody.” The situation is a challenge when a supervisor is located in a facility across the country but has “never met” or talked to the Program Manager and is responsible for the continued career of the individual.

PM #9 pointed out that many people in project management “now work from home.” Even with the improved technology, communications can be difficult when people have a choice about taking a call from another member of the team. Often you have to leave a message and they will get back to you when they have time, frequently resulting in major frustration.

PM #9 believes the demand for “instantaneous knowledge and instantaneous data” will continue along with “instantaneous communications.” Our society has become “an information age and everybody wants perfect information now, and in many cases they just want perfect communication down the food chain now.”

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. Because of the changes referenced in question one above, PM #9 believes that the situation between contractor and customer is all about “building relationships.” “If you’re not really good with your interpersonal skills and if you’re really not good with networking, you’re toast.”

With respect to experience, PM #9 stated that a new program manager with no prior experience or education typically spends two or three years with a mentor while they attend the special military training schools. “It takes a year to get them comfortable and at least doing basic project management tasks.” PM #9 described the mentoring as “almost direct one-on-one mentoring, if you don’t have that they will not succeed.”

PM #9 further points out that companies “are trying to hire the best and the brightest in a very tight job market and they are getting them and they are good.” These new employees do not necessarily have engineering backgrounds. They are educated in program management and business management qualifying them to be hired as “assistant project manager[s]” in some companies.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #9 believes “technical experience is good for understanding” the jargon used during project discussions. Individuals with business backgrounds will need to take the initiative to learn enough basic information to function in this acronym rich environment.

Entry-level project managers should have a good understanding of project financials according to PM #9. They should be “conversant on what pricing should look like,” knowing how quotes are constructed and how to arrive at a total contract price for a project.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. Regarding the technical experience, PM #9 recommends schools provide project management students with basic through advanced systems courses in bachelors’ degree programs to prepare them for work in the aerospace industry.

This is how an airplane works; this is propulsion; this is hydraulics; this is electrics; this is avionics; and then this is how rockets work; and this is how orbital dynamics work. You don’t need to get into it at the NASA level but at the Popular Science magazine type it would be good, so at least when they are thrown into an environment either with the service or with a contractor, they don’t have the deer in the headlights look.

PM #9 pointed out the importance of a program manager possessing excellent communications skills so they can easily collect and present technical data in such a way that laymen understand. Students should also be instructed on how to work with others in a collaborative way, how to harness the mental power of a team, how to work with interpersonal skills to accomplish goals, and how to manage through organizational

bureaucracy. Students entering project management today should also be proficient in the electronic tools of the trade such as electronic spreadsheets.

PM #9 recommended colleges consider a Bachelor of Arts degree in business administration with a minor in project or program management to include aerospace systems and basic engineering courses. This would be a winning combination for someone interested in gaining civilian employment with the government. “It would be good to have someone who could walk right in and say, *I can spell project management so give me a little project to manage*” allowing the individual to gain valuable work experience.

#### Program Manager Ten (PM #10)

PM #10's responses are predicated on years of experience with domestic and international, commercial and government projects, valued in the hundreds of millions of dollars. PM # 10 holds a college degree and is not certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #10 pointed out that the discipline, complexity, and requirements particularly in the area of project documentation have all seen noticeable increases in recent years. Customers require more documentation on

project data in the form of reports related to the planning used in the system engineering process. This situation primarily exists for governmental customers.

PM #10 believes that the discipline of program management will continue to increase in importance as technology advances because customer organizations will not be able to afford the full-time employment of highly skilled professional program managers.

They need someone who could come in; look objectively with discipline, with processes, and the appropriate skill sets to bring not only their own internal organizations together but to bring whatever teams or resources are needed to effect whatever project or to execute whatever project is in front of them.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. According to PM #10 the skills, knowledge, and experience has changed far less than the significant increase in the demand for documentation on programs. The area effecting program managers abilities the greatest has been a concentration on the “formal identification, documentation, [and] mitigations of risk.” Program managers are now required to report continuous status updates on risk issues externally to customers and internally to upper management. Risk reporting has become an area of great importance internally and externally creating a situation of extreme oversight.



PM #10 identified the ability to communicate persuasively with political savvy as being the most significant new requirement for program managers. Although PM #10 believes the requirement to communicate with customers has always existed, the difference now is that internal organizational customer or stakeholders are demanding a greater share of the information, significantly increasing the workload on program managers.

PM #10 summarized how the requirements of a project manager have changed as follows:

The largest thing I see is you can no longer have a technically competent program manager who cannot stand in front of a crowd, a legal entity, internal groups and present. In years past a good program manager could state just the facts as it were and get away, now he's got to be able to be persuasive with the lobbyist. He's got to be able to argue his point and influence both internal and external customers.

The program manager must be able to convey complex technical issues to people "who don't understand the complexity, you have to express it clearly [and] concisely." The program manager must be able to read the audience interpreting their understanding of the technical issues and then respond with a discussion targeted at the appropriate technical level.

As discussed in Question 1, the program manager must have a thorough familiarity with the "iterative process of system engineering;" otherwise they will be "severely handicapped." Not that the program manager has to be a system engineer; they just have to have an "understanding of the systems engineering processes" to survive.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #10 stated that program finance is an area in which entry-level program managers must possess knowledge and skill. Historically, PM #10 has seen a lack of “skills to convert...[financial information into] accurate planning and budgeting” information.

Students pursuing a career in the field of program management must possess program situational awareness, meaning they must have the “ability to identify that you’re going off the track and the ability as a result of that identification to adequately communicate internally the need for resources, the need for corrective action.” Students should be able to recognize and react quickly to situations that might threaten the eventual outcome of the project.

Project managers must also develop the skill to accurately read what is going on within the customers’ organization. PM #10 called this trait being “politically savvy.” This closely goes along with a previous statement that “a program manager who does not have the people skills, the soft skills, will fail.”

PM #10 summed up the requirements for a program manager as a person who is “well rounded”, technically savvy, “conversant, who is personable, who is politically savvy, [and] who can think on their feet.”

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #10 recommends that program managers should have an understanding of the systems engineering process before stepping into the task of program manager. PM #10 believes students can gain this knowledge through the formal educational process.

Scenario training and specifically crisis management scenario training are highly recommended by PM #10 who believes that the stress of decision-making under pressure as usually experienced in real program environments could be simulated in scenario training significantly benefiting students.

Regarding mentors, PM #10 believes “having a good mentor is most important.” The mentor is “someone that you can call on and ask questions” and an effective mentor might be more helpful than “having a very strong team leader who is there all the time.” PM #10 has been undecided about which option, mentoring or strong team leader, produces the best results but concludes that mentoring is the better of the approaches to training a new program manager.

PM #10 stated that “program management is a stressful occupation.” Education should prepare students to be able to manage the stress present during a typical program crisis by exposing them to these pressures through scenario simulations. Not everyone has the inherent ability to function under these conditions. Early identification of students who do not respond well to this level of stress will benefit students as well as employers.

Discussing soft skills, PM #10 pointed out that an educational institution might be able to hone the skills of a student that has the “innate sense” yet warns “there are some people you could never train to be a project manager.” PM #10 also believes that customers expect project or program managers to speak from experience “so expanding the experience level within the educational system is a must.” This can be done by academia utilizing closely monitored co-op and internship programs in partnership with industry.

PM #10 believes cooperative and internship arrangements do not always produce the desired results because students often end up “doing the grunt work and not really being exposed to the” rigorous experience necessary to produce viable program managers”. Co-ops and internships must be “well structured and monitored” by both the employer and the educational institution to be truly productive. “I think we would all benefit if there was a more interactive kind of university...checking, guiding, [and] making sure that the person was actually getting what they needed.” A system with close faculty monitoring and established objectives would create greater awareness on the part of the assigned corporate mentor to make sure the student received the kind of experience expected.

PM #10 talked about the opportunity for educational institutions to expose students to the stresses of program management before they enter the field. Some students may decide to pursue other related career fields based on crisis simulations experienced in the program management curriculum saving the student, potential employers, and customer’s considerable difficulty.

Students interested in program management as a career must have a good foundation in project accounting, cost estimating, and financial reporting. PM #10 went on to say that they also must be able to quickly assimilate functional knowledge about the products and service offered by their employer.

Other related information. PM #10 offered the following observation:

My belief [is] that a program manager has to be a fully well rounded person who has technical discipline, who has political savvy, who has the interpersonal skills to interact, the presentation and presence...there is a whole package that is incumbent on someone who is going to be a successful program manager.

#### Program Manager Eleven (PM #11)

PM #11's response is predicated on several decades of experience managing domestic commercial and government projects, while managing other project and program managers. PM #11 has managed projects valued in the hundreds of millions of dollars and is not certified in project management.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing Trends and Changes. PM #11 described the program life-cycle of a specific sector of the aerospace industry as being long term to the point that change

“would scarcely be noticeable.” There has not been much change in program management over the past several years.

PM #11’s opinion is that business trends “ebb and flow” gaining and losing popularity over time. This concept applies to program management as well. PM #11 did indicate that the volume of “intellectual assets and intellectual properties that are difficult to visualize” such as software engineering, will predictably continue to increase with time. Software engineering involved in most aerospace programs today requires the ability to manage a product you cannot see; and “is a bit different than managing things that you can see.” Capability Maturity Model Integration (CMMI) is a tool that was designed to assist with the virtual world of software development and “now we are trying to apply it to the non-virtual concrete world and it seems to be way more than we need to manage things that you can readily see.” Trends such as this will continue to change as organizations work toward the latest heralded idea, until evidence proves otherwise.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. PM #11 suggests “one of the things you need to be prepared for in a career in program management is change.” The tools have changed more than the project manager’s responsibilities. New devices have not substantially altered the need for training or education other than requiring the ability to efficiently apply these tools to ongoing programs. The tools available to the program

manager have “changed the form of reporting, the facts of reporting haven’t changed substantially.”

“Program lengths are so long that experience is gained fairly slowly in terms of the calendar.” Some organizations would not consider hiring a program manager without considerable related experience. For example, in some organizations program managers are recruited having “design engineering and test engineering background[s].” An undergraduate college student with a degree in program management with no real program experience is “not going to be real useful to me.” PM #11’s employees “would best benefit from program management as a secondary degree program or graduate program” where the education is on top of the skills they have already obtained and practiced.

### Research Question 3

*What skills and knowledge areas do entry-level program managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #11 described an organization where most project managers originally worked in engineering. When they moved to project management they were often lacking knowledge in the area of finance. Mentoring and additional training is usually required to adequately prepare engineering types for program management. People skills represent another skill in which engineering types often require additional training. Some have previously had the responsibility of managing other people whereas other entry-level program managers have not.

According to PM #11, students who completed an education in program management often possess an unsubstantiated opinion or expectation about their own capability in the field of program management. Completion of a program to a “very high academic achievement” may falsely lead the student to believe they are ready to manage a large program. Their education, without adequate experience only prepares them to start learning in “the structure of actually accomplishing programs.” If they arrive at this point with a strong belief about their abilities they may still require “a considerable amount of experience.” When they realize considerable experience is required before taking on a program they “many not be prepared to continue.” Even with superior theoretical and academic knowledge about the subject, without actual hands-on experience, students will have to start at the very bottom of the organization and work their way up.

New program managers should possess an understanding of how to manage customer expectations. This is an area that can cause a program to fail without proper awareness by the manager. “If the customers expectations have been shaped appropriately along the way, that program won’t be a failure, or at least not perceived as a failure.” Engineering types might tend to overlook this area of programs and this topic is an area on which educational programs should focus.

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*



Education and training recommendations. PM #11 believes schools should consider including imbedded “rigorous simulations” in their program management curriculum. Training simulations should include “all the key events of a real program operated in a simulated environment.” Project simulation should be considered as vital training. Education should also place a “strong emphasis on those tools that are specific to program management.” Program finance and accounting are additional areas in which engineers turned program managers will particularly need training and education.

PM #11 believes program management training should be “part of a continual learning process” and “program management skills are better obtained after they have reached the level of expertise in what ever that underlying business is.”

Other related information. PM #11 described one organization as a strongly vertical matrix organization which is often referred to as a stove pipe organization. The vertical matrix structure works well for them because they “share resources more efficiently by being stronger along the vertical lines so people aren’t attached as strongly to programs.” This allows resources to move easily between programs when resources are no longer needed on a program. Sometimes subcontractors are arranged “more strongly along the other axes” which results in “some mismatch in expectations and mismatch in assessments” although not to the point of conflict.

#### Program Manager Twelve (PM #12)

PM #12’s response to the interview questions is predicated on over a decade of experience managing domestic and international projects and program managers in the

aerospace and defense industry, with projects managed valued in the millions of dollars.

PM #12 is a college graduate, but does not hold a project management certification.

#### Research Question 1

*What recent developments and emerging trends in the aerospace industry signal a possible change in seminal skills, education, knowledge or experience required of future project managers?*

Developing trends and changes. PM #12 does not believe the discipline of program management has changed noticeably. What has changed is the level of oversight from the federal government. Reporting and documentation requirements have certainly increased as prescribed by government regulations increasing incurred costs on programs. Increased documentation requirements are placing a time strain on the program managers who may not have anyone to assist with these tasks.

PM #12 described the process for an organization to obtain Capability Maturity Model Integration (CMMI) certification. CMMI has “its own set of artifacts that need to be created along with the path of the project.” CMMI reporting requirements further compound an already significant paperwork burden placed on program managers.

Like CMMI, Earned Value Management (EVM) is another tool of program management that will add contract deliverable item responsibility to the already heavy workload of a program manager. Organizations receiving ISO certification must document procedures while requiring maintenance of documentation. When all these requirements are layered out together the result for the program manager is a feeling of over processing. Augmenting the program staff with a person dedicated to generating

reports may be necessary in the future to free the program manager to focus on the management of the program.

## Research Question 2

*How do emerging trends and recent developments in the aerospace industry change the demands placed on the skills and knowledge of project managers?*

Changing skills, knowledge, and experience. Program managers should have a good technical knowledge base regarding the products they are managing in a program. The reason this knowledge is important is to insure the program manager can recognize inaccurate technical information used as evidence for an argument or decision.

Program managers will need good financial accounting knowledge for producing the reports required by EVM. These added requirements will place the burden on the program manager to be knowledgeable about the government audit procedures and federal acquisition regulations.

New program managers must spend time understanding the official requirements of a program. They will need to study the request for proposal document, specifications document, proposal, and the signed contract, otherwise they will not be able to defend or maintain the company position with statements like “it may be a requirement but you didn’t ask for it to be bid and it can certainly be funded but it is going to cost you.”

Effective program managers utilize interpersonal skills to build a cohesive team able to respond with a joint effort when called upon. Team leadership is not an easy subject to teach. Program managers with military service experience “have had more

exposure” to leadership training than their counterparts and “not everyone excels” at team leadership.

### Research Question 3

*What skills and knowledge areas do entry-level project managers most often display as deficiencies?*

Preparation of entry-level project managers. PM #12 described an organization that selects potential program managers primarily from the “ranks of engineers” which means they already possess an excellent technical knowledge base requiring only the added knowledge and skills of program management to be a proficient manager. “They will struggle usually in dealings with the customer, particularly in dealings with the customer that is wanting to squeeze you for whatever.” These new program managers will also “experience some scope creep” and they do not “know how to stop it” because they are often told when they get into a customer meeting, “this is a requirement; we can’t do without it.” This is where the entry-level program manager must be willing to spend considerable time studying the project documentation. Some companies do not emphasize program management training or value program management certification.

New program managers run a risk when they first enter the position if they are over-confident in their own abilities. PM #12 recommends new managers ask for help from their supervisor, mentor or other more experienced program managers. This is especially true Program Manager Twelve said, when sitting across the table from a customer facing a difficult situation or negotiations. “The military is a little different animal.”

Unanticipated scope creep due to technical issues or un-bid tasks is another area where program managers must be exceptionally cautious because added costs are a root cause of project failures. “A healthy dose of caution and detail analysis up front is really critical.”

#### Research Question 4

*How can education and/or training better prepare project managers for the changing demands in the aerospace industry of the future?*

Education and training recommendations. PM #12 recommends people entering programs with purely technical backgrounds should receive program specific education and training before entering programs. Those candidates with management education and no technical background should receive technical training, “not a full engineering course” but enough to function in a technical environment. The technical folks particularly need finance and accounting courses to prepare them for the job of program manager.

Program managers need to be able to analyze financial information on their project including actual costs incurred, to be able to determine independently the financial viability of the project. They should possess the skill necessary to review actual costs incurred on a program to ascertain if anyone is inaccurately charging the program for time spent or materials purchased.

PM #12 recommended that anyone aspiring to be a program manager should be a “generalist” not a specialist in any one discipline “they’ve got to be a little bit all-purpose.” Taking additional course work specifically in contract negotiations was

identified as important to keeping the project from “swelling on them.” “The customer wants more than you’re contracted for - he always wants more than you’re contracted for.” “Knowing what you can give without giving away the farm to keep that customer from exercising all the bad carrot and stick type stuff, then you know that’s where some of the art of negotiation...comes in.” Program managers need to be “well rounded” individuals.

Other related information. PM #12 pointed out that a program manager without some basic understanding of financial accounting will have a very difficult time in some companies because several days every month are spent “feeding the internal reporting beast.”

PM #12’s opinion about the benefit of program managers being involved in the up-front proposal activity was evident in the following statement:

It is critical for the prospective PM, if he is going to be assigned the project, to be involved in it from the beginning and know the intimate details of what is in scope and not in scope and that may involve a lot of digging through...some fairly significant size volumes of stuff.

PM #12 described one organization that had restructured adding the position of Director of Program Management. This position was responsible for mentoring and training associate program managers while assisting them with customer relations issues as well as financial tracking and reporting. Utilizing this new Director allowed the company to train existing internal candidates to fill the needs of their organization.

The same organization was implementing a new “enterprise project management tool.” This would allow the company to better understand their resource loads and

demand requirements by combining the resource requirements and schedules of all ongoing programs. This tool should help the company control their costs as compared to the manual system which “you usually run on the lean side and a little behind where you need to be or want to be.”

## Discussion of Findings

### Research Question 1 - Finding related to Developments and Trends

When participants of this study were asked to identify any recent developments or emerging trends in the aerospace industry which might impact the educational requirements of project managers, all twelve responded. Ten participants, or 83%, confirmed developments and trends affecting project management have been experienced. Two, or 17% of the participants, reported that no appreciable change had been noticed in the field of project management.

Developments and trends perceived by the 12 participants are reported by category in Table 6. The column labeled “Categories” represents concepts reported by the participants and organized by the researcher. The column labeled “Ref.” indicates the number of participants who reported perceptions categorized under that heading. The center section of the chart depicts each of the twelve participants’ responses by category, reported in order by word volume as compared to the other categories. The column to the right labeled “Sources” indicates the total number of discrete phrases or themes recorded in each category collected from the participants’ interview responses.

Table 6

*Research Question 1 – Categories*

Categories	Ref.	Participant												Sources
		1	2	3	4	5	6	7	8	9	10	11	12	
Trends & Changes	11	1	1	6	2	3	2		1	2	1	1	1	34
Communications	6			2			1	5		1	2		2	13
Certification	3	2			3				2					10
Organization	5			3	1	2		3		4				9
Dispersed Teams	4	4					4	2		3				8
Authority	4			1			6	7		5				8
Education	5			4	4	1	5	1						8
Technology	4	3					3	8	3					6
Leadership	3	5		5				4						4
Risk	3			7	5			6						3

Participants reporting emerging trends or developments in the application, prevalence or demand of project management techniques provided various descriptions as they interpreted their perceptions about the discipline. They offered their own rationale for why they perceived growth and development in the discipline of project management which was recorded during the interviews. Participant rationales for perceived growth in the discipline are provided in Table 7.



Table 7

*Rationale for Growth in Project Management*

- 
- Availability and Growth of Communication
  - Improves Financial Performance, Stability, and Business Results
  - Global Competitiveness
  - Greater Value to Organizations
  - Increased Technical Complexity
  - Increase in the Speed and Volume of Data
  - Maturity and Discipline of the Practice
  - Constant Change in Organizational Focus
  - Business Management morphing towards Project Management
  - Failure of Business Fads
  - Need for Organizational Responsiveness
  - Complexity of Customer Requirements
  - Focus on Project Managers Soft Skills
- 

Several participants described the increase in speed and volume of data, communications, and business as rationale for the growth reported in project management. Organizations must respond with greater agility which is purported as a benefit of project management. Other participants commented on the increasing complexity of technology, while one participant suggested that project management would eventually replace the term business management.

Participant rational for growth in project management is summarized below by categories.

Communications. Among the participants who commented specifically about trends in communications and data flow, 4 of 12 participants (33%), cited the speed of communications and flow of data as having increased, causing an impact on project managers. Another 25% of participants commented on the volume of communications and data having increased as compared to past experience. Two participants suggested

that there was a noticeable increase in the data requirements placed on projects by customers. And one participant cited the methods used to communicate, which have also experienced change.

Certification. Project management professional certification was raised by three participants in response to the first research question. Concern over the established standards for professional certification was raised by two participants, or 17% of the participants. Two participants also cited the value of certification as a knowledge baseline. Other comments about project management professional certification programs suggested that acceptance of the certification may vary by industry and sector. Some of the global interest in the discipline may be a result of an increase in employment specifications listing project management certification as a position requirement.

Organizations. The category of organizations was cited by 42% or five interview participants. Two participants suggested that larger project organizations may eventually be divided into smaller size organizations in the future. In general, comments regarding organizations ranged from concerns regarding knowledge management, a shift away from command and control to agile organizations, increase in project management processes, development of Centers of Excellence, and a perceived priority on soft skills for project managers.

Dispersed Teams. The topic of dispersed project teams is frequently discussed in literature. This current study found 33% of participants referenced distributed project teams in their response to question one regarding trends and changes in project management. Comments in this section centered on a similar theme; project teams are frequently geographically dispersed. Project teams are no longer located in a single

office within visual range of the other project team members. Distributed teams challenge the skills of a project manager when team members in different locations operate with varying local procedures, goals, and business objectives. Dispersed project teams have an impact on several aspects of a project manager's knowledge and skills that impact educational requirements.

Authority. Two of the participants, or 17%, responded with a perception that the authority of project managers has been reduced in part due to the increased speed and availability of information and communications. Management authority is perceived to be reduced because executives, sometimes several levels above the project managers, will insert themselves in the project decision process based on information they receive regarding a project issue. Project managers question whether executives should be making decisions which could impact a project outcome without knowing the subtle nuances of the project situation and customer. Another participant suggested that the span of control of project managers is likely to increase as budgets are reduced. Another participant pointed out that the chain of command has become blurred as project teams are further distributed.

Education. Developments and trends in the area of training and education are effected by several aspects. Dispersed project teams presents a problem when training or mentoring new staff located in different states or countries. Concern over anticipated baby-boomer retirements was also cited as an issue for managing the knowledge capital of an organization.

Technology. The effects of technology in project management can be most vividly witnessed in the perceptions described by participants about changes and

developments in communications. The volume and flow of data has apparently increased, creating new challenges for project managers as they cope with managing project responsibilities. Electronic mail, video conferencing, and social networks were described as emerging technology impacting change in project management.

New technology as applied to the office environment is changing the methods and procedures used by project managers to maneuver the responsibilities of the position. Technological advances are often the core of the products or services being produced by a project. Developments in technology create new demands on the skills and knowledge of project managers impacting the need for updated educational programs.

Leadership. The leadership skills of project managers are apparently challenged when managing distributed project teams as compared to co-located. Two participants (17%) suggested that project managers must alter their leadership approach when managing distributed project teams.

Risk. Three participants raised risk management as an area demanding greater attention from project managers. The task of risk management has gained greater attention from both corporate executives and customers, both demanding closer scrutiny and regular reporting. This raised priority of risk management is changing the way project teams manage their efforts and resources for a variety of reasons. Project managers require additional knowledge and skill to manage the risk component of projects, an area educational programs need to better address academically.

## Research Question 2. Changing Skills, Knowledge, and Experience

Research Question 2 asked how the demands on skills, knowledge, and experience of aerospace project managers were changing. All twelve participants provided a response to this question. Participant responses to Research Question 2 were categorized into six areas as depicted in Table 8.

Table 8

### *Research Question 2 – Categories*

Categories	Ref.	Participant												Sources
		1	2	3	4	5	6	7	8	9	10	11	12	
Academics	10	2	1			2	2	3	2	1	2	1	3	22
Soft Skills	7			4	1		3	1	1	2	1			20
Leadership	7	3		1	2		1	4	3	3			2	17
Technical	9			3	3	1	4	5			3	3	1	14
Tools	5	1	2						4			2	4	11
Global	2			2				2						5

The need for educational programs in project management was evident from the comments made by participants during the response to Research Question 2. Ten participants or (83%) commented on the need for educational institutions to address various issues in project management. The follow sections discuss the major findings in response to Research Question 2.

Academics. Higher education must re-evaluate their project management academic programs continuously to insure they are addressing the latest knowledge requirements of field practitioners. Providing educational instruction on the latest tools and techniques used in project management was specifically addressed by 17% of the

respondents. The importance of experience in combination with education was also apparent, as 25% of participants indicated that experience played an important role in project management. Participants voiced a variety of academic issues which they feel need to be addressed including (a) risk management education, (b) financial education, (c) continuing professional education, (d) mentoring and assignment rotation, and (e) project management agility.

Soft Skills. Project management soft skills, as discussed by 58% of participants, should be addressed by an academic program for educating project managers. Participants described several skills under the heading of soft skills.

Within the category of soft skills, 58% of the participants described effective communications or interpersonal skills as a priority skill needed by project managers. They discussed the need for project managers to be persuasive in written correspondence, slide presentations, public speaking, voice and video conferences, and during face to face discussions. The ability to interpret situations, attitudes, and audiences accurately responding with appropriate levels of detail, was cited by 42% of participants as an important skill. Demonstrating empathy in communications was described by 33% of the participants as political or organizational savvy. The issue of “savvy” as described by participants required greater attention by project managers, signaling a topic which should be addressed by formal education.

Leadership. The term “soft skills” can encompass many interpersonal skills. Leadership was discussed by 58% of the participants when explaining trends and developments in aerospace project management. Discussions by 33% of the participants described the need for project managers to demonstrate team leadership. Leading a team

was further defined as bringing a group of people together as an effective cohesive team, by motivating them to action in an established direction, empowering them to excel, and providing a single point of focus for decisions. Administrative courage displayed by the project manager was also cited by participants as an important trait of successful project managers.

Technical. Possessing underlying technical abilities was discussed by 75% of the participants. The majority of these participants, (42%), described the need for technical understanding as critical, necessary to survive, would not hire without, fundamental, and primarily comfortable with technology. This topic is an important issue when discussing educational programs aimed at undergraduate students with no prior training or experience.

Tools. Changes in the tools available to project managers were discussed by 42% of the participants. They cited recent developments in the area of project management tools aimed at increasing efficiency and performance, especially in data reporting. Availability of “new” project management tools cited by 25% of participants, suggested educational program and continuing education programs need to continually address changes. Tools used in the development of software were cited as an example of development in this area. One participant projected that the project management tool bag can be expected to grow in the future.

Globalization. During response to question two, 17% or two participants, raised the change in impact project globalization is having on project manager skills and knowledge requirements. They discussed the need for project managers to have an understanding of the cultural, linguistic, and legal differences when working with teams,

customer, and suppliers from other countries. One participant pointed out the legal implications on the company and individual when a clear understanding of international law does not exist, especially regarding shipping and import/export laws.

### Research Question 3. Preparation of Entry-Level Project Managers

Research Question 3 asked participants to describe the skills and knowledge areas most often displayed as deficient by entry-level project managers. All 12 participants contributed categorical information in response to Research Question 3 as presented in Table 9 below.

Table 9

#### *Research Question 3 – Categories*

Categories	Ref.	Participant												Sources
		1	2	3	4	5	6	7	8	9	10	11	12	
Education	10	4	1	5	3	3	1	3		1	2	4		21
Experience	7	5			2			1	1	2		2	4	15
Soft Skills	8	2	2	1	7	4	3				1	5		14
Leadership	6	1		2	6	1	2	2						13
Communications	5	3	4	4	1		4							10
Expectations	5			6	4				3			1	1	10
Techniques	4			3	5				2				2	7
Mentoring	5		3	7		2						3	3	5

Education. In response to Research Question 3 regarding skills and knowledge areas entry-level project managers' display as deficient, 25% of the participants recommended that entry-level project managers receive education in project finance to develop the skill necessary to plan, budget, and track project financial activity.



This, according to one participant, is often true for engineers switching to project management. One participant commented that a measured portion of a project manager's month is spent preparing project financial reports for internal and external consumption.

Entry-level project managers, according to another participant should be allowed additional time in the learning process to strategically analyze and apply theoretical knowledge for the long term benefit of the project. Participants also commented on the need for entry-level project managers to understand the dynamics of teams and organization. Project risk management was an area raised by participants which project managers need to understand how to apply documented mitigation techniques.

Participants commented about the work ethic of younger generations as an issue which should be addressed by the educational process. This topic is covered further in the Leadership discussion.

Experience. The topic of prior working experience for entry-level project managers was mentioned by 58% of the participants. Several participants explained that project management should be a second career field following experience in some technical area as preparation. However, given the expansion of project management globally, students are exploring project management education as the primary field. This research project does not address the issue of project management as a primary or secondary career and will only report the perceptions of the participants. The participants that commented on the benefit of prior experience ranged from comments about how students could gain valuable experience prior to graduation to one individual mentioning an organization would not consider hiring a project manager without considerable experience. Based on the comments of participants, experience in some form is

necessary for a project manager to successfully function in this career field. Educational institutions should address this requirement as they consider academic programs to address the educational needs of project managers.

Soft Skills. The category of soft skills was again raised when discussing the skills and knowledge of entry-level project managers. Participants discussed the need for entry-level project managers to be politically and organizationally savvy, meaning they need to be able to interpret situations accurately and respond appropriately. This is an area of soft skills which might be difficult to convert into an academic setting.

Leadership. Participants described the need for entry-level project managers to possess leadership skills necessary to manage, motivate, and reward members of a team, according to 42% of participants. Project managers also need to demonstrate the trait of courage when dealing with difficult situations with customers and internal management. Participants also discussed the need for entry-level project managers to demonstrate ethical behavior in project dealings.

Communications. Entry-level project managers must be clear communicators according to 42% of participants. They need to demonstrate the ability to communicate with people in a variety of situations. Participants of this research study cited communications as a necessary trait for any project manager. One participant suggested, levels of skill in communications should be very high on the priority list; another said communications skill was “the lynch-pin” of effective project management; and another said it was “more critical today than in the past.”

Expectations. Participant discussions about entry-level project managers suggest that there are two areas which require attention by an educational program. First is the

perception of two participants (16%), that entry-level project managers can be over confident of their skills and abilities, which can lead to several issues managing projects. The second issue raised was with managing customer expectations. Scope creep by entry-level project managers was presented as a potential disaster for a project when unattended. Entry-level project managers, according to the participants may not possess the skill or experience to recognize the impact of project scope creep.

Techniques. This category was set aside to collect comments regarding the issue of project management techniques. One participant pointed out that the “basic skills of a project don’t change no matter the [dollar] size.” Entry-level project managers according to the participants should be adequately skilled in the basics of project management to understand the documented parameters or baseline of a project and to be able to manage scope creep with discipline. Application of best practices and lessons learned can help entry-level project managers gain perspective on the tasks. According to one participant, “the project baseline is your key metric to success.”

Mentoring. Entry-level project managers, according to 42% of the participants, can greatly benefit from the guidance of a mentor. Mentoring can provide needed transition for new project manager as they adapt to the site-specific situations of the organizations, practice, and customer base. One participant suggested educational institutions should combine classroom theory with technical field experience utilizing a qualified mentor to provide students with hands-on practicum.

#### Research Question 4. Education and Training Recommendations

In the final question of the research study, all 12 participants provided responses to question four. They provided perspective on what educational institutions might do to enhance the instruction of future project managers. Comments were categorized and charted in Table 10 and summarized below.

Table 10

##### *Research Question 4 – Categories*

Categories	Ref.	Participant												Sources
		1	2	3	4	5	6	7	8	9	10	11	12	
Recommendations	6	3		6	4		2		1	4	2	2	2	18
Delivery Methods	9	1		5	1		1		1	3	1			18
Topic Areas	9		2	1	2		4	4		1	6	3	1	17
Experience	7	4	3	3	3	1		1			3			13
Simulation	5				6			2	3		4	1		9
Internship	7	2	1	2	8	2	3		2					7
Team Leadership	4			4	7				4	2				5
Technical	3				5			3			5			4

Recommendations. Participants offered many recommendations as to how education and training could better prepare future project managers for the field. One participant pointed out that leadership and project management are similar and that some in the industry view them as the same. Another participant suggested all college business students should receive some form of project management education because of the pervasiveness of project management in business.

An underlying issue discussed by participants was how project management training in their perspective should be provided after an individual achieves a level of

proficiency in an underlying field. This does not rule out project management as a primary career field. However, participants discussed that project management is a stressful field and not all individuals will be able to personally manage the stress of the job. They also suggested that despite education and training, not everyone has the inherent traits to proficiently demonstrate necessary soft skills to be a successful project manager. A project manager, one participant said, should be a “generalist.”

Curriculum developers will need to be very responsive to changes in the taking place in the field of project management to insure students always receive the latest concepts. One participant recommended students should strive to be “reflective in practice” and that project management education should be a “continual learning process.” Another participant recommended project management education should allow enough time in the program for students to absorb and apply the knowledge they receive. Educational programs need to consider the students background when tailoring a program for the individual. If the student has a technical background then they will require additional business administrative training. If a student has no underlying training, they will need rudimentary technical training in an educational program. Regardless of the design of the program, one participant recommended “after action evaluations” to understand the effectiveness of training and allow feedback for future program modifications.

Two participants recommended educational institutions should offer a Bachelor of Arts degree in project management with a minor in aerospace systems or basic engineering as a “career track” for entry-level students. Another suggested there should be a “more interactive” university where project management programs are tailored to the

specific needs of individual students. And a participant commented that higher education will provide better programs in the future because the career field of project management is lucrative.

Delivery Methods. Two participants, (16%), voiced concern with the use of weekend training programs to teach project management. They believed weekend programs do not allow enough time to absorb and apply the knowledge necessary to be successful. One participant took a contrary view on this situation suggesting training *should* be taught in short weekend classes because they need to appeal to the younger generation and longer classes would not hold their attention. One participant suggested that project management education programs should involve fewer lectures and textbooks on theory and more hands on experiences. Additionally, one participant did not recommend on-line training for project management because this method does not provide adequate human interaction which is at the root of project management.

Mentoring was recommended as an excellent method of teaching and evaluating project management students. This approach provides greater learning by doing. However, participants recommended that mentoring programs, co-operative education programs, and student internships can all provide excellent learning opportunities if the programs are well structured, with academic oversight responsibility, and adequate program performance evaluations. Students learn, one participant said, when experienced field practitioners tell stories about their experiences. They also learn from exposure to many different types of projects which reinforce the process through repetition, which is why one participant recommended scenario training as a method of education and training delivery.

Topics. Four participants (33%), discussed the need to teach entry-level students about the different functions involved in a typical A&D organization or project team. Three participants (25%) stressed the need to teach communication skills along with all the ramifications of this topic as with soft skills. Another three (25%) participants talked about the need for financial and accounting knowledge because a project manager's responsibility is typically focused on the financial performance of a project. Understanding customer and organizational politics is considered by 16% of the participants as an important topic for entry-level project managers.

Project management has seen an increase in available project management tools used to aid the process, entry-level project managers should be trained on all the latest techniques and tools available. The following is a list of other topics raised by participants as important for an entry-level project manager: contract negotiations, behavioral attitudes and confidence, analytical skills, and ethics. Other topics to be covered in an educational program are covered in the balance of this summary.

Hands-on Experience. Experience has been indicated by 42% of participants as an important aspect of an entry-level project manager's educational process. Participants offered many suggestions regarding how educational institutions could provide students with meaningful experience. These include internships, co-operative education programs, and mentor arrangements as discussed in an earlier section of this report.

One participant recommended that capstone projects should be started earlier in a project management academic program while another discussed taking advantage of school and community projects to provide students with real-world experience.

Simulation. Simulations in education can take on several forms to provide students with experience similar to real-world experience. Participants of this study recommended rigorous imbedded scenario and simulation training as a way of enhancing student knowledge retention. Four participants (33%) discussed different forms of simulation in education to provide students with the experience of managing a real project without the exposure to risk. Two participants specifically recommended students be exposed to crisis management scenarios where the stress of actual project environments can be experienced by the students.

Internship. The next category is student internships, which 58% of participants described as a valuable hands-on learning experience for students of project management. In this method of learning students would be involved in actual project activity on live projects. One participant suggested long-term relationships with large corporate organizations that could provide internship positions for several years in a row would allow students to intersperse theory with application benefiting the student, organizations, customers, and the academic program.

Team Leadership. According to one participant, project management is really about leadership. Recommendation from 42% of participants described leadership as an important part of any educational program in project management. Discussions centered on the basic concepts of leadership. Topics recommended by the participants included: interpersonal communication skills, setting expectations, motivating teams, use of persuasion, collaboration, and celebrating successes.

Technical. Understanding the technical aspects of the products or service being offered by an assigned project is considered a prerequisite for most assignments.



Participants commented during discussions about research question four that project managers should have a basic understanding of technical issues related to the product offered by the effort they expect to be managing. Project managers should be able to quickly assume the knowledge necessary to manage the technical team.

Other related information. Some comments made by participants during the interview process were not relevant to the specific research or interview questions. These comments were collected, reviewed, and are provided in the following section as additional related information.

One participant commented about IT project managers, that some of the best project managers spent the first part of their careers in a “very technical role” and later moved into project management. Another participant described successful project managers as “well-rounded” individuals with political savvy, interpersonal skills, and presence.

When discussing higher education and project managers, one participant commented that organizations are missing out when they ignore qualified project managers because they lack a college degree. This participant went on to say that natural leaders are not always the individual put in charge of a project and that the project manager should be able to recognize the rectitude of the members of the team for the benefit of the project.

Some organizations, according to one participant, do not recognize the value or skills project management brings to an organization. Project management is a means of focusing an organization on task completion while controlling the potential risks of an undertaking. Yet, evidence in the form of professional project organizations membership

growth suggests that many organizations are embracing the techniques offered by the discipline of project management.

One participant suggested that project managers should be involved in a project from the very beginning so that they are intimately familiar with the details of the project preventing false demands from creating risk to the project.

Contrary to what many of the participants said about the need for project managers to possess technical acumen, one participant suggested this could actually be a deterrent. This participant believes the project manager should ask the technical questions of the team using the leadership role to move the information from the team expert to the inquirer. The participant said a project manager is like an entrepreneur “running a business;” it is all about leadership.

Two participants pointed out project managers must stay current with the industry by staying attuned through life-long learning. They recommended project managers search out continuing education courses, attend trade shows, interact with other field practitioners, and read biographies and military history. One of the participants closed the interview by saying that above all else, a project manager should “have fun” in the process.

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

#### Introduction

The purpose of the study was to describe the perceptions of project managers regarding the skills, knowledge, and experience necessary for success of entry-level project managers in the 21<sup>st</sup> Century. This chapter will explore conclusions and recommendations drawn from the data collected and analyzed from 12 qualified project managers who were considered to be a rich source of data based on their depth of experience and academic background in the field of aerospace and project management. The results of this study are intended to aid project managers and academics in the on-going evaluation and updating of courses and curriculum used in the education of project managers. Although results of a study using this research design methodology should not be generalized to a larger population, the data did provide valuable insight for project management officials and academic professionals as well as identify topics for future research in this field.

#### Research Question One: Finding related to Developments and Trends

Participants in this study responding to Research Question 1 cited various examples of developments and trends in project management that are affecting the

discipline. The developments discussed by participants focused on a distinct difference in communications. Technology has increased the speed, availability, and volume of information communicated daily regarding project activities. There are physically more methods of staying in communication, the amount of data available has increased, and the speed of transmission has increased. The triad of communication enhancements is challenging the leadership skills of project managers.

This change in communications may also account for another area of response to Research Question 1, related to the dispersed project team. Enhanced communications allows for greater project team geographic distribution. Participants reported an increase in project team members working in dissimilar locations.

Changes in communications have also caused negative effect on project managers, as described by participants. Project decisions, once the responsibility of the project manager, are in some cases being elevated in the organization purportedly due to the increase in availability of information. Executives are weighing in on project related issues and decisions reducing the perceived authority of project managers.

Technology has improved the way we communicate which has increased the speed of conducting business. Project managers are directly affected by the speed of business, creating greater stress to achieve improved results for a lower cost resulting in more process and greater discipline.

#### Research Question Two: Changing Skills, Knowledge, and Experience

Research question two asked how trends and developments change the demands placed on the skills and knowledge of project managers. Participants described how

changes in project management have only heightened the demand for soft skills. All forms of communications were stressed as critical for a project. They also described the need for a project manager to be keenly aware of their surroundings, being particularly attuned to other people's abilities, attitudes, and perspective in the project context. Several participants referred to this as being savvy. A better description might be to say project managers must possess situational awareness related to their project.

Many participants consider technical experience as 'fundamental' to the position, that a project manager must have a base technical expertise available before entering project management. Few would argue against this premise. However, it does raise the question whether a person lacking technical background yet highly educated and trained in the discipline of project management would perform on parity or better than a project manager with professional technical education. The hard skills of project management remain as important as ever to the function of a project manager. But, as the complexity and size of projects grow, so too must the project manager's ability and skill to manage and lead a diverse group of actors.

### Research Question Three: Preparation of Entry-Level Project Managers

Participants responded to Research Question 3 with perceptions about what skills and knowledge areas new or entry-level project managers are demonstrating to indicate they are inadequately prepared. The discussion centers around the same responses received from earlier questions. As discussed by Pant and Baroudi, (2008) soft skills should be considered in the process of presenting project management in the classrooms. Soft skills can be described in many different ways. In this current study, participants

focused on the ability to communicate effectively, interact with other humans in a productive way, and have the ability to understand and acknowledge the positions of others. Project management situational awareness is another way of describing what was suggested as being politically or organizationally savvy. The hard skills in project management cannot be overlooked either, as pointed out by Zielinski (2010). Again, financial management knowledge and technical experience or background rise to the top of concerns for new entrants into project management.

#### Research Question Four: Education and Training Recommendations

In response to Research Question 4 regarding how education and training can better prepare project managers for changing demands in the aerospace industry, participants provided two perspectives. First, they offered their perspective on what schools might consider when developing a project management educational program. Their recommendations have been consolidated and are offered as follows:

##### Academic recommendations.

- Curriculum planning must be agile in response to market changes.
- Regular industry advisory board sessions should be held to stay current with market changes.
- Student learning should be distributed throughout the duration of the educational program.
- Project management classes should be taught by experienced project managers.
- Experienced guest lecturers should be utilized in every class to heighten student learning.

- A separate learning module should be dedicated to reviewing Lessons Learned.
- Student learning should be enhanced with question and answer sessions between field practitioners and students.
- Capstone projects should start in freshman year and continue through graduation.
- Leadership should be taught in a learning lab (explore military leadership training methods).
- Leadership education should be taught as a series of courses building to high proficiency.
- Project management curriculum should require interdisciplinary studies.
- Project management curriculum should include required technical education courses.
- Project management introduction courses should be taught to students in other disciplines.
- Ideal project managers should be well rounded, all-purpose, generalists.
- Institutions should partner with large corporations to offer students extended multiyear internships and co-operative education agreements.
- Continuing education should be offered in short segments using multimedia delivery methods.
- After education effectiveness surveys should be conducted and courses adjusted based on outcomes.
- Crisis management module should be mandatory followed by a crisis simulation project.
- Gaining technical experience should be an important aspect of project management education.

- Colleges should offer professional project management career track programs.
- Educational rigor should identify students who may not possess required stamina for project management.
- Project management curricula should include several opportunities for students to receive hands on experience such as:
  - Actual work experience gained through internships and co-operative agreements.
  - Liberal use of scenario based training modules.
  - Use of the latest rigorous project management simulation programs by schools.
  - Use of project management students to manage local community and school projects.
  - Enhancement of student learning by providing opportunities to experience the stress of running a project in a safe environment.
  - Use of concept based scenarios such as Crisis Management to enhance student learning.
  - Development of curriculum to hone student's innate soft skills.
- Internships, Co-operative, and Work Study Programs
  - Students should be assigned pre-qualified mentor/teachers in the workplace.
  - Students should be exposed to a diversity of project experiences by rotating through different industry projects to gain broad perspective.

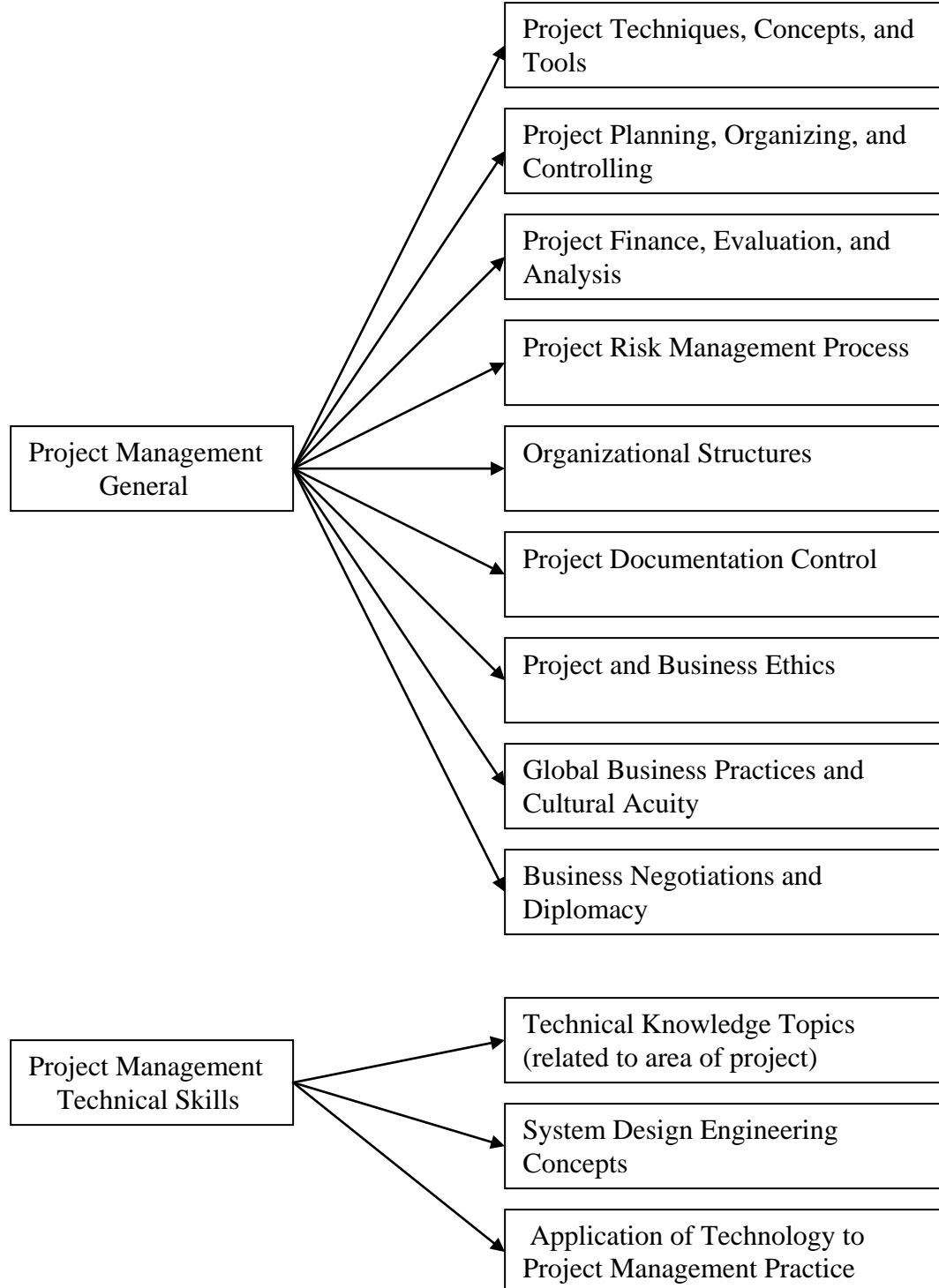


- Institutions should partner with government agencies to offer extended duration internships.
- Student progress should be closely monitored and evaluated by supervising school faculty during any field practicum work.
- Co-operative and internship programs should be well designed and closely tied to the curriculum.

#### Curriculum recommendations.

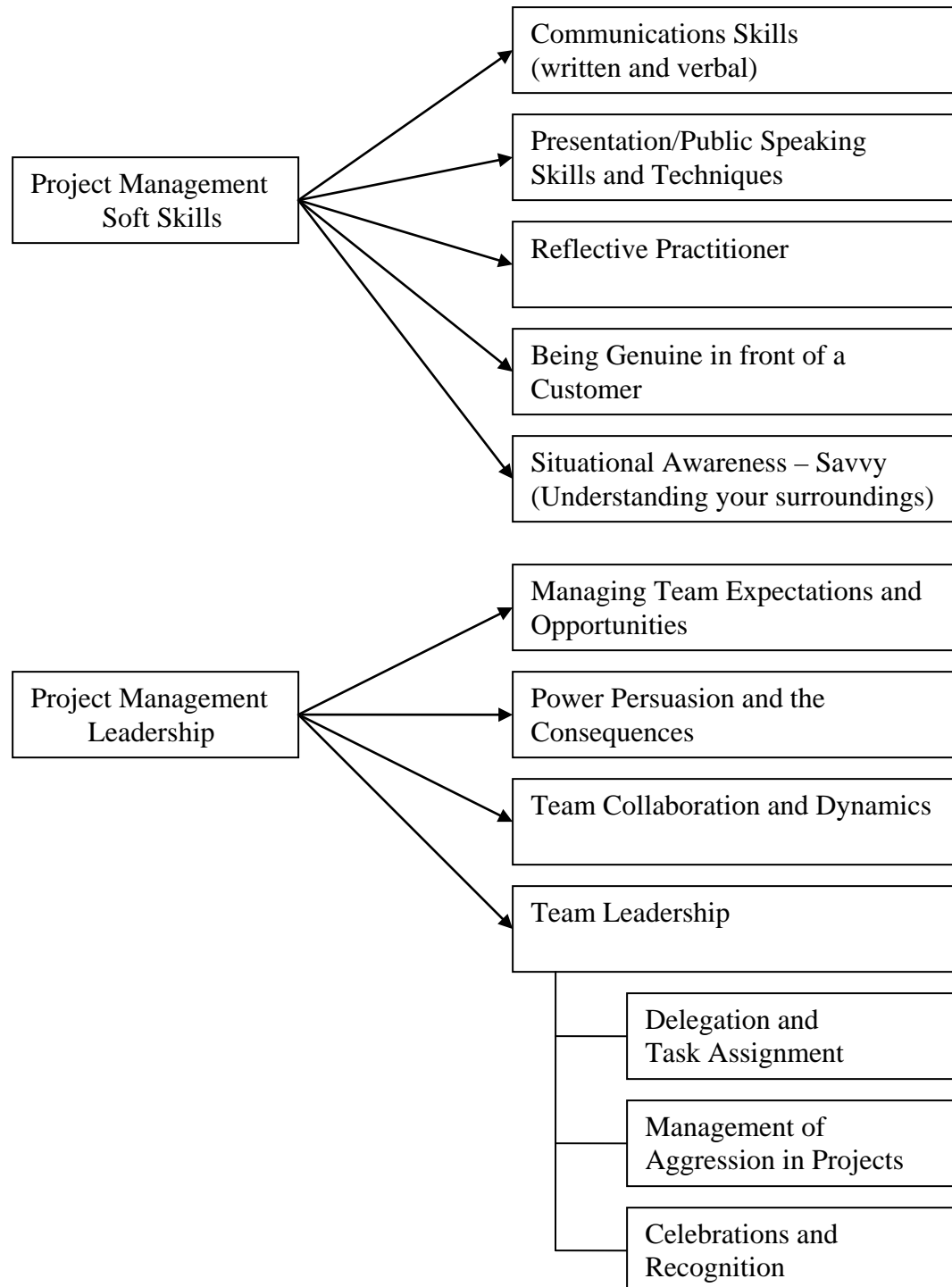
The participants offered their perspective on topics that should be included in a project management curriculum. Figure 4 depicts topics described by the participants of this study as necessary for any project management education program.

Figure 4. Dionne Project Management Learning Model



*Figure 4.* Participant perspective regarding topics that should be included in any project management curriculum. This is not an all-inclusive list of topics for a project management education program, rather a list of topics the participants felt were important to be included as part of any program.

Figure 4. (continued) Dionne Project Management Learning Model



*Figure 4. (continued) Participant perspective regarding topics that should be included in any project management curriculum. This is not an all-inclusive list of topics for a project management education program, rather a list of topics the participants felt were important to be included as part of any program.*

## Recommendation for Future Research

This current study considered perceptions of 12 experienced project managers in the aerospace and defense industry. The results of this study cannot be generalized to the larger population. The initial model developed in this study can inform future descriptive development studies through the use of quantitative survey methods. The resulting information should allow the development of a curricular model which could be further tested, utilizing longitudinal repeated measures to evaluate the performance outcomes of the curriculum in action. An alternate approach would be to use the “developing a curriculum” (DACUM) and task analysis approach to verify the results of this study and develop a curriculum (Finch & Crunkilton, 1989).

Additionally, several other research questions can be generated based on the findings of this study. These include:

1. Participants described differing opinions on the necessity of technical experience in the background of a project manager. Additional research is recommended concerning the role technical experience plays in project management success.
2. Participants voiced various perspectives on the usefulness of project management certification. Further research is recommended to better understand the impact certification may have in project management.
3. Communication changes taking place in project management were described as impacting many aspects of the discipline. Additional research is recommended to better describe these aspects and the implications on the practice of project management.

4. Competency in the soft skills of project management was described as necessary for entry level project managers. Additional research is recommended into the most effective instructional methods for teaching soft skills need by project managers who frequently must operate in both face to face and virtual team communication settings.

### Reflections

Technical competence of a project manager has been a prerequisite for project management positions for a many years. But the educational requirements of a project manager can no longer be accomplished by attending a few weekend seminars. The degree of knowledge and skill necessary to manage a multimillion-dollar international technology project will take several years of intense education. The proliferation of colleges and universities offering project management education is evidence of the growing demand for greater educational opportunities. The number of professional project manager openings will continue to increase, to qualify for these positions individuals will need educational credentials in addition to documented project successes to secure these very lucrative positions.

Project management certification is frequently a qualification required by employers in today's job market. This current study found only one participant (8%) held a certification issued by a project management organization, while another three (25%) held certification issued by the government as part of military training received during active duty. One additional participant (8%) held what was described as a corporate equivalent of the project management certification. The experience level of

this group may explain the participants' perspectives in the current study concerning certification in project management, an issue warranting additional study.

### Conclusions

The discipline of project management has experienced greater worldwide popularity in recent years; projects being managed have also experienced expansion in technical complexity and total project cost. Technology is changing the way we manage projects. Project manager's often work from home offices and team members are now located in different states and countries. When you consider the generational, cultural, and operational differences facing project teams the education they receive should be akin to any other professional education program. The skills and knowledge demands place on project managers have changed along with the projects. To address the complexity of managing projects in today's business environment, education for future project managers must also change. New education programs addressing the latest trends supported with research will be necessary to equipment project managers with the updated tools to address projects of the future.

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## APPENDICES

APPENDIX A  
IRB APPROVAL FORM

## Oklahoma State University Institutional Review Board

Date: Monday, June 21, 2010  
IRB Application No ED1081  
Proposal Title: An Assessment of Project Management Skills and Knowledge Requirements in the 21st Century Based on Emerging Trends in the Changing Landscape of the Aerospace Industry  
Reviewed and Processed as: Exempt

**Status Recommended by Reviewer(s): Approved Protocol Expires: 6/20/2011**

Principal Investigator(s):  
Robert A. Dionne Mary Kutz  
3716 Winners Circle 6108 Winfield Dr.  
Edmond, OK 73034 Okla. City, OK 73162

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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, [beth.mcternan@okstate.edu](mailto:beth.mcternan@okstate.edu)).

Sincerely,



Shelia Kennison, Chair  
Institutional Review Board

APPENDIX B

PARTICIPANT CONSENT FORM

**APPENDIX C**  
**INFORMED CONSENT DOCUMENT**

**Robert Dionne**

**Project Title:**

*An assessment of project management skills and knowledge requirements in the 21<sup>st</sup> Century based on emerging trends in the changing landscape of the aerospace industry*

**Investigator:**

*Robert A. Dionne*

*MAM - Embry Riddle Aeronautical University – Aviation Management*

*BS – State University of New York – Society and Technology*

*AS – Broome Community College – Business Administration*

**Purpose:**

*The purpose of this research study is to establish the first step in identifying possible changes in the skills, knowledge, and experience necessary for project/program managers to successfully negotiate the evolving environment of aerospace program management in the 21<sup>st</sup> Century. This research study is based on the assumption that data collected from experienced project /program managers, managers, and consultants will provide valuable insight into the current trends and conditions being experienced by project and program managers in the aerospace field. The intended outcome of this research study is to glean useful information which could be incorporated into future training and education programs used to prepare project/program managers to face the challenging environment of aerospace projects and programs.*

*Interviewing experienced individuals in this discipline is important to understanding the latest trends in the changing landscape of project/program management which would allow practitioners and educators the opportunity to better prepare individuals for responsibilities and risks that might lie ahead. The question to be answered is: what fundamental changes in skill, knowledge, and experience may be needed to successfully run complex technical development and production projects and programs of the future? The outcome of this research study will hopefully identify specific issues within the practice of project management which should be enhanced to improve the knowledge toolkit available to project and program managers employed in the global and virtual world of aerospace project and program management in the 21<sup>st</sup> Century.*

**Procedures:**

*When a participant agrees to be interviewed for this research study they will be requested to read and sign the informed consent form acknowledging the conditions and rights associated with this research study. A personal one-on-one interview utilizing the open-ended questions listed in the Interview Questionnaire Guide (APPENDIX A) will be conducted to collect pertinent information from each participant.*

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*The interview process is expected to last about one hour, not to exceed a maximum of one and a half hours. If a face-to-face interview is not convenient or possible, a telephone interview may substitute if acceptable by the participant. The participant agrees to the use of digital audio recording equipment to capture the complete interview allowing accurate transcription of the conversation. These digital audio recording will be transcribed verbatim along with the researcher's field notes from the interview. This data will then be coded into themes, categories, and subcategories for purposes of analyzing the collected information. The specifics of this coding process will be determined as the data is analyzed searching for data associated with the purpose of this study. The audio recordings, transcriptions, and field notes will be retain until all analysis has been complete and the final report is issued.*

*Broad categories will include: emerging trends experienced in the management of projects and programs, including new methods and practiced, application of new technologies to assist in the management of projects and programs, and educational areas where project and program managers most often need remedial training to perform at existing standards. These categories will be compared within and across the collected data to identify any new trends which will require new or enhanced training of project and program managers.*

*There is a possibility that additional data or questions may need to be collected from participants. As the data progresses additional questions may need to be added to enhance the results of the study. In this event, each participant will be contact and a follow-up session will be requested not to exceed a total of thirty minutes in duration. Should the participant be interested in the results of this research study, a copy of the finding will be available from the researcher upon request.*

**Risk of Participation:**

*There are no known risks associated with this research study which are greater than those ordinarily encountered in daily life.*

**Benefits:**

*The intent of this research study is to determine if emerging trends in the discipline of project / program management will have any impact on the skills and knowledge areas required to operate in the aerospace industry of the 21<sup>st</sup> Century. Interviewing experienced project and program managers, managers, and consultants will provide valuable insight into the possible changes taking place in the industry and the impact on field practitioners. If the resulting data indicates changes are needed in the training and education of project and program managers of the future, educators and managers may be able to use this information to better prepare current and future project and program managers for the roles and responsibility of the job. The results may indicate a follow-on research study is needed to develop new curricula for the field of program/project management.*

**Confidentiality:**

*Digital audio files will be made during the one-on-one interview process which will then be transcribed into text files for use in the data analysis. All records and data collected during this research study will be stored in a secured file cabinet at the researcher's home office to maintain privacy at all times. Digital files will be stored on the researcher's private computer protected by a password or will be transferred to digital media and stored with the other research study records referenced above. Signed Informed Consent Forms will also be protected and kept private by being stored separately in the researcher home office. Information collected during this research study will be combined and reported as group finding with no identifying information attached. All records collected during the research study will be destroyed once the final report has been issues.*

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*All research study records will be stored securely with only the researcher and those with oversight responsibility allowed access to the data collected. It is possible that the consent process and data collection effort may be observed by the oversight staff as they have responsibility for safeguarding the rights and wellbeing of the people who participate in research.*

**Compensation:**

*Participants in this research study will receive no compensation.*

**Contact:**

Primary Investigator:

Robert A. Dionne  
3716 Winners Circle  
Edmond, Oklahoma 73034

[rdionne@okstate.edu](mailto:rdionne@okstate.edu)

Adviser:

Dr. Mary Kutz  
School of Educational Studies  
319 Willard Hall  
Stillwater, Oklahoma 74048

[mary.kutz@okstate.edu](mailto:mary.kutz@okstate.edu)

*If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, (405) 744-3377 or [irb@okstate.edu](mailto:irb@okstate.edu)*

**Participant Rights:**

*Participation in this research study is strictly voluntary and subjects may elect to discontinue the research activity at any time without reprisal or penalty. There is no risk to the participant should they decide to discontinue involvement or withdraw from this research study at any time.*

**Signatures:**

*I have read and fully understand the consent form. I sign it freely and voluntarily. A copy of this form has been given to me.*

\_\_\_\_\_  
**Signature of Participant**

\_\_\_\_\_  
**Date**

I certify that I have personally explained this document before requesting that the participant sign it.

\_\_\_\_\_  
**Signature of Researcher**

\_\_\_\_\_  
**Date**

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APPENDIX C  
PARTICIPATION LETTER

## Appendix B

### Interview Participation Letter and Telephone Script

#### Participation Letter

Dear \_\_\_\_\_,

My name is Bob Dionne. I am a graduate student at Oklahoma State University working on a research study regarding training and education needs of project and program managers. I understand you may be an experienced field project or program manager in the aerospace industry (or related technical fields). The reason for contacting you is because I am looking for experienced practitioners willing to participate in this research study and you have been identified as a potential participant. Experience requirements include at least five years of overall project/program management experience with three years of complex technical or aerospace project/program experience and three years experience managing other project or program managers.

The purpose of this research study is to assess the adequacy of existing training and education used to prepare individuals for the responsibilities of project and program management positions. Results of this study might conclude further research is needed to redefine the existing curricula used in the education process.

The method used to collect data for this research study will be voluntary private one-on-one interviews of field practitioners, such as yourself. The confidential interview would consist of a series of open-ended questions with the total interview lasting about one hour, but not longer than one and a half hours. Participants would be asked questions about their perceptions of how well project and program managers are prepared for the duties of the job, about gaps in knowledge and skills of project and program managers, and how education and training could better prepare individuals for the responsibilities of the job, among other similar questions.

To ensure accurate data collection, a digital audio recording device would be utilized to capture the participant's words. Audio recordings would not be identified by individual and would only be used for the purposes of developing a de-identified text transcript of the interview. All findings would be reported as a group with no identification of original interviewees or their comments; participation in this research study will remain private. The de-identified transcript would be used to analyze the data collected and will be destroyed along with the audio files to protect participant's confidentiality once the final report has been completed.

The benefit of participating in this research study is that the results might produce important information that can be used to enhance the future of the field of project and program management.

I would greatly appreciate the opportunity to include you in this research study. An interview could be scheduled sometime in the next thirty days at a location and time convenient to you. I will call or emailing you in the next week to see if you have any questions and to discuss the possibility of arranging a convenient time and place to conduct an interview. Replying to this email is another way of reaching me. If you agree to participate, there are a few documents I will need to send you before the interview, including an Informed Consent Form for your review.

Thank you for the opportunity to present information about this research study to you. My desire is for this research study to produce results that are beneficial to the practice of project and program management, your voluntary participation in this research study would be appreciated.

Sincerely,

Robert Dionne

Oklahoma State University

(405) 315-2035

[rdionne@okstate.edu](mailto:rdionne@okstate.edu)

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APPENDIX D

PARTICIPANT TELEPHONE SCRIPT

## Telephone Script

Hello, my name is Bob Dionne. I am a graduate student at Oklahoma State University working on a research study regarding training and education needs of project and program managers. As an experienced field project or program manager in the aerospace industry (or related technical fields), you have been identified as a potential participant in this research study. Do you possess at least five years of overall project/program management experience with three years of complex technical or aerospace project/program experience and three years experience managing other project or program managers? \_\_\_\_\_. *(If yes, continue. If no, thank them and discontinue conversation)*

The purpose of this research study is to assess the adequacy of existing training and education used to prepare individuals for the responsibilities of project and program management. Results of this study might conclude further research is needed to redefine the existing curricula used in the education process.

The method used to collect data for this research study will be voluntary private one-on-one interviews of field practitioners, such as yourself. A confidential interview would consist of a series of open-ended questions with the total interview lasting about one hour, but not longer than one and a half hours. Participants would be asked questions about their perceptions of how well project and program managers are prepared for the duties of the job, about gaps in knowledge and skills of project and program managers, and how education and training could better prepare individuals for the responsibilities of the job, among other similar questions.

To ensure accurate data collection, a digital audio recording device would be utilized to capture the participant's words. Audio recordings would not be identified by individual and would only be used for the purposes of developing a de-identified text transcript of the interview. All findings would be reported as a group with no identification of original interviewees or their comments; participation in this research study will remain private. The de-identified transcript would be used to analyze the data collected and will be destroyed along with the audio files to protect participant's confidentiality once the final report has been completed.

The benefit of participating in this research study is that the results might produce important information that could be used to enhance the future of the field of project and program management.

I would greatly appreciate the opportunity to include you in this research study. An interview would be scheduled sometime in the next thirty days at a location and time convenient to you. If you have any questions about this research study, I would be glad to discuss them with you at this time or in the future. I may be reached at (405) 315-2035 or by email at [rdionne@okstate.edu](mailto:rdionne@okstate.edu).

Would you be willing to participate in the research study? \_\_\_\_ Can we schedule a time and location to conduct an interview? \_\_\_\_ I will need to send you some paperwork before the interview which includes an Informed Consent Form, what email address should I use? \_\_\_\_\_

Thank you for this opportunity to discuss my research study with you today. My desire is for this research study to produce results that are beneficial to the practice of project and program management, your voluntary participation in this research study would be appreciated.

Sincerely,

Robert Dionne

Oklahoma State University

(405) 315-2035

[rdionne@okstate.edu](mailto:rdionne@okstate.edu)

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APPENDIX E

RESEARCH QUESTIONNAIRE GUIDE

## **Appendix A**

### **Research Questionnaire**

#### **Demographics Questions**

- In what field, area or industry is your project/program management experience? \_\_\_\_\_
- How many years have you been practicing as a project/program manager? \_\_\_\_\_
- What is the highest educational degree you hold? \_\_\_\_\_
- If certified in project/program management, which certification do you hold? \_\_\_\_\_
- What is the approximate monetary value of the largest project or program under your purview? \_\_\_\_\_
- How many years have you been managing other project or program managers? \_\_\_\_\_
- Have you been involved in any international projects or programs? \_\_\_\_\_

#### **Research Questions**

1. How is the discipline of project/program management different today than it was three to five years ago?
2. How have the tasks and responsibilities of managing projects and programs changed in recent years?
3. How do you see these changes in tasks and responsibilities effecting the needed skills, education background, knowledge or experience of project/program managers?
4. Are you aware of any emerging initiatives or trends in industry which have not impacted the demands placed on aerospace project/program managers, but might cause a shift in the needed skills and/or education of future project/program managers?
5. What tasks, skills or knowledge areas do junior level (entry-level) project/program managers most often have difficulty with, requiring mentoring, remedial training, continued supervision or guidance?
6. What gaps do you most often see in the training or education of new entry level project/program managers and how could they be better prepared for the role?
7. What role does prior technical experience play in the success of project/program managers and could education and or training substitute for technical experience?
8. How should education and training organizations change their current approach or curriculum to prepare students for the responsibilities of the job as well as increase their potential for long-term career success as an aerospace project/program manager?



9. In your experience, based on the reason(s) most often cited in project/program failure, what additional skills or knowledge training should be required of project/program manager?
10. If you could predict the future, how do you see the role of project/program manager possibly changing?
11. With the idea of enhancing educational curriculum, would you like to offer any additional thoughts or ideas about preparing candidates for the position of project/program manager?

APPENDIX F

RESEARCHER CURRICULUM VITA

## VITA

Robert A. Dionne

Candidate for the Degree of

Doctor of Education

Thesis: EMERGENT REQUIREMENTS FOR PROJECT MANAGEMENT  
EDUCATION IN THE AEROSPACE INDUSTRY OF THE 21<sup>ST</sup> CENTURY

Major Field: Applied Educational Studies

Biographical:

Education: Received Associate in Science Degree in Business Administration from Broome Community College, June, 1977; received Bachelor of Science in Society and Technology from the State University of New York, May, 1979; received a Master of Science in Aviation Management from Embry Riddle Aeronautical University, August, 1985; completed requirements for a Doctor of Education degree in Applied Educational Studies, Aviation and Space, from Oklahoma State University, Stillwater, Oklahoma in December, 2010.

Experience: Manager, Program Management, Tyco Electronics Corporation 1994 to 2007; Program Control Manager, General ElectricCo./Lockheed Martin 1989 to 1994; Manager Support Services / Project Manager, Link/Simuflite Training Services Division 1985 to 1989; Program Analyst, General Electric Co. Aerospace Electronics 1981 to 1985; Customer Service/Aircraft Technician, commuter and major air carriers 1975 to 1980.

Professional Memberships: Project Management Institute

Name: Robert A. Dionne

Date of Degree: December, 2010

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: EMERGENT REQUIREMENTS FOR PROJECT MANAGEMENT  
EDUCATION IN THE AEROSPACE INDUSTRY OF THE 21<sup>ST</sup> CENTURY

Pages in Study: 155

Candidate for the Degree of Doctor of Education

Major Field: Applied Educational Studies (Aviation & Space Science Specialization)

Scope and Method of Study: Senior Project Managers Qualitative Interview.

Use of project management techniques has increased world wide. Demand placed on the skills and knowledge of project managers has also changed. The purpose of the study was to describe the perceptions of project managers regarding the skills, knowledge, and experience necessary for the success of entry-level project managers in the 21<sup>st</sup> Century. A purposive sample of 12 senior level project managers was recruited for semi-structured interviews utilizing qualitative grounded theory research methods. Primarily from Aerospace and Defense organizations, these senior practitioners possessed a combination of years experience and supervision to provide perceptions regarding recent changes in the practice of project management which might impact needed skills and knowledge.

Findings and Conclusions:

Results of this study indicate that educational institutions must stay current with conditions experienced in practice. Schools must regularly alter their curricula to adapt to changes taking place in project management. New technology and increasing complexity of projects have altered the focus educational institutions should take in preparing students for careers in project management. Teaching soft skills, especially all forms of communications along with awareness will challenge educators as they prepare students for the role of project manager.

Finding better ways of providing hands-on experience as part of a career track education program is essential. Entry-level project managers must be proficient in all the latest tools and techniques so they can face the challenges of future aerospace and defense project management positions.

ADVISOR'S APPROVAL: Dr. Mary Kutz