

NOTE TO USERS

Page(s) not included in the original manuscript are unavailable from the author or university. The manuscript was microfilmed as received

9 & 10

This reproduction is the best copy available.

UMI[®]

**CLEARED FOR LIFTOFF: AN EVALUATION OF AMBIDEXTERITY AND
TEAM PERFORMANCE IN THE AEROSPACE INDUSTRY**

John Fiset

A Thesis
In
The John Molson School of Business

Presented in Partial Fulfilment of the Requirements
for the Degree of Master of Science in Administration (Management) at
Concordia University
Montreal, Quebec, Canada

December, 1st 2009

© John Fiset, 2009



Library and Archives
Canada

Published Heritage
Branch

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque et
Archives Canada

Direction du
Patrimoine de l'édition

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file *Votre référence*
ISBN: 978-0-494-67216-7
Our file *Notre référence*
ISBN: 978-0-494-67216-7

NOTICE:

The author has granted a non-exclusive license allowing Library and Archives Canada to reproduce, publish, archive, preserve, conserve, communicate to the public by telecommunication or on the Internet, loan, distribute and sell theses worldwide, for commercial or non-commercial purposes, in microform, paper, electronic and/or any other formats.

The author retains copyright ownership and moral rights in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

AVIS:

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque et Archives Canada de reproduire, publier, archiver, sauvegarder, conserver, transmettre au public par télécommunication ou par l'Internet, prêter, distribuer et vendre des thèses partout dans le monde, à des fins commerciales ou autres, sur support microforme, papier, électronique et/ou autres formats.

L'auteur conserve la propriété du droit d'auteur et des droits moraux qui protègent cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

In compliance with the Canadian Privacy Act some supporting forms may have been removed from this thesis.

While these forms may be included in the document page count, their removal does not represent any loss of content from the thesis.

Conformément à la loi canadienne sur la protection de la vie privée, quelques formulaires secondaires ont été enlevés de cette thèse.

Bien que ces formulaires aient inclus dans la pagination, il n'y aura aucun contenu manquant.


Canada

ABSTRACT

Cleared for Liftoff: An Evaluation of Ambidexterity and Team Performance in the Aerospace Industry

John Fiset

With the advent of globalization, shortened product life cycles and higher levels of competition (Li, Lin and Chu, 2008) firms have been forced to react faster to changes than ever before. In the context of aerospace product development, designers must master latest technological developments while continuing to rely on tried and true design practices. Furthermore, design teams must collaborate closely with new risk-sharing partners around the world as well as focus on schedule and budget targets. This study uses the concept of contextual ambidexterity defined as defined as behavioral capacity of an individual to simultaneously demonstrate alignment and adaptability (Gibson and Birkinshaw, 2004) to examine the extent to which individual project teams are able to leverage skills and capabilities built up over time and also adapt to the latest technological developments. It is suggested that project team contexts that are typified by a combination of stretch, discipline and support, trust as well as organizational slack enable contextual ambidexterity and, in turn, improved schedule adherence. The ambidextrous solutions identified during this research lead to a number of recommendations for successful aerospace product design.

AKNOWLEDGEMENT

I would like to thank my supervisor Dr. Isabelle Dostaler, for her hard work and support throughout my thesis. I also appreciate her willingness in allowing me the ability to study and explore this research in my own way. Once simply could not ask for a better or more supportive supervisor

I would also like to extend my gratitude to my family and friends for all of their assistance; especially to my mother, for her encouragement and her enduring personal belief in me, in addition to Sarah for keeping me motivated and being so supportive.

Table of Content

Table of Content	iv
List of Tables	viii
List of Figures	xi
Introduction.....	12
CHAPTER 1: Literature Review	17
1. Ambidexterity	18
1.1 Structural Ambidexterity	18
1.2 Contextual Ambidexterity.....	20
1.3 Strategic Ambidexterity	21
2. Becoming Ambidextrous	23
2.1 Willingness to Change	23
2.2 Leading Ambidextrous Organizations	25
2.3 Designing Job Tasks	27
2.4 Developing New Products	29
3. Empirical Research on Ambidexterity.....	30
3.1 Structural, Contextual and Strategic Ambidexterity	31
3.2 Measurement of Ambidexterity	33
3.3 Antecedents of Ambidexterity	35
3.3.1 Organizational Context	35
3.3.2 Organizational Slack.....	37
3.3.3 Environmental Uncertainty	40
4 Ambidexterity and Performance	42
CHAPTER 2: Conceptual Framework.....	45
1. Ambidextrous Solutions.....	47
2. Ambidexterity and Performance	48

3. Organizational Context and Ambidexterity	49
4. The Impact of Environmental Uncertainty	50
5. The Impact of Organizational Slack	52
Chapter 3: Methodology	54
1. Selected Aerospace Programs.....	54
2. Project Teams.....	57
3. Respondents	60
4. Data Collection	62
5. Interview Schedule.....	63
5.1 Ambidexterity	63
5.2 Project Team Context	64
5.3 Organizational Slack.....	65
5.4 Environmental Uncertainty.....	65
5.5 Performance	66
CHAPTER 4: Results	67
1. External and Internal Contextual Factors	68
1.1 General Environment.....	68
1.2 Industry Environment	70
1.3 Company Context	72
1.4 Program Context.....	75
1.4.1 Alpha.....	75
1.4.2 Beta	78
1.4.3 Gamma.....	80
2. Project Team Context	81
2.1 Propulsion Team	83
2.1.1 Stretch	84

2.1.2 Trust	85
2.1.3 Accountability	85
2.1.4 Support	86
2.1.5 Summary of the Propulsion Team working context	86
2.2 Wing Team.....	87
2.2.1 Stretch	88
2.2.2 Trust	88
2.2.3 Accountability.....	88
2.2.4 Support.....	89
2.2.5 Summary of the Wing Team working context.....	90
2.3 Structures Team	90
2.3.1 Stretch	91
2.3.2 Trust	92
2.3.3 Accountability.....	92
2.3.4 Support.....	92
2.3.5 Summary of the Structures Team working context	93
2.4 Systems Team	93
2.4.1 Stretch	94
2.4.2 Trust	95
2.4.3 Accountability.....	95
2.4.4 Support.....	96
2.4.5 Summary of the Systems Team working context	96
2.5 Avionics Team	97
2.5.1 Stretch	98
2.5.2 Trust	98
2.5.3 Accountability.....	99

2.5.4 Support.....	99
2.5.5 Summary of the Avionics Team working context.....	100
3. Organizational Slack.....	101
3.1 Propulsion Team.....	101
3.2 Wing Team.....	102
3.3 Structures Team.....	102
3.4 Systems Team.....	103
3.5 Avionics Team.....	103
4. Ambidexterity.....	105
4.1 Propulsion Team.....	105
4.2 Wing Team.....	110
4.3 Structures Team.....	111
4.4 Systems Team.....	114
4.5 Avionics Team.....	116
4.6 Ambidexterity Ranking.....	118
4.7 Ambidexterity Rating.....	118
5. Performance.....	124
Chapter 5: Discussion and Conclusion.....	127
1. Interpretation of results.....	127
2. Managerial Implications.....	132
3. Contributions.....	135
4. Limitations.....	137
5. Implications for future research.....	138
References.....	141
Appendix 1.....	148

List of Tables

Table 1 Interviewee Hierarchy and Project Team Designation	59
Table 2 Interviewee Socio-graphic Information	61
Table 3 Project Team Roles and Responsibilities.....	82
Table 4 Project Team Contextual Factors and Rankings.....	100
Table 5 Evaluation of Project Team Organizational Slack and Stretch Comparison.....	104
Table 6 Ambidexterity Evaluations	119
Table 7 Propulsion Project Team (Alpha Program – Canada)	121
Table 8 Wing Project Team (Alpha Program – United Kingdom).....	121
Table 9 Structures Project Team (Beta Program – Canada/ United States)	122
Table 10 Systems Project Team (Beta Program – United States)	122
Table 11 Avionics Project Team (Gamma Program – Canada)	123
Table 12 Project Team Performance.....	124
Table 13 Summary of Project Team Results	128

List of Figures

Figure 1 Theoretical Framework	46
--------------------------------------	----

Introduction

With the advent of ever abbreviated product life cycles, globalization of markets and competitors (Li, Lin and Chu, 2008) firms have been forced to react more quickly to changes than ever before. Faced with rapid advances in new technologies managers must prepare themselves for disruptive technologies and emerging markets over the long term (Judge and Blocker, 2008). In an effort to deal with this notion of extreme or hyper-competition firms face an immediate temptation to forget about past achievements and the path taken to get where they are now by concentrating only on developing new business strategies. In addition to the issue of a constantly changing competitive environment the recent international financial crisis has created fear in the markets and stymied capital investments available to firms. As such, firms not only have to make sure that they do everything in their power to strengthen their balance sheets through expense cutting measures, but they also must remain aware of potential growth opportunities.

In a business setting there is always a constant struggle between moving forward through the creation of new ideas and processes and retaining tried and true methods and traditions. These conflicts, be they resource or decision based, lead to potential trade-offs decisions as time and resources are finite. Although it would be unrealistic for trade-offs to be eliminated in their entirety, firms that most successfully navigate this balancing act serve to enhance their long-term competitiveness (Gibson and Brikshaw, 2004).

In order for firms to accomplish both of these paradoxical competencies, they must be proficient at continually innovating while finding increasingly efficient means of

bringing those innovations to market. By ignoring this combination of small incremental and radical change firms risk losing market share to companies who have embraced this notion of constant improvement in both the short and long term.

This ability to balance two seemingly opposed competencies is exhibited by firms with an ambidextrous orientation. Ambidextrous firms ensure that their affairs are in order to meet the most pressing demands of today, while never losing sight of the next innovation that will set them apart from their competitors (Gibson and Birkinshaw, 2004). Being successful in reconciling these competing demands provides firms with an opportunity to increase their chance for survival (Duncan, 1976, Tushman and O'Reilly, 1996).

A famous example of an organization that fosters ambidexterity on the individual level is Google and their use of "the 20 percent rule" (Vise & Malseed, 2005). This rule specifies that each employee should designate 80 percent of their time to core business activities while the other 20 percent of their time, or approximately one work day per week, is spent developing new products or ideas. This program was designed to enable employees to explore new approaches while at the same time intrinsically motivating them through self-directed activities.

Google not only benefits from having employees who are more satisfied with their job but they also foster bottom-up innovation. What this means is that as each employee or group of employees begins to explore and develop a new product or service. This will likely take the company in directions that the top management team would never have envisioned. By having an upper management group who is willing to take

chances and believe completely in the ability of their staff, this organizational culture can bring about significant amounts of innovation (Vise & Malseed, 2005).

Not all businesses, however, embrace this radical approach to innovation. There can be many reasons for this, ranging from the type of industry to the top management team.. The following is a cautionary example about what may happen if a company in a competitive environment focuses too much on incremental change and not enough on their long term sustainability.

General Motors, one of the largest companies in the United States, came very close to bankruptcy, due in part to Rick Wagoner, their previous Chief Executive Officer's intense focus on incremental improvement. Although he was praised for his cost cutting and operational improvements he was criticized for not seeing the trend towards more fuel-efficient automobiles and removing funding from their electric car program. Rick Wagoner was unable to align the company's product line with the changing needs of the driving population. In addition, he and his team were not able to foresee the major drop in demand faced by Sport Utility Vehicle market due in part to increased fuel prices (Taylor, 2008).

The above example shows just how fast a once revered company can lose its competitive advantage when it fails to plan for the future. It also indicates that improving an organization's offering only through incremental means can have some drastic effects on the company when faced with changes in market demand. Although this story illustrates the danger of only focusing on incremental improvement, the same can be said of radical innovation where ideas and methods that had previously worked for the

organization are discarded (March, 1991). The approach that is expected to bring with it the most stability and foresight is through reconciling these competing objectives through the use of organizational ambidexterity.

The present research focuses on the effects of ambidexterity on the development of new aerospace products. More specifically, the research will attempt to address the following questions:

- *What is the impact of working context, perceived levels of organizational slack and environmental uncertainty on the project team's ambidexterity?*
- *What is the impact of the project team's ambidexterity on its performance?*

The first research question examines the various factors that must be present for a project team to successfully become ambidextrous. Every organization and even groups in that same organization can have a different working context. This context refers to the selected set of systems and processes that define how the organization or team operates (Nohira & Gulati, 1996). More specifically, this research examines how a supportive project team context enables team members to more effectively divide their time between various competing demands. It is argued that a context that best exemplifies trust, support, accountability and stretch will provide the easiest means of creating ambidextrous project teams (Gibson and Birkinshaw, 2004).

Groups that perceive low levels of organizational slack, defined as available resources to accomplish firm goals (Bourgeois, 1981), are believed to be less willing to

take on the additional work needed to bring about a change through ambidextrous solutions. Project teams with only the most essential resources needed to execute their work simply will not have the wherewithal to explore new methods of accomplishing tasks. As such, these groups will be forced into survival mode and may have difficulty meeting their goals over the long-term.

The same idea translates over to perceived environmental uncertainty. If the industry is unchanging and the competition is of little threat to the organization, work groups will not feel the need to change and the status quo will remain. However, if there are many potential external threats it will not only bind team members together to face a common menace but force all members to seriously consider their normal methods of operation.

The second research question examines the links between ambidexterity and performance. It is further believed that having an ambidextrous orientation within a particular project team will lead to them to higher levels of performance (Gibson and Birkinshaw, 2004). This ability for project teams within a firm to align themselves with the goals of the organization while, at the same time, adapting to changes in their environment will provide an improved base for solving the challenges likely to be faced over the course of an aerospace program design process.

The aim of this research is therefore to explore how ambidexterity manifests itself and how it can be best utilized. In the literature, successful organizational change is very difficult to implement successfully (Beer and Nohria, 2000). Much of the reason for this low success rate for organizational change is that many competing factors demand

attention from those bringing about a change. It is for this reason that it is believed that during times of great challenge and change, the frequency of ambidexterity will increase. In addition, to an increased occurrence of ambidexterity during times of upheaval, the ability to reconcile competing objectives which is at the heart of ambidexterity is hypothesized to create a positive basis for transformation.

The thesis will be is five sections. The first section presents a literature review of the relevant work in the field of ambidexterity, major findings in the field and research questions. The second section presents a conceptual framework in an effort to effectively respond to the research questions posed in section one. The third section presents the methodology of this research, while chapter four presents the results. Finally, chapter five interprets these results, discusses managerial implications, provides limitations of the present research and provides future areas of study.

CHAPTER 1: Literature Review

This research seeks to understand the various factors that contribute to an organizations ability to retain their core principles and practices, while embracing new approaches to remain relevant in the changing economy. The ability to balance seemingly competing objectives is labeled in the literature as ambidexterity. Although the term was coined by Duncan in 1976, its roots date back to classic management authors such as March & Simon (1958). A review of the literature on ambidexterity is presented in what follows.

1. Ambidexterity

Tushman and O'Reilly define ambidexterity as the ability to simultaneously pursue both incremental and discontinuous innovation and change (1996, p.24). There has been some debate, however, on the specificity of this particular definition and other scholars have proposed broader definitions to encompass a wider array of paradoxical goals. Ambidexterity has therefore been recently defined as a metaphor to describe an organization's ability to perform seemingly conflicting tasks or pursuing disparate things simultaneously (Lubatkin, Simsek, Ling and Viega, 2006; Gibson and Birkinshaw, 2004). Generally speaking, ambidextrous organizations are successful firms that are able to reconcile conflicting demands. Authors distinguish between structural, contextual and strategic ambidexterity. Each of these concepts will be presented in the following sections.

1.1 Structural Ambidexterity

Duncan (1976) became the first author to use the term ambidexterity. He used it to refer specifically to the structure of organizations that were able to find a proper balance between the conflicting objectives of remaining aligned and adaptable.

Alignment, defined as the coherence among the patterns of activities in the business unit, serves to increase competitive advantage due to an increased fit between strategy, structure and environment. Adaptability, defined as the capacity to reconfigure activities in the business unit quickly to meet changing demands in a firm creates the responsiveness necessary to survive innovative leaps.

Duncan's (1976) solution for finding a balance between alignment and adaptability objectives relies on creating dual structures within the same organization. This meant that certain business units or groups within the unit would focus on alignment goals such as improving efficiency within the firm, while other groups would focus on adapting to changes in the competitive environment.

This partitioning of the organizational groups for the purpose of focusing on separate objectives has been termed structural ambidexterity (Benner & Tushman, 2003; Tushman & O'Reilly, 1996; Duncan, 1976). As more research has been done on the subject, however, scholars have documented the necessity of balancing these same contradictory tensions within these separate units and have thus shifted their focus. This shift has moved from what is considered the trade-off school, which relies on separate groups pursuing separate goals in an effort to find a balance to the paradoxical school which believes that competing objectives can be met simultaneously (Morgeson and Hoffman, 1999). The paradoxical school focuses on both the adaptability and alignment processes occurring within the same work groups, units or individuals (Gibson and Birkinshaw, 2004).

Although Duncan (1976) was the first to use the term organizational ambidexterity, it was not until March's (1991) landmark article that interest in the topic began to propagate. His propositions hinged on how firms can divide their attention and resources between two fundamentally different learning activities, namely exploration and exploitation. He associated exploration with such things as discovery, innovation and risk-taking as they all can lead to original outcomes for the organization. Alternatively,

exploitation differs as a learning activity because it is associated with efficiency, execution and implementation. March (1991) further argued that by trying to reach a proper balance between exploration and exploitation a firm runs the risk of being mediocre at both.

1.2 Contextual Ambidexterity

Nearly thirty years after Duncan's (1976) seminal book article was published, Gibson and Birkinshaw (2004) added to the ambidextrous literature by developing the concept of contextual ambidexterity. This concept served to unite both the trade-off and paradoxical schools of thought (Morgeson and Hoffman, 1999). Contextual ambidexterity is defined as the behavioral capacity to simultaneously demonstrate alignment and adaptability in individuals across an entire business unit.

Contextual ambidexterity differs fundamentally from its structural ambidextrous predecessor as it enables individuals within the various business units to make their own judgments about how to best go about resolving the daily conflicting demands that they face (Duncan, 1976; Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004). Contextual ambidexterity, as opposed to structural ambidexterity does not rely on separated groups to manage competing goals. Rather, alignment and adaptability goals are managed concurrently by each individual employee. This, in theory, provides a means of improved communication and innovation as there is less reason to create organizational barriers among employees.

Gibson and Birkinshaw (2004) in their examination of 41 business units found that no trade-off existed between the variables of alignment and adaptability orientations

in organizations. They found that firms who were able to simultaneously develop alignment and adaptability capacities by creating new abilities that complement their core functions. An example of a firm who ranked very high in contextual ambidexterity according to Gibson and Birkinshaw (2004b) is Oracle Corporation, an American enterprise software company. Due to their extraordinary growth and founder Larry Ellison's rejection of formal structures within the organization, the firm has been able to succeed at their core business while taking advantage of many new business opportunities. According to an executive at the company, the firm was able to bring about adaptability through hiring the right people and setting high goals for their employees. To maintain alignment, the companies' goal setting and incentive systems were created to match the firms' strategy (Gibson and Birkinshaw, 2004b).

1.3 Strategic Ambidexterity

It could be argued that the concept of ambidexterity roots back to March and Simon's (1958) proposition that firms faced conflicting demands with regards to exploration and exploitation. Exploration is considered to take place when managers devote their energy to innovation through experimentation, creative risks and proactively exploring new markets (Covin and Slevin, 1989). Conversely, exploitation occurs through the understanding and focus on market requirements and customer needs through the generation, dissemination and responsiveness to market intelligence (Jawroski and Kohli, 1993).

According to March (1991), organizational systems that employ an exploration strategy to the extent that exploitation is excluded are more likely to find that they suffer the added costs of experimentation which places great burdens on the organizations finances. Alternatively, organizations that focus solely on exploitation strategies are likely to be ensnared into producing incremental improvements that will be quickly surpassed by competitors.

Building on March and Simon (1958), Aulakh and Sarkar (2005) defined the term strategic ambidexterity as a firm's ability to combine exploration and exploitation strategies across product, market, and resource domains. Strategic ambidexterity is interdisciplinary in nature and builds on a growing literature in marketing, organizational theory and strategic management to promote a balance between improvement of current processes and experimentation strategies across different business units (Berthon, Hulbert and Pitt, 2004; Gibson and Birkinshaw, 2004; March, 1991).

In their study of a sample of South American manufacturing firms, Aulakh and Sarkar's (2005) found that those exhibiting superior levels of performance showed a greater integration of exploration and exploitation strategies. Judge and Blocker (2008) in a further examination of the construct of strategic ambidexterity hypothesized that a firm's organizations capacity for change is related to the firm's ability to be strategically ambidextrous.

As strategic ambidexterity is an overarching concept of top level decision making mechanisms, it is possible for it to be present along with any other form of ambidexterity in the same organization. For instance, an organization can explore and exploit its

resource base while dividing its structure by separating the research and development group from the core business to deal with competing goals. It is for this reason that the introduction of this third ambidextrous label adds little insight into how organizations can adapt to changing demands while still remaining true to what has made them successful in the past.

It is for this reason that contextual ambidexterity will be used as the primary method of analyzing the data. Contextual ambidexterity relies on the supportiveness of the organizational unit to create a supportive context. This form of ambidexterity places the emphasis on the individual employee and how they can judge for themselves the best way to split up their time between conflicting demands.

2. Becoming Ambidextrous

In this section, the path to reaching ambidexterity is explained by examining the steps that organizations and individuals must take before it can be attained. These factors will be examined from the standpoint of the individual and how their own willingness to change can affect their ambidexterity along with various organizational contributions such as organizational leadership and improved job-task design.

2.1 Willingness to Change

Some companies appear to be better than others at undertaking significant changes. Various factors can explain this. Three requirements for successful organizational change can be found in the management literature. First, the firm must create an appropriate definition of any existing problem(s) (Rice, 1994). The organization must have the capacity and willingness to address said problem(s) (Bandeh, Kaye, Wolff,

Trascolini, & Cassidy, 1996.). Finally, those leading the change must have a clear vision of what could be and how to get there (Weaver, 1994).

There are a number of reasons why organizational members may resist change. Resistance to change, however, is primarily attributed to protecting an individual's place in the hierarchy (Fiol & O'Connor, 2002). As such, it is rare that those who are content with their position in the firm will ever actively engage in change unless forced into doing so. To make matters worse, some lower to mid-level employees tasked with creating and sustaining organizational changes generally run into trouble as they do not have the formal authority to force the transition (Fiol & O'Connor, 2002). Organizational change therefore needs to be introduced in more subtle ways.

As organizations focus increasingly on group work, the collective identity of the team (Albert and Whetten, 1985) and the context in which they work in becomes an increasingly important means of investigating organizational change. Collective identity refers to characteristics that members of a group feel are central to defining who they are (Albert and Whetten, 1985). This ability to collectively appreciate and identify with the members of the group has become an increasingly important issue when bringing about an organizational change.

Although the importance of organizational change is generally agreed upon by managers to be of great importance, success rates for change initiatives remain relatively low (Beer and Nohria, 2000). As such, organizations perceive change initiatives to be risky endeavors. Organizations, however, must adapt and change with the varying demands of the market (Klarner, Probst & Soparnot, 2008) as this has been attributed to

firm success in the long term (Greenwood and Hinings, 1996). By fostering this organizational capacity for change the firm offers itself an improved chance of survival.

There is no doubt that change is difficult for many to deal with. With no competition, many organizations would simply continue on doing what they have done in the past. This inaction would be a much safer decision as one cannot fail something they have already accomplished. However, this cannot be the case anymore with the rapidity in which technology has grown and globalization has taken hold. Inaction simply will no longer be an effective of survival. As such, organizations must be willing to change and create an atmosphere where these changes can be discussed openly to dispel any fear that may arise from their employees

2.2 Leading Ambidextrous Organizations

Initiating and sustaining the necessary changes for a firm to become ambidextrous demands leadership that sees the value of this kind of organization. In a study of ambidexterity in small and medium enterprises, Lubatkin, Simsek and Viega (2006) suggested that an ambidextrous organization would improve relative firm performance when compared to non-ambidextrous organizations. They further examined the effects of the top management team's unity in meeting the many incongruent demands that often arise in ambidextrous organizations. Behavioral integration is considered to be an all inclusive construct created by Hambrick (1994) to capture the level of unity among top management. This construct also includes the quality of information exchange, joint decision making and collaborative behavior. Lubatkin et al.'s (2006) study relies on the proposition that ambidexterity is largely created by top management team's internal

processes. Lubatkin et al (2006) suggest that organizational leaders play a pivotal role in ambidextrous organizations. This notion of the importance of leadership was first suggested by Tushman and O'Reilly (1997), and has become an increasingly important topic in ambidexterity research.

Beckman (2006) discusses how founding top management team composition is an important antecedent of whether a firm will choose an explorative, exploitative or ambidextrous approach. Teams who have, for the most part, worked together at a previous firm generally take on an exploitative orientation because they have common understandings and can react quickly as a team. On the other hand, a founding team that is composed of members from many different companies of origin is more likely to produce new ideas and foster an exploratory orientation. Finally, she states that by having a founding team that has a mixture of members who have worked alongside one another and those who have no experience working together will have an advantage over fully heterogeneous or homogenous groups in their potential to become ambidextrous.

The research done on the relationship between ambidexterity and leadership has mainly focused on the inner processes of the top management and has yet to put an emphasis on front line managers. This oversight seems to suggest that leadership is defined by these scholars as place in the hierarchy, rather than aiding followers in reaching an objective. Floyd and Lane (2000) related exploration to the lower levels of the group where managers and employees experiment with new ways of accomplishing their tasks while upper management levels select the best of these experiments and exploit them program or companywide.

By assuring subordinates that managers are available to provide necessary support to help overcome roadblocks, organizations show their employees that they are concerned about their individual success. This assurance of support as well as the provision proper direction on how to negotiate around various competing objectives provides the project team with much greater chances of becoming ambidextrous.

One area, however, where work has been done to try and explain the mechanisms with which individual level ambidexterity can effectively be brought about has been Gibson & Birkinshaw (2004b) article where it lists four ambidextrous behaviors. The first of these is an initiative taker as they are willing to go beyond the confines of their job description to take advantage of new opportunities. The second is that they are cooperative to combine efforts with others. The third is that they are brokers, looking to build partnerships with others and finally, they are multi-taskers who are willing to take on multiple roles. According to Gibson and Birkinshaw (2004b) these four behaviors portray an ambidextrous employee and were documented by a range of employees throughout an organizations hierarchy.

2.3 Designing Job Tasks

Organizations striving towards an ambidextrous orientation must balance the inherent risks of developing their innovativeness in non-routine tasks without impairing their efficiency (Adler, Goldoftas and Levine, 1999). They further identified in their examination of the production systems at Toyota three factors to promote ambidexterity. These three factors include: enrichment, switching and partitioning as they serve to aid the organization in resolving competing objectives that may arise.

Through job enrichment initiatives such as goal development, Victor, Boynton & Stephens-Jahng (2000) found that production line workers could be attentive simultaneously able to identify improvement opportunities while performing their routine tasks. Managers must work alongside each employee to develop stretch goals; defined as short or long term objectives that induce employees to accomplish more than what is comfortably attainable. These stretch goals, if done correctly, serve to empower employees approach problems differently and strive to achieve more. The effectiveness of these objectives is improved significantly through the incorporation of stretch. This result adds further evidence to contextual ambidexterity as it documents how an individual can focus on their main objectives while being aware of opportunities for improvement.

The difficulty with stretch goals is that they can often lead to high levels of stress, especially when employees are given several of these goals. Once an employee has shown that they can accomplish a difficult task they are given increasingly difficult goals to attain. Care must be used when using stretch goals as being pushed too hard to go beyond can lead to lower levels of motivation (Latham and Locke, 2006).

The second mechanism that favors ambidexterity is job switching. This particular method focuses predominately on structural ambidexterity as job tasks are separated and changed in sequence rather than multi-tasking or performing jobs at the same time. This allows for a greater focus and reduces confusion; although no judgment is made by the employee regarding the best method of divide their time. Switching can be further nurtured by such practices as quality circles, which enable individuals to move back and

forth between bureaucratic structures for routine tasks and more organic structures for non-routine tasks (Adler, Goldoftas & Levine, 1999).

Finally, Alder et al. (1999) suggest that partitioning allows units to specialize in routine tasks while others concern themselves with more novel and innovative tasks. Their argument for this is that by separating groups they are given the opportunity to specialize. This definition mirrors that of structural ambidexterity and has been the predominant way of producing innovation. In addition, Toyota, one of the world's most successful manufacturing companies, uses this particular mechanism for many years to their advantage.

2.4 Developing New Products

The vast majority of the scholarly work done on ambidexterity has focused on new product development (Daneels, 2002; Adler, Goldoftas and Levine, 1999). This relationship is not surprising as a firm's ability to embrace change is effectively put to the test in the creation of new products (Schilling, 2005). The development and introduction of new products is the firm's external way of expressing that they are moving forward. Successful new product introductions must also resolve the difficulty of aligning this innovation with the history and culture of the organization that creates it. The successful marketing of these products depend on the conveyance to consumers of the innovativeness and relevance of the product (Schilling, 2005)

When it comes to innovation and bringing new products to market, organizations must be careful to keep some focus on their existing products and services. Lessons learned from previous projects provide a basis of knowledge, routines and available

resources to implement innovations. However, it is through innovation that firms can provide new knowledge and enhanced current products (Gibson and Birkinshaw, 2004).

It may be possible in many cases to sequence exploration and exploitation separately. This can however be difficult in industry going through rapid transformation. Tushman and O'Reilly (1997) argued that given the speed of change in many industries and the lengths of time necessary to create new products ambidexterity may provide the only method for thriving in a competitive environment.

A word of caution must be given regarding the relationship between new product development and ambidexterity. While developing new products may be considered a form of innovation, there is no guarantee that it will help bring about adaptation (Dew, Goldfarb & Sarasvathy, 2006). A company with success in bringing new products to market does not ensure that the organization is adapting to potential changes in their competitive environment. These two competencies are not necessarily an extension of one another.

The relationship between ambidexterity and new product development in the management literature has been very strong since its inception. As such, it is a natural extension for the present research to focus on the development of commercial products. Commercial products, especially those selling high technology are generally extremely competitive markets where change is a reality, and cannot be ignored.

3. Empirical Research on Ambidexterity

The empirical research that has been conducted on organizational ambidexterity will be covered in the present section. This review will focus on the antecedents and

moderators of ambidexterity that were defined and empirically tested by the major authors in the field. This present section will therefore focus on the major articles that helped shape structural, contextual and strategic ambidexterity.

3.1 Structural, Contextual and Strategic Ambidexterity

After being created and defined by Duncan (1976) the main proponents of structural ambidexterity has been the team of Tushman and O'Reilly (1996, 1997). Much of the work on structural ambidexterity has focused on the separation of organizational units. Duncan (1976), building on the work of Burns and Stalker's (1961) work on mechanistic and organic structures suggests that organizations necessitate both structures to deal effectively with competing objectives. He proposed that organizations need organic units to create innovation as well as mechanistic units to efficiently bring these innovations to life. Although there has been some debate regarding the difficulty involved with having these separate groups present within the same firm (Lewis, 2000), recent studies have documented that firms may resolve this difficulty by combining these divergent features together (Adler et al., 1999, Jensen et al. 2005). This combination of these paradoxical structures together into one unit was what Gibson and Birkinshaw (2004) used as their rationale for creating contextual ambidexterity.

In the introductory paper presenting contextual ambidexterity, Gibson and Birkinshaw (2004) surveyed 4,195 employees in 41 business units representing ten organizations. Their goal was to discover whether the context in which employees worked in contributed to individual ambidexterity and, in turn, improved business

performance. Their research suggested that ambidexterity plays a mediating relationship between the contextual factors of stretch, support, trust and discipline/accountability.

In a subsequent article, Jansen, Ven Den Bosch and Volberda (2006) studied the effects of formal and informal coordination mechanisms and environmental factors on ambidexterity. They discover that managers of large European financial services firm were able to create strong social relationships with their coworkers and that this increased the unit's ability to become contextually ambidextrous. Furthermore, informality in the workplace played an important part in predicting ambidextrous innovation.

Research on strategic ambidexterity can be separated into two diverging research avenues. The first avenue was taken by Aulakh and Sarkar (2005) studied the international expansion strategies of South American firms and found that those with a more balanced approach of exploration and exploitation strategies produced greater firm performance. This particular aspect of ambidexterity focuses on a firm's ability to pursue new prospects while taking full advantage of their existing market opportunities.

The second, although similar, research avenue for strategic ambidexterity has been pursued by researcher Mary Han (2007). In two successive articles (Han & Celly, 2008; Han, 2007) strategic ambidexterity is examined through the lens of pro-growth and pro-profit strategies rather than exploration and exploitation. Her findings suggest that firms that use strategic ambidexterity during their effort to expand to other nations perform better in both the short and long term in both the banking and international new ventures industries.

Strategic ambidexterity's unit of analysis focuses on executive decision making rather than the individual. This being said, contextual ambidexterity provides a more attractive means of examining the internal mechanisms that brings about ambidexterity. The working context plays an important role in developing ambidextrous employees able to deal effectively with competing tasks. Individual teams could therefore constitute a relevant unit of analysis to better understand contextual ambidexterity.

3.2 Measurement of Ambidexterity

Research has generally incorporated a multi-method approach in the search for organizational ambidexterity. This form of data collection includes questionnaires as well as interviews with members of varying levels within the organizational hierarchy. This dual method of data collection seemed to be the most commonly accepted means of finding evidence of ambidexterity in a firm. For the most part, the interviews incorporated open ended questions regarding how the firm's management system promotes flexibility and cohesion within the work systems of the firm (Gibson & Birkinshaw, 2004) as well as core competencies (Beckman, 2006).

The debate about how to accurately measure ambidexterity began to grow once He and Wong (2004) produced a measure that examined the exploration and exploitation abilities of organizations. In a previous work Benner and Tushman (2003), believed that product design is not the only area where ambidexterity would be present and developed a definition with two dimensions. Lubatkin, Simsek, Ling and Viega (2006) brought the concepts of exploration and exploitation together with measures of the innovation's

proximity to the firms existing market segment to form a 12 item scale of firm ambidexterity.

He and Wong (2004) also make the distinction of when to use the incremental/radical innovation model versus the explorative/exploitative model. They argue that the exploration versus exploitation model should be used when examining strategic objectives in pursuing innovation after all of the decisions have been made. The incremental/radical innovation model should be used in reference to the firm's capabilities and not in relation to a particular competitor in the industry. They also conclude that the radical versus incremental innovation model should be used during the innovation process in an effort to measure outcomes.

Gibson and Birkinshaw (2004) take another approach to measuring ambidexterity. As they were interested in the way that units act in terms of ambidexterity, they decided to survey a large sample using a relatively short questionnaire of six questions. The reasoning for this decision was that by having a larger sample size they would be able to aggregate these responses to create an overall picture of different business units. Another area that sets this particular study apart is the size of their sample. Forty one business units were sampled with a total of 4,195 respondents.

Gibson and Birkinshaw (2004) used two separate scales consisting of three questions to measure adaptability and alignment separately within each of the 41 business units. Alignment questions focused on whether management practices worked well to support overall objectives and efficient in their processes while adaptability questions focused on the flexibility and openness of the management team.

What is important to note about the Gibson and Birkinshaw (2004) article is that prior to any surveys being handed out, interviews with top management and key personnel of each firm were held to gather information on ambidexterity and the context that each group operates in. The researchers could gain valuable knowledge about what should be asked during the survey.

With these various means of interpreting and explaining ambidexterity, it becomes evident that a more clear and simplified definition of ambidexterity is needed. In order to do this, however, the mechanisms of ambidexterity must be broken down and examined. Ambidexterity research, thus far, has done very well explaining its antecedents, moderators and outcomes, however, the next stage of research is to open the “ambidexterity black box.” By doing this we are trying to see what it means for an organization or project teams to be truly ambidextrous

3.3 Antecedents of Ambidexterity

3.3.1 Organizational Context

Organizational context is defined as the often invisible set of stimuli and pressures that motivate people to act in a certain way (Ghoshal and Bartlett, 1994). These stimuli are shaped by managers through the various incentive and control systems put in place and are reinforced by behaviors of employee in the organization (Gibson & Birkinshaw, 2004).

Ghoshal and Bartlett (1994) in their examination of positive organizational context found four key contributing factors. The first of these factors is stretch. From a contextual standpoint stretch challenges individuals to look beyond what is comfortable

and strive to accomplish more. (Hamel & Prahalad, 1994). The second factor of support takes into account the accessibility of tools and information for each individual as well as the willingness of members to lend assistance to others. This is more likely to be found where managers place an importance on providing guidance (Gibson and Birkinshaw, 2004). The third factor of discipline persuades members to meet objectives that they have committed to or they have been tasked with. This can be implemented through clear performance standards and rapid feedback mechanisms (Gibson and Birkinshaw, 2004). Finally, trust is the ability to rely on others to meet those commitments. Trust is fostered through managerial fairness and involving members in decision making (Ghoshal and Bartlett, 1994).

These four attributes of organizational context are believed to be interdependent. In an effort to produce the most effective context, organizations through their management need to foster stretch and discipline for subordinates to strive towards more ambitious goals while providing support and trust to provide an environment where these ambitions are focused towards a common goal as opposed to competing internally (Ghoshal & Bartlett, 1994). This relationship can be thought of as a balance of solid fundamental factors such as accountability and stretch as well as the two more soft features of trust and support (Ghoshal & Bartlett, 1997).

Initially the contextual factors of stretch, support, trust and accountability were not considered antecedents of ambidexterity. Rather, these factors were found to produce positive individual employee behaviors such as cooperation, learning and personal initiative (Ghoshal and Bartlett, 1994). It was not until Gibson and Birkinshaw (2004)

began to examine the effects of context on the competing objectives that individuals face that contextual ambidexterity came into being.

Gibson and Birkinshaw (2004) were only able to support their context hypothesis once the four contextual factors were paired into two variables. The first of these variables was social support which included the factors of support and trust. The second was performance management which was composed of accountability-discipline and stretch. As their entire work hinged on competing objectives, it came as no surprise that these pairs served to compete with one another. High levels of both variables would produce a high-performance context. However, if there were high levels of performance management with little social support, it would create a burnout context. Conversely, too much social support and too little performance management produce a country-club context where the workplace would be very fun and friendly, but production would rarely meet expectations (Gibson & Birkinshaw, 2004b).

A favorable, balanced context of stretch, trust, support and accountability plays an important role in promoting ambidexterity. By creating a supportive context it encourages employees to create a means of dealing with competing objectives and how to best split their time dealing effectively with them (Gibson and Birkinshaw, 2004). The balance of more hard contextual factors such as discipline and stretch with soft managerial elements of support and trust seemed to produce the most ambidextrous business units.

3.3.2 Organizational Slack

Organizational slack, at its very essence, is a buffer that can help organizations deal with changes in the environment. This being said, a firm deciding to go through an

organizational change must have an adequate amount of slack to see it through to its completion. It is through these surplus resources that an organization can adapt to dramatic shifts in the environment (Bourgeois, 1981) and remain sustainable.

In an ever changing and varied economy firms must find ways to effectively deal with significant changes in their environment in order to remain competitive. In his seminal paper on organizational slack, Bourgeois (1981) argued that there is a curvilinear relationship existing between slack and performance: as slack increases performance improves up to a point beyond which performance start to decline. Management scholars consider that hoarding slack resources beyond this point results in waste. Idle employees and unused production capacity are examples of ineffective slack resources.

Years later, Singh (1986) divided the concept of organizational slack into both absorbed and unabsorbed slack. Unabsorbed slack is defined as excess uncommitted liquid resources. This type of slack is measured by the firm's current ratio, which is an indicator of the firm's ability to meet current obligations or liabilities with liquid assets such as cash.

Absorbed slack is defined as the resources allocated to salaries, overhead and administrative costs and has been measured as a ratio of general and administrative expenses to sales. One of the ways in which firms can increase performance is to convert their available unabsorbed slack into absorbed slack by hiring new staff members (Singh, 1986). This result suggest that by cutting waste and saving money on products and services the organization utilizes, they can transform those savings into increased human resources and potentially more productivity.

The idea that organizations must adapt to changes in their industry to remain viable is a generally agreed upon principle of organizational slack (McKelvey and Aldrich, 1983). In addition, the relationship between the firm's ability to adapt and the level of slack is curvilinear in nature, meaning that either an insufficient or an excessive amount of slack tends to hamper the firm from effectively adapting environmental changes. An insufficient amount of slack resource may inhibit experimentation; conversely, an excessive amount of slack may give rise to reduced discipline and accountability in the management and oversight of projects, thus impairing innovation (Nohria and Gulati, 1996). Organizational slack has been shown to have a curvilinear relationship with innovation (Bourgeois, 1981) as extra resources are able to aid in the production of new products and services, up to a certain point where the law of diminishing returns sets in.

Pfeffer and Salancik (1978) considered slack resources to be a means of buffering the firm from environmental variation and lowering the need to make substantial changes firm's core. However, this idea of having extra resources on hand has generally gone against the more recently developed lean production model (Womack, Jones and Roos, 1991). Lean production considers any expenditure of resources that does not create value wasteful. According to this philosophy value is considered anything that customers are willing to spend money purchasing. Consequently, firms implementing this method of removing waste from the manufacturing and production process have far fewer slack resources available at any given moment to deal with potential shocks such environmental uncertainty.

When discussing the antecedents of ambidexterity there seems to be a lot of similarity between the contextual factor of stretch and organizational slack as one seems to take the place of the other. Stretch is an effort to get the most productivity out of your human resources by setting difficult, but achievable goals, while organizational slack is the availability of excess resources within the firm. If slack resources within the firm are few, there is more of an impetus for managers to implement higher levels of stretch and vice versa.

According to Jansen et al. (2006) suggest that organizational ambidexterity may be contingent on the availability of sufficient slack resources. Firms or even organizational units within the same firm who have the resources available to simultaneously explore and exploit will have a less difficult time attaining ambidexterity. There is caution, however, that too much organizational slack or bureaucracy can cause difficulties in reaching ambidexterity.

3.3.3 Environmental Uncertainty

With the advent of global competition, firms no longer have the luxury to overlook their external environment. With new firms rapidly entering markets and older firms reinventing themselves to become more competitive organization are confronted with the need focus on existing competencies while developing new ones (March, 1991; Tushman and O'Reilly, 1997). This need to adapt to surrounding environmental changes does not occur in a vacuum, but rather, takes place when organizations realize that if they do not stay ahead of their global competition, they will face increasing difficulty over the long-term. Using this model of perpetual competition and change, scholars have argued

that successful firms in difficult environments are ambidextrous (Gibson and Birkinshaw, 2004; He and Wong, 2004). They further go on to say that as these firms are able to produce profits through both evolutionary and revolutionary change (Tushman and O'Reilly, 1996) and they generally are in the best position to survive in a competitive environment.

A recent study by Jensen, Van den Bosch and Volberda (2005) suggests that environmental uncertainty is positively related to an organizational unit's ambidexterity. This researcher surveyed over 750 organizational units within the same organization operating in the banking industry. Their results document that in a dynamically competitive environment, rather than opting for a single focus such as the exploitation of a niche market or exploration of a new product design, organizational units pursue both types of innovations simultaneously.

Organizational slack was also found to make the transition much easier when pursuing contrary strategies and acts to support the firm during times of environmental uncertainty (Dess and Beard, 1984). In their study they defined environmental uncertainty as the rate of change and the degree of instability in the market. This study provides evidence that in times of crisis, moderate amounts of organizational slack provide a buffer for the firm to continue innovating and moving forward.

Upon examination of the research it becomes evident that the environment which an organization operates in plays a major role in becoming ambidextrous (Floyd & Lane, 2000). As competition becomes more concentrated and intense, the need to change

increases, thus providing ample need to reconcile the tensions between competing objectives.

This section has served to document the three most important antecedents for organizational ambidexterity. By providing a positive organizational context, ensuring that adequate resources are allocated to business units and employees and when operating in a competitive environment, ambidexterity is most likely to be present. In the following section, the relationship between organizational ambidexterity and firm performance will be examined.

4 Ambidexterity and Performance

According to scholars, ambidexterity plays an essential part in the ability for an organization to thrive and survive in a difficult environment. For this reason, much of the work done on ambidexterity in the past has focused on the relationship between ambidexterity and firm performance. Firm performance, however, can be measured in various ways. In this section, the research on ambidexterity and performance will be explained in greater detail with an emphasis on the type of performance measure used.

From a general survey of the literature there seems to be three ways that performance is discussed and analyzed in the ambidexterity literature. In total, three articles compare the relationship of ambidexterity to archival performance data. Others use employee self-report performance data convenience sake. Finally, there are theory

building articles propose a relationship between ambidexterity and organizational performance.

He & Wong (2004) were the first to formally test the effects of ambidexterity on technological innovations in an examination of Asian manufacturing firms. In a sample of 206 firms' interaction between exploration and exploitation in terms of their innovation strategy was found to be positively related to firm sales performance. In addition, firms that focused too strongly on either exploration or exploitation were found to be negatively related to sales performance.

Jansen, Van Den Bosch, & Volberda (2006) used organizational unit's average profitability over a course of three years. That profitability data was further divided by each unit's target to get profitability-achieved rate. This information was acquired through internal corporate records compiled by the researchers.

According to Gibson and Birkinshaw (2004) if managers can somehow reconcile the differences between alignment and adaptability goals with their employees, it will lead to a higher performing firm. The researchers measured the performance of 41 project teams using a four-item measure which asked managers to reflect on their performance over the past five years. This type of measure of performance is easy to acquire, however, there is a high potential for biased answers as managers are not likely to truthfully discuss suboptimal performance.

Lubatkin et al. (2006) used a self-report eight-item scale to compare the firm's performance relative to that of other major competitors on several factors. Their examination focused on top management teams therefore only the CEO's of the

companies surveyed were asked to evaluate performance given their knowledge of their company's finances. The researcher's argument for using this approach was that their sample consisted of private small and medium enterprises (SME's) and they are not legally required to publish any financial data.

Since the concept of ambidexterity is relatively new, there has been no generally accepted way to measure the relationship between organizational ambidexterity and performance. In addition, there is a relative paucity of independently collected performance data across this field of study. In addition, the financial performance indicators chosen by researchers such as short-term profitability fall short of providing a accurate picture of the effects of ambidexterity due to temporal limitations. With one aspect of ambidexterity being a focus on the future, this should be mirrored in any analysis of performance results. Contextual ambidexterity's focus on the individual and their personal judgments is expected to play an even more important role in new product development. The reason for this is the emphasis on meeting schedule goals and the competing difficulties involved in a successful outcome.

In the next chapter a conceptual framework will be presented encompassing the literature presented. The framework will provide a basis for the researcher to evaluate individuals working as a part of a project team in the context of the aerospace industry. It will further serve to provide a means of exploring the various factors that both affect ambidextrous initiatives and its relationship with group performance.

CHAPTER 2: Conceptual Framework

The purpose of the present research is to empirically explore an organization's ability to cope with change through the incorporation of both tested, stable work practices and new exploratory strategies. The second object of the research is to go into greater detail exploring not only to examine its antecedents but also explore what it actually means to be ambidextrous. Researchers have made a lot of effort defining its antecedents and moderators (Gibson and Raisch, 2008); however, the "black box" that makes up ambidexterity and how it manifests itself in organizations has not been adequately examined.

In an effort to better explain the ways in which ambidexterity manifests itself this research will concentrate on contextual ambidexterity. Contextual ambidexterity rather than focusing on strategic or executive decision making focuses on the daily decision making at the project team level. The decision to examine the project team rather than the organization as a whole is that it provides a much clearer method of surveying the mechanisms that create ambidexterity. In addition, project teams provide a means of evaluating the context in which the employees working within have to deal with. The importance of context is the reason why it is not possible to pursue this research from the standpoint of the individual.

The ability for project teams to be able to effectively deal with these paradoxical goals will be considered contextual ambidexterity. It is believed that a supportive organizational context plays a positive role in creating ambidextrous solutions.

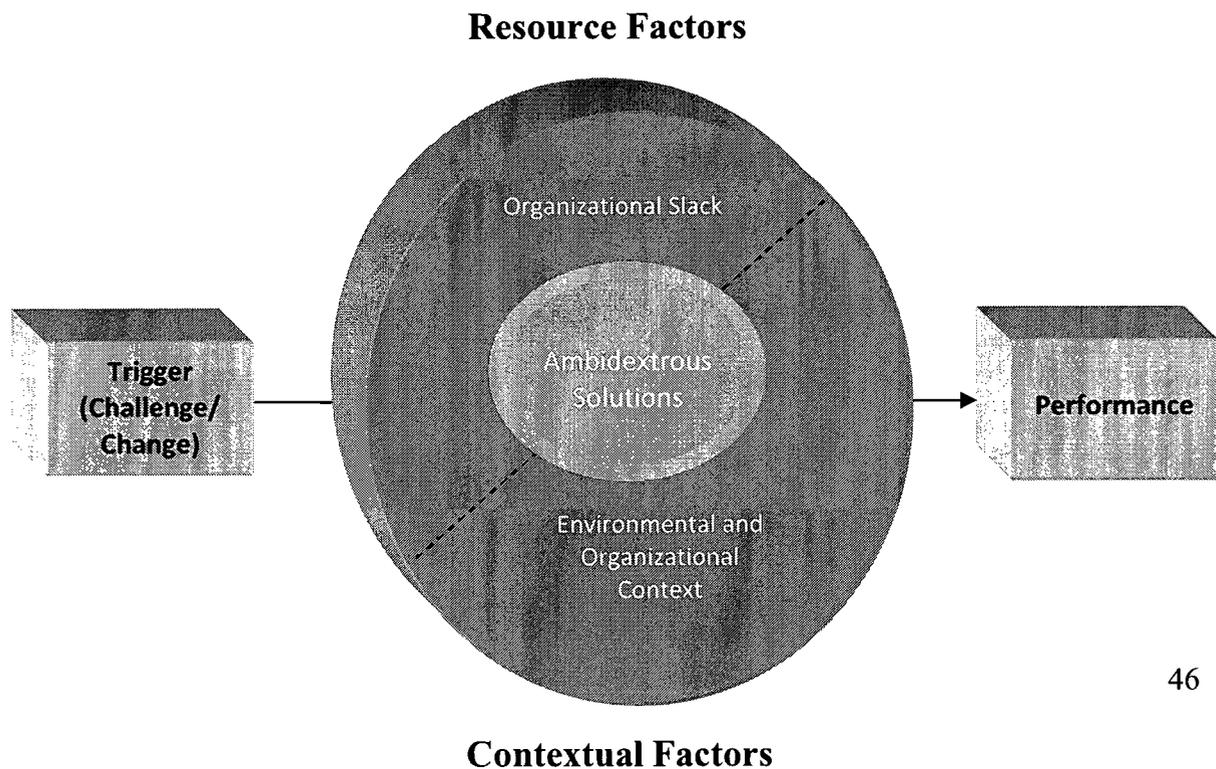
Environmental uncertainty is expected to provide more of an impetus for organizations to

become ambidextrous while the existence slack resources is expected to improve ambidexterity within the organization as more resources can be allocated to finding potential ambidextrous solutions. This is stated by the following two research questions:

- *What is the impact of the project team's ambidexterity on its performance?*
- *What is the impact of working context, perceived levels of organizational slack and environmental uncertainty on the project team's ambidexterity?*

Below, Figure 1 can be considered as a theoretical answer to the research questions. Simply stated, ambidexterity is expected to have a positive impact of schedule adherence performance. In addition, the ability for project teams to find ambidextrous solutions to imminent challenges is expected to be affected by both resource and contextual factors. Resource factors include organizational slack while contextual factors including working context and industry competitiveness.

Figure 1 Theoretical Framework



1. Ambidextrous Solutions

Dealing effectively with competing objectives is considered to be a highly attractive, yet difficult goal to reach and maintain (March, 1991). As such, firms that are successful at realizing organizational ambidexterity are believed to achieve superior performance than those who focus on one aspect entirely (Tushman and O'Reilly, 1996). This ability to prepare for change while making sure that daily operations continue on efficiently as the competition intensifies. This, however, is not the case as firms are continually challenged to improve and streamline their product lines and processes.

According to Auh and Menguc (2005) firms that are faced with increased environmental competitiveness are more likely to strike a balance between the competing factors of exploration and exploitation. These challenges provide a common goal for employees to stand behind in an effort to ensure long-term survival (Levinthal and March, 1993). These same challenges are also likely to become the catalyst for ambidexterity solutions which combine existing work practices with what is needed in the future to produce an improved organizational unit or firm.

Ambidextrous solutions are considered to be a reaction by an individual or group of individuals to a particular challenge or change that serves to respond innovatively within the framework of existing resources and capabilities. Ambidextrous solutions are believed to be most effectively brought about in contextually ambidextrous

environments where an individual feels comfortable to go beyond what is expected of them and respond effectively to a given challenge (Gibson and Birkinshaw, 2004b).

2. Ambidexterity and Performance

There are divergent views in the literature about the impact of ambidexterity on organizational performance. March (1991) contends that by simultaneously pursuing exploration and exploitation goals, firms run the risk of being mediocre at both. Contrarily, Tushman and O'Reilly suggest that firms focusing on these contradictory goals are likely to achieve superior performance. The reasoning given is that by focusing solely on exploration, firms may allocate large amounts of resources to new projects or ventures that may never materialize into anything useful (Volberda & Lewin, 2003). While focusing on exploitation will bring about guaranteed short-term performance but can lead to problems in the future as the firm will not be able to adequately respond to changes in their competitive environment (Ahuja & Lampert, 2001)

In a study of 139 small to medium enterprises Lubatkin, Simesk, Ling & Viega (2006) found that the highest level of performance was achieved when firms exhibited the highest levels of ambidexterity. Gibson and Birkinshaw (2004) used a more subjective means of performance measure which comprised of managers reflections of their units past five years of business accomplishments. What they found was the business units that exhibited the highest levels of contextual ambidexterity had the highest responses of performance. Although there has been a limited number of studies

that have explicitly examined the interaction between ambidexterity and performance the size and quality of these studies suggests that a relationship exists. From this information, the following research question is derived.

3. Organizational Context and Ambidexterity

Creating ambidextrous project teams is by no means an easy task. Managers must consistently ask their employees to reflect on the best ways of getting their work done, while still keeping an eye on performance. These same teams must also be prepared to split attention further when it becomes necessary to cooperate with other teams and stakeholders. As organizational workforces contract due to slack reduction initiatives, employees must prepare not only to offer more in terms of education and experience than in previous generations but also adapt more to changing job roles and responsibilities. With fewer employees tasked with creating the same output, expectations on each employee become increasingly burdensome. For these employees to succeed, the onus is on both the employee and the organization to work alongside one another to create an organizational context that enables groups to become increasingly ambidextrous.

There are several key contextual factors that are considered to be of importance to create ambidexterity in a project team. As mentioned in the previous chapter, the contextual factors of stretch, discipline, support and trust were found to be positively related to ambidexterity at the business-unit level (Gibson and Birkinshaw, 2004). Discipline, stimulates employees to meet the expectations and commitments that have been agreed to. This is the action taken by managers to establish standards and

consistency within the group. The present study will use the term accountability as it has fewer negative connotations with interviewees and is highly present in disciplined environments. Stretch is the voluntary attempt to take on more ambitious objectives, rather than less. This idea of personal stretch can be fostered in an organization by developing personal meaning through a shared ambition. This further enables individual members of the project team to create personal meaning to their contributions. Support is the willingness to lend aid to a fellow worker. The creation of an atmosphere where support is freely given is one where initiative is taken from lower levels and management making a priority of providing guidance rather than direction. The fourth and final contextual factor is trust. Trust enables members to rely on each other's commitments. This can be extended through perceptions of fairness, transparency and equity in decision making procedures. It is further helped by enabling all members of the group, regardless of their station to take part in the decision making process (Gibson and Birkinshaw, 2004, Nohira and Gulati, 1996).

4. The Impact of Environmental Uncertainty

During times of hyper-competition and unpredictability, the tensions that are naturally created by organizational paradoxes begin to increase (Volberda, 1998). Firms are under constant stress to produce goods and services that will give them an advantage over their competitors. This has become increasingly difficult as more challengers enter the market.

As the external factors surrounding the firm become increasingly difficult to manager, firms are increasingly faced with the decision to exploit their existing capabilities or explore new ones (Jansen, Van Den Bosch & Volberda, 2005). According to Jensen et al. (2006) organizational units operating in more dynamic and uncertain environments that pursue an ambidextrous approach to innovation are far more likely to increase their financial performance. The reasoning behind this is that as the competition becomes fiercer, the only way in which a firm can secure its financial success is to pursue radical innovations, while incrementally improving the firm's core business.

Dynamic and uncertain competitive environments are defined as highly unstable in nature and constitute short product life cycles and rapid change. There is a greater likelihood that an ever changing competitive landscape will force organizations to become ambidextrous. In competitive environments, firms feel more pressure to secure existing clientele, while continuing to development new products to sustain the firm over the long term (Jensen et al., 2005).

Both Levinthal and March (1993) and Lewin, Long & Carrol (1999) believed that environmental factors moderate the relationship between the competing areas of ambidexterity and performance. Jansen, Van Den Bosch, and Volberda (2006) further determined that in more competitive environments, exploratory innovation is more effective and exploitative innovation creates higher financial performance than in less competitive environments.

5. The Impact of Organizational Slack

Over the past several years, the pressure on firms has increased to eliminate wasteful spending in an effort to cut costs and improve the firm's bottom line. This focus on making the firm as "lean" as possible has led to far fewer slack resources left available for innovative practices. By doing this, firms also run the risk of not having the ability to deal adequately with an unanticipated environmental change (Lawson, 2001)

Organizations have also begun to focus more intently on how to achieve the highest levels of efficiency from the different aspects of their organization. With stock market demands pressuring companies to become increasingly profitable, restructuring has become a very common activity. By restructuring, managers try to bring about ways that will keep costs as low as possible while still providing the same services. These reorganizations ensure that unused or slack resources are kept to an absolute minimum making employees work lives progressively more demanding. Under these pressures, employees are provided with very little opportunity to reflect on potential improvements or ambidextrous solutions to challenges that present themselves.

Providing a reasonable amount of slack resources to do the job is hypothesized to create a strong base for an ambidextrous orientation. With some room to maneuver provided by the this additional slack, employees will be able to focus on more than simply their core activities as they do not feel that they are unnecessarily rushed. Without this feeling of being constantly under pressure, employees will also be able to find potential improvements to their processes. Another benefit of slack is that it becomes

useful for organizational responsiveness during the time when emergencies arise (Cheng and Kessler, 1997).

This theoretical framework will be applied to several new product development project teams working on three aircraft programs. The organization in question is a large Canadian aircraft producer with offices in the United States and United Kingdom. The methodology used to conduct the research will be presented in the next chapter.

Chapter 3: Methodology

The previous two chapters discussed the general background and framework of the organizational ambidexterity in an effort to address two specific research questions. The first of these being the effect several antecedents such as slack, context and environmental uncertainty on project team ambidexterity as well as the impact of project team ambidexterity on performance. This third section explains the method in which this research attempts to answer these questions.

This section begins with a general overview of the various aircraft programs as well as some of the details surrounding their creation. Following this is an analysis of the participating project teams as well as a breakdown of the respondents in this sample. Although details regarding the participating programs and project teams will be documented in this chapter, it is important to note that further information will be supplied in successive chapters. Finally, details regarding the data collection method and interview schedule will be supplied.

1. Selected Aerospace Programs

The research focused on three new product development programs¹ currently being conducted by a major aerospace producer. These aircraft are currently being designed and produced in four geographic sites. Two of which are situated in Canada, one in the Midwestern United States and one in the United Kingdom. This research focuses on five project teams involved in the three programs.

¹ An aerospace “program” refers to the design and development of a complete aircraft.

The first development program in this study is the Alpha program, which consists of a family of narrow bodied, twin-engine aircraft medium-range commercial aircraft. The aircraft is based on a completely clean sheet design. This implies that the drawings of the aircraft are not based on any previous design. Additionally, as all of the design work for this particular program is conducted in Canada, the Alpha program is considered to be the largest aerospace endeavor undertaken in Canadian history, based on employment size and budget. The significance of this aircraft is made even more important by the recent economic recession where both employment and budgets within the firm have been trimmed to meet the challenges in the industry.

The focus of the Alpha program has been to enter into the relatively uncontested niche of the medium sized single aisle, narrow body airliner market. This niche generally dominated by two very large aircraft producers, however, both of these organizations have looked over this area of their business as they have been focusing on much larger aircraft capable of carrying far more passengers. In addition to entering this new market there has been a concerted effort to provide the most fuel efficient aircraft possible. This has been accomplished by advanced composite materials being integrated into the airframe and an innovative engine design.

This Alpha has the first jet engine designed for commercial aircraft use with a gearbox linked to the turbine and the fan. The rationale behind this innovation is that the turbine and the fan rotate most efficiently at two different speeds. By having this gearbox in place, the turbine and fan can rotate separately ensuring that they are both able to run

at their most efficient speed. This has made it so there is no longer a need to compromise the efficiency of one portion of the engine for the other.

The Beta program positions itself as a mid-range business jet. This ten passenger aircraft business jet is the firm's first aircraft to feature an all-composite fuselage. With the structure of the aircraft being produced entirely out of composite materials, this produces two distinct advantages. Composite materials serve to lessen the overall weight of the aircraft, thus, lowering the amount of fuel it takes to fly it from one point to another. In addition, composite materials cut down substantially on the amount of structural parts of the aircraft. This saves in production time, has fewer weak points and gives designers more interior space to work with as composite parts take up less space.

In 2005, the aircraft producer signed on with an expert in composite aircraft design situated in Germany to help them further develop structural components of the aircraft. Late in 2008, the site announced that due to the insolvency issues suffered by the German firm, they would be no longer involved in the development of the aircraft. Later, in a surprise announcement, the aircraft producer made the decision to continue on with the program despite the bankruptcy of their primary supplier and produce all of the composite work in-house.

This reversal of situation left the firm with a much larger stake of the overall risk for this aircraft. As is the norm today, many aircraft producers go into risk-sharing partnerships with their suppliers. This enables the producers to invest a smaller amount of financial resources into each aircraft development program while spreading the risk. In return, the suppliers receive a portion of the profits for their initial investment. With their

major supplier recently filing for bankruptcy, the producer had to take up their share in order to continue with the program.

The work for this aircraft will be split amongst three countries. The Canadian group is tasked with the structures certification and engine detail. The American group will perform flight testing, do interior work and final assembly. Finally, fabrication and assembly of the composite structures subassemblies will take place in another facility situated in an emergent nation.

The third aircraft, Gamma program is classified in the ultra-long range business jet category based on a previous aircraft design. The project team in charge of avionics was interviewed for this research. The Gamma's fuselage comes from an existed aircraft program entered service in 1999 and in that time, nearly three hundred aircraft have been produced. In 2007, the organization announced an entirely new flight deck for the aircraft which provides the pilot with among other things an improved display, communication and a synthetic vision system. This new avionics system plans to receive its certification by late 2010 and will launch in 2011.

2. Project Teams

The Alpha program was represented by two project teams for this research. The first was the propulsion project team located at one of the firm's Canadian offices. Their responsibility is the integration of all propulsion and air systems for the aircraft. The second project team, located in the firms United Kingdom office was in charge of the program wing design. They were tasked with providing all of the work on the wing including all testing and demonstration for the Alpha regional jet.

Overall, four directors, One Integrated Product Development (IPDT) Leader, ten managers, four section chiefs and five integrators were interviewed for this research. A director is usually tasked with a large section of a particular aircraft and the responsibility flows down through the hierarchy to the integrator level. The integrators are tasked with liaising with a particular supplier about a certain section or part of the aircraft and making sure that not only do they follow their schedule but part(s) that they are responsible for fits with its adjacent parts.

This entire hierarchy, especially the role of integrator has been developed to improve the relationship between supplier and manufacturer in a risk sharing partnership. Each integrator generally deals with one supplier and their responsibility is to make sure that the relationship between the two groups is strong and that the manufacturer is getting what they have been promised. In addition, this model places much of the onus on the supplier in the event of an error. As the supplier has become an investor in the particular program they must ensure that all of their work meets certification or they have not met their side of the contract.

The structures project team employees were split between one the company's Canadian locations and their Midwestern United States location. This project team's responsibility dealt the structures, installation, air systems and interiors for the Beta business aircraft. Beta's second project team systems group was represented by three employees. The entire group was located in the firm's Midwestern United States office and was tasked with all electrical and hydraulic systems for Beta business aircraft.

Three members of Gamma's avionics project team were interviewed. The group is split up between the aircraft producers two Canadian offices; however, all employees interviewed came from the same office. The responsibility of this group is the integration of the new avionics suite into the existing Delta fuselage to produce the Gamma aircraft.

The following table gives a breakdown of the amount of total employees interviewed in each project team as well as their position. The table also provides information into the orientation of the project team and whether they work strictly in the design of an aspect of their given program or whether they work alongside suppliers to integrate their section of the aircraft with others. The Structures project team; however, working on the Beta program has the distinction of having both design and integration team elements working in the same area.

Table 1 Interviewee Hierarchy and Project Team Designation

	Program				
	Alpha Propulsion*	Alpha Wing†	Beta Structures*†	Beta Systems*	Gamma Avionics*
Director	1	0	1	1	1
IPDT Leader	0	1	0	0	0
Manager	2	2	3	2	1
Section Chief	3	0	0	0	1
Integrator	3	1	1	0	0
Total:	9	4	5	3	3

*Denotes an integration team

†Denotes a design team.

To sum up, there were thirteen employees in total with connections to the Alpha program, eight members of Beta program and three members of the Gamma program interviewed as part of this research. Four of these members were situated in the UK,

eleven in the first Canadian city, three in the second and six in the Midwestern United States. The next section a breakdown of the employees will be provided as well as relevant information about their work experience and education.

3. Respondents

In total twenty two men and two women took part in one-on-one interviews for this research. The Alpha program was represented by nine members of their propulsion project team headquartered in Canada as well as four members of their wing project team from the United Kingdom. The Beta program is represented by five members of their structures project team including three Canadian and two American employees and three members of their systems project team from the United States. Finally, the Gamma program is represented by three members of their avionics project team working in Canada.

The respondents had an average of 20.6 years of experience in the aerospace industry and 14.6 years of experience with the firm. The participants averaged 5.2 positions with the firm during their tenure and had spent 1.4 years in their current position. The group as a whole had an average of 17 direct employees and 74 total employees under their direct supervision. Table 2 presents data regarding the means and ranges of several demographic factors of each project team.

Table 2 Interviewee Socio-graphic Information

Mean/ (Range)	Project Teams					Totals
	Alpha Propulsion	Alpha Wing	Beta Structures	Beta Systems	Gamma Avionics	
Years of Experience	16.8/ (2-30)	14.2/ (4-30)	21/ (12-30)	22.3/ (20-26)	18/ (12-23)	20.2/ (2-30)
Years with Firm	14.2/ (0.5-13)	18.5/ (4-30)	15/ (6-23)	14.8/ (9-20)	15/ (9-18)	14.6/ (0.5-30)
Number of Positions	3.25/ (1-6)	5.3/ (2-7)	5/ (2-8)	53/ (3-7)	8/ (5-12)	5.4/ (1-12)
Years in Position	1.4/ (0-4)	0.9/ (0.5-1.5)	1.4/ (1-2.5)	1.3/ (0-2)	2/ (0.5-3)	1.36/ (0.5-4)
Direct Reports	5.7/ (0-9)	0/ (0)	23/ (6-40)	30/ (5-55)	0/ (0)	17.1/ (0-55)
Total Reports	5/ (0-23)	75/ (0-200)	14.4/ (0-200)	53/ (10-125)	218.3/ (10-600)	74.7/ (0-600)

The educational background of the group was fairly homogenous with each possessing at least one undergraduate engineering degree. Five members possessed Civil Engineering degrees, 13 had Mechanical Engineering degrees, four received Aerospace Engineering degrees and one acquired an Electrical Engineering degree.

In terms of graduate level education, eleven of the twenty four possessed degrees which included: Three in Aerospace Engineering, Two MBA's, two in Mechanical Engineering, one post-graduate diploma in Management, one Military Aerospace Engineering degree, one in Gas Turbine Engineering and one in Controls Engineering.

The general hierarchy of individuals being interviewed can be broken down into four major positions as mentioned above in table 1. The highest ranking project team

position is that of the director, who is tasked with the overall operations for one major section of the aircraft's design such as the systems or structures.

Directly subordinate to the director is the position of manager. Managers are put in charge of a smaller, more particular project team role, for example the power plant section group of the propulsion group. Managers, in turn, would have several section chiefs directly reporting to them. These section chiefs are tasked with a more specific section or portion of the aircraft and have several integrators working under their supervision. Integrators play a pivotal role in the design and creation of aircraft in the new risk partner paradigm taken on by many aerospace companies. Integrators constitute for suppliers a direct link to the manufacturer as part of the risk sharing partnership model. As both groups are working alongside each other so closely, constant communication is needed to ensure that work runs smoothly. In addition, integrators ensure that all parts under their supervision meet certification standards and assimilate perfectly with other sections of the aircraft.

4. Data Collection

The research began with a meeting with the aircraft producers Product Development Systems Manager. The initial goal of the research was that the organization being examined needed assistance on how to more effectively bring about change while limiting the initial negative reactions to it. Once the method to explore this issue was agreed upon contact was made for interested participants in this research. Project team directors who showed interest were given an information package regarding the goals of the study. Once consent to interview the project team was reached, the director was

contacted in order to schedule a one-on-one interview. For the interview, the choice was given to either meet face to face or talk over telephone.

After the interview with the project team's top manager, they were asked to provide the names of up to three direct reports for subsequent interviews. Upon receiving the contact information of these direct reports, they would similarly be asked to take part in a similar interview, and the process would be repeated where these employees would be asked to provide contact information to their direct reports. This method of data collection continued until participants from all levels of the project team were interviewed.

This sample allowed the researcher to get some insight into the inner workings of the project team from all levels of responsibility. This was essential, from the standpoint of how various levels deal with challenges and change. This also provided a means of protecting against various overstatements of positive attributes and the ability to cross-reference facts with other members of the project team.

5. Interview Schedule

5.1 Ambidexterity

As indicated in the interview schedule presented in Appendix, respondents were asked to describe a particularly important change or challenge to their project team within the past six months. Specific questions regarding who instigated the change, the timelines and its reception were posed to each respondent. From this information, further questions were asked about whether they were trying to improve the situation and by what means.

Once they had fully explained their situation they were asked whether anything had remained unchanged during the transition.

Respondents were asked to describe whether their project team encouraged people to challenge outmoded traditions and practices. If they agreed with this statement they would be asked to describe examples of occasions where these traditions and practices were employees bringing up new ideas and whether they had been successfully implemented. The quality and prevalence of ambidexterity as well as the way in which it was able to lead to an ambidextrous solution will be the way in which each project team is compared to come up with an ambidextrous measurement. In an effort to ensure fairness, each instance of ambidexterity will be evaluated by two judges.

5.2 Project Team Context

The measure of context within each team was accomplished by interviewing members of the project team using various contextual dimensions identified by Ghoshal and Bartlett (1994). These included: accountability/discipline, stretch, support and trust. Each project team member was asked to discuss the prevalence and impact of each of these four contextual factors. In the case of asking these questions to directors they would be directed towards how they use these four factors during their daily operations. In the case of lower level employees they would be asked to discuss how their managers created an environment where these contextual factors were present.

5.3 Organizational Slack

Organizational slack was measured using a two item measure developed by Nohria and Gulati's (1996). This measure focused on the perceived extent to which a reduction in employee hours or budgetary resources would have an effect on the yearly performance of the project team. A baseline reduction of 10% was given to each employee for each of the two questions.

5.4 Environmental Uncertainty

The extent to which the environmental uncertainty affected the individuals of the project team was measured using three questions measure adapted from the work of Swamidass and Newell (1987). Respondents were asked to comment on the major issues facing the aerospace industry as well as whether these had had any noticeable effects on their project team. In addition, respondents were asked about the effects of competitors and internal competition on their project team.

6. Data Analysis

All the interviews were taped and transcribed. The transcriptions were analyzed by classifying and sectioning responses based on whether they dealt with performance metrics, contextual factors, environmental factors as well as any mention of ambidexterity from the project team. The results from this analysis will be presented in the next chapter

5.5 Performance

For each of the five project teams, the most senior member was formally asked to provide schedule adherence data leading up to the date of August 10th, 2009. This date was picked arbitrarily and served to make sure that each team would be compared at a comparable point in time. Using a common date also provides a means of gauging how various project teams react to external environmental factors. It was specified to each project team leader that only project team specific schedule adherence performance data be used, as opposed to program specific data.

The specific schedule variable being sought is the ability of each project team to meet their original or baseline list of deliverables as of August 10th, 2009. The term deliverables in project management is used to denote something produced as a result of a particular program that is intended to be delivered to a customer. As each program sets out an original schedule documenting timelines and important deliverable milestones, the percentage of deliverables actually being produced to those initially forecasted will be the means of measuring schedule adherence.

CHAPTER 4: Results

The present chapter attempts to analyze the key data provided by each of the five project teams. The information is broken down by concept and then once again by project team. First, the external environmental that all project teams must face will be examined. From this, the focus shifts to industrial, company specific and individual project team contextual factors. Upon completing the contextual examination of all five project teams, an assessment of the level of organizational slack will be performed. Finally, the ambidextrous solutions brought forward by each project team will be documented along with the challenges that helped bring them about. Finally, archival performance data from each project team will be presented and explained.

As mentioned previously, the terms “group” and “project team” denote the same unit of analysis. The term “program” represents the whole of the aircraft being designed by any project team. Finally, “top manager” signifies highest ranked project team member interviewed in the present research.

As stated in chapter 3, the hierarchy of individuals being interviewed can be broken down into four major positions. The role of the director is the highest ranking member of the project team. They are tasked with the managing the daily operations of one major section of the aircraft’s design. The direct subordinate to the director is the position of manager. Managers are put in charge of a smaller, more particular project team role. Managers, in turn, have section chiefs directly reporting to them. These section chiefs are tasked with a more specific section or portion of the aircraft and generally have several integrators working under their supervision. Integrators are tasked with liaising directly with suppliers to ensure that the section or part under

their responsibility is created by the supplier to exact specifications. In addition, they ensure that all parts will meet certification standards and can be fitted perfectly with other sections of the aircraft.

1. External and Internal Contextual Factors

This section will document the various contextual factors that affect the way in which these project teams are able to accomplish their tasks. The dynamic that makes each project team unique will be first be analyzed through the lens of the general environment that the aircraft produce faces in each country that they operate in. These environmental factors will include the world financial crisis, fuel costs, general waste-reducing measures and the ever present opportunity and threat of innovation.

1.1 General Environment

“The aerospace industry is cyclical in nature.” This comment or variations of it was a recurring theme among employees in this sample. For the most part, these cycles follow the ups and downs of the overall market and are generally seen to be relatively constant. However, as of late 2008, the world economy was hit by a global financial crisis which brought about a recession and threw these normal market cycles off considerably.

As home prices and stocks began to plummet as a result of the recession, companies were affected by having the demand for their goods and services drop. The recession created a buyers’ market where those with available cash were able to get significant discounts on purchases. With this decline in demand for goods and services, companies were forced to cut costs. This need to

reduce overhead ended in many employees being laid off and a general fear with those remaining that they might be next. This fear for their future has led to a lot of stress, uncertainty and fear. This combination of emotions has created a ripe environment for rumors to swirl regarding pending layoffs.

Another factor that has contributed the general economic environment has been increasing price of fuel. For many industries, especially those focused on transport, the need for fuel economy has become a paramount issue. With fuel prices reaching record levels, paired with increased environmental awareness, the ability to conserve fuel and produce low-carbon emitting products has become a driving force in the market.

This focus on the price of fuel has led to buyers to show more interest in increasingly fuel efficient aircraft. With the variable cost of fuel rising and the profitability of each flight being squeezed, those who are willing to spend money on new aircraft demand significant improvements to previous designs and materials. In order for a program to be approved, the design must deliver considerable reductions on a variety of metrics including: fuel consumption, weight and maintenance cost. It is typical for an aircraft producer to reject a developmental program that is unable to produce double digit improvements on at least one of these factors. Conversely, in previous generations a program could be accepted if it was able to show improvements of only a few percentage points on these variables.

Composite materials are becoming a key competitive advantage for aircraft producers. These materials are made up of several different components that when combined results in property changes that differ from the original materials (Jones, 1999). The advantage of composite materials is that if produced correctly, they can exhibit the best qualities of the

amalgamated materials as well as many others. Recently, very strong fiber-reinforced resin materials have been developed that provide aircraft with the necessary strength as well as weight savings and corrosion resistance (Jones, 1999). For years this technology was only used for military aircraft, however, this trend is beginning to take hold in the commercial aircraft market as fuel efficiency becomes paramount to aircraft producers.

1.2 Industry Environment

For the purpose of this research, it is important to denote the designation between commercial and business aircraft. A commercial aircraft is generally a large fixed-wing aircraft that serves to transport passengers and cargo. They are generally owned by airlines or courier services and are a means of providing a service with the intent of making a profit. Business aircraft, on the other hand, are for the most part designed for fewer, generally wealthy and powerful passengers willing to pay a premium to travel privately. Each of these aircraft markets attracts a different clientele and demand for these two aircraft segments can differ enormously depending on an array of different economical, social and political factors.

The commercial aircraft industry has received a large amount of negative press recently about major aerospace firm's inability to produce their newest aircraft on schedule. Furthermore, as much of an aircraft development budget consists of variable costs such as labor, these projects have evidently faced cost overruns. These unexpected delays have caused issues with buyers trying to replace their aging aircraft. Two recent examples of these delays in the news have been the Boeing 787 and the Airbus A380, both of which have been considerably behind schedule.

In an effort to stem these problems, airlines and aircraft lessors, the major buyers of commercial aircraft, began to impose significant penalties in their contracts on any aircraft that goes over its mandated delivery date. By forcing these aircraft producer to become responsible for their promises, these buyers are further protecting themselves from uncertainty and delays in the future. The buyers also demand reassurance from aircraft producers, as orders are generally placed many years in advance for a seamless transition between newly delivered and existing, soon to be retired aircraft.

The business aircraft market, although not facing the same issues with delivery times has faced its own backlash recently on account of one infamous event. On November 19th, 2008 the top executives from the three major American automobile manufacturers took separate private business jets to Washington in an effort to secure bailout money for their respective companies. The act of flying multi-million dollar private aircraft to ask for loans from the government was considered by many as a symbol of the corporate overspending that helped bring about the global financial crisis. As such, business aircraft producers, who have been deemed guilty by association, have seen their sales drop significantly as many buyers find other, less conspicuous means of transportation.

Both the commercial and business aircraft market have had to react and quickly integrate the array of new composite materials being produced. These materials are known to produce significant reductions in the overall weight of the aircraft and are manufactured to be as strong as metal. The issue being faced by many aircraft producers is that composite materials have not been used in civil aircraft design for many years. As such, there remains a relatively low number

of experts able to work and design effectively with the material. Even so, this move towards composite materials has become a form of first mover advantage.

Reducing the time to market in the aerospace industry is important. The entire industry is relatively slow moving in nature. By having your product arrive late an aircraft producer is apt to lose sales for many years. Each program takes years to develop, so once an aircraft producer falls behind in terms of their product offering, it will take years of research and development work to move back to parity with their competitor. This provides a very large incentive for aircraft producers to pay close attention to any changes in market demand while forecasting well into the future regarding their product offering.

1.3 Company Context

The company being examined in this research is a global transportation corporation headquartered in Canada and produces both commercial and business aircraft. Their business aircraft models are split into three specific groupings: the light to midsize business jet family with four aircraft in service, the super-midsize to large business jet with three aircraft and the super large to ultra-long business jet family also comprised of three aircraft. Of the two aircraft being examined in this research the Beta belongs to the light to midsize business jet family while Gamma belongs to the super large ultra-long business jet family.

The aircraft producer's commercial aircraft are also split into three groups. The first is a regional business jet that is comprised of two aircraft with a capacity of 100-149 passengers. The second family is a group of six regional jets manufactured to seat 50-100 passengers. Finally, there is a series of four medium range turboprop airliners with between 37-90 passengers. In the

context of this research Alpha belongs to the larger family of 100-149 passenger regional business jets.

In order to deal with the growing demands put on the aircraft producer from aircraft buyers regarding fuel economy, the firm has been making an effort to keep weight to an absolute minimum. In their clean sheet designs they have dealt with lowering overall aircraft weight by implementing significant innovations. These include such things as improved engine designs, aerodynamics and the usage composite materials. These innovations manage to keep fuel consumption at a very low level as the engines do not need to bear as much weight through the air.

The issue with developing these fuel efficient, innovative new projects that there are many inherent unknowns during the course of their development. As unknown variables can wreak havoc on schedules, employees generally must work extra hours to make up for the shortfalls. This can often lead to cost overruns attributed to overtime wages. In an effort to curb this extra cost the organization has moved to halt overtime payments by implementing a new company-wide incentive scheme.

The incentive scheme pays out bonuses rather than overtime payments at the end of each fiscal year to each and every member of the organization. These bonuses are calculated based on the position of the employee, the success of each program and certain organizational key performance indicators. The scheme was initiated to improve the firms' cash flow position by providing bonuses only when the firm has funds disposable to do so.

This feeling of powerlessness stems from the belief that in such a large organization, the work of one employee, especially one working at a lower level, has a minimal impact on the

profitability of the firm as a whole. This is felt especially with a program that is not planned to go to market for another three years. As such, the eventuality and size of this bonus becomes far more risky in the mind of employees as opposed to guaranteed overtime wages.

Yet another motivation behind this scheme was to provide a method of ensuring that all employees had a manageable work-life balance. This was done by allowing each employee to return home earlier than their allotted 40 hours if their responsibilities were taken care of. The reality, however, as one section chief states is “a development program doesn’t work that way...there is no such thing as a 30 or 40 hour work week. There is simply too much to do.”

Conversely, members of the management team seem to have adapted well to the newly implemented bonus scheme. Although they admit that there have been problems with its acceptance from an employee standpoint, they prefer this plan as it serves to cut down on the time they must spend focusing on adhering to budgets. As such, engineer salaries, which make up the better part of their non-recurring development costs, now become fixed costs rather than variable costs in their budgetary calculations.

Upon observation, there have been several additional reactions to this new employee incentive scheme. The first and most evident is that there now seems to be a large amount of difference in the amount of effort in terms of overtime hours that each individual was willing to work now that overtime payments are no longer given. “Some were pretty motivated; I can say they were more of the young bloods... [those with] more experience felt that it was just a carrot and a stick situation” as an integrator comments.

The aircraft producer must continually remain aware of what is taking place both inside and outside their company as competitors try to gain market share. As schedule remains such an

important issue both from the standpoint of the producer and buyer, all efforts are taken to make sure that the aircraft is provided on time and to specifications. If delays make this impossible, the entire firm suffers as resources cannot be redistributed to other programs. As such, it seems rather questionable that overtime budgets have been cut as issues with new designs always arise and extra attention must be given or schedules fall behind. By taking away the incentive for employees to work longer hours, this could lead to decreased schedule adherence.

1.4 Program Context

All information depicted in this section comes from responses to the interview questions. These responses were then coded and analyzed in order to fit into the sections provided. All direct quotes made by the interviewees are enclosed in quotation marks. It is important to note that this section and the following sections represents the perceived context of the respondents and may not be a completely accurate picture of the entire project team.

1.4.1 Alpha

The Alpha aircraft development group is preparing itself to deliver their first aircraft in 2013. Until then, designs must be accepted, mock-ups of the plane created, flight tests arranged and certification given. Once in service, the lifespan of the Alpha is expected to be in upwards of 20 years. With the understanding that this aircraft will be around for many years, it requires that all members work towards creating an aircraft that uses the latest technology of today while ensuring that the needs of the future are considered.

The Alpha is also trying to chart a new path for their organization by creating an organizational structure that fosters communication while focusing less on hierarchy within

project teams. The team realizes that they must adapt and grow as “competitors are getting better and they are always finding new ways of doing things.” One of the ways in which they tried improve on a previous program was through the enhancement of their Integrated Product Development Team program, better known in organizational theory literature as horizontal integration. This approach groups supplier representatives, customer service team members and designers together in an open concept office environment to facilitate communication among members. The end goal of this change is to promote fully integrated project teams companywide. To quote one of the managers “What we are trying to do is essentially change the way the whole company behaves.”

There was a general feeling among those working on the Alpha program that they felt very fortunate to remain employed with the company throughout the recession. As their project was deemed essential to the long-term survival of the aircraft producer, resources allocated to the Alpha program would remain constant until its completion. This protection meant that Alpha was immune to any budgetary cuts and would be able to retain a full staff. Although the employees felt reassured that their positions in the firm, the importance placed on the success of this program by the organization was not lost on them.

This project’s importance from the standpoint of all stakeholders can be attributed to several factors. The first is the high developmental cost, as so many resources are being placed in this program. As such, there are high expectations for its success and the group’s ability to deliver the aircraft on time. There is also the knowledge that this is the future flagship aircraft of the organization. This project in both cost and size has become the largest endeavor taken on by the aircraft producer and is the largest aerospace project in Canadian history. One further

contributing factor to the importance placed on meeting schedule objectives is, in part, due to the firm's competitors.

The pressure to meet schedule objectives is by no means a new phenomenon. However, in the case of the Alpha program, it has been an inability on the part of other aircraft producers to provide their products on schedule that has caused many several issues for the aircraft producer. With recent schedule overruns by other aircraft manufacturers, aircraft buyers are doing what they must to ensure that their purchases are delivered on time including stiff penalties for late delivery. This has created an environment where the project team "cannot fail to deliver". Paired with this high demand on meeting the schedule is the upper management's directive to "spend money as you would spend your own." Management has made it very clear that the overall health of the company relies on making sure that both spending is kept under control and the Alpha is produced on time.

The Alpha program in addition to many other new aerospace projects works daily with a variety of partners to develop components for the aircraft. These risk sharing partners also serve to mitigate a portion of the risk involved in bringing an aircraft to market. This relationship with local and foreign companies can lead to challenges especially with different time zones. As one individual says regarding this topic "I have not met people I have been working with for the past six months." When project team members and supplier representatives travel, they often find that they are hamstrung internal security features that put limits on how and where information can be accessed. The following example shows how this can cause undue trouble. "Most suppliers do not keep backup files at our firm because of technical difficulties like the internet being slow...they keep everything close just to be more efficient, which can be very risky." This was

documented when one supplier decided to go to a restaurant and upon their return “his car was broken into and his laptop and all of the designs he did were stolen.” Because the employees work was not backed up, all of previous work was lost and put in jeopardy. This example documents the danger of not being able to transmit information effectively among groups working on the same project.

1.4.2 Beta

The groups director stated that the downturn has ended up being relatively good for his project team as so many layoffs of skilled aerospace personnel has led to far less “job-hopping” which was considered to be a concern for the company as engineers tended to move from company to company looking for the best compensation package. In addition, there were far more qualified people on the market looking for work, making it much easier to fill vacant positions.

Working with composite materials has recently become an important competitive advantage for the aircraft producer. Its relative recent introduction into the civil aircraft market has made it difficult to find an ample amount of employees comfortable with working with this new material. Because of the relative scarcity of composite material experts the company decided to work with a German-Swiss firm specializing in designing aircraft fuselages out of these materials. In late September 2008, as the supplier was facing impending bankruptcy, the aircraft producer decided that the only avenue to continue with the program was to produce the composite structures themselves. This served to create a large upheaval in the program where

new designers needing to be hired, expertise from around the company brought together and new techniques learned in very short order.

Much like the Alpha program, the Beta program was able to effectively weather the economic downturn due to their status as a protected program. However, adjacent to their office several thousand employees had been made redundant by an aerospace competitor. This event has given each employee a sense of what could have happened and has created a sense of gratitude for their continued employment.

The firm's ability to generate cash during this period was noted to be increasingly difficult. As a result members of the entire project had to delay spending money as much as possible as well as optimize what was being purchased. If purchased were needed they were monitored very carefully. From training programs to travel expenses, employees were asked to be as economical as possible when it came to company spending. This vigilant eye on spending seemed to be something that the employees working on the Beta were fairly unused to dealing with.

It is interesting to note that one of the Beta's managers mentioned how he was still looking for more trained staff for his group. Since its inception, his group has been understaffed and he is constantly on the lookout for properly trained members to join his team. "Had I been looking for a system installation designer who can work with CATIA [a design software program], I could have filled 100 positions in three days". However, as he was looking for highly trained personnel, he mentioned how competitors recognize the importance of hold on to their most highly trained and specialized employees. It is because of this that the Beta program

manager found very little difference in the availability of highly trained employees in the job market over his past ten other years as a supervisor.

1.4.3 Gamma

The Gamma is the next generation previous aircraft designed by the aircraft producer. The Gamma is considered an ultra long range corporate jet aircraft. However, the difference between the two aircraft is that the Gamma, once completed will contain an entirely revamped avionics suite. This suite includes all of the electronics of the aircraft including software, cockpit displays and internal systems within the plane.

One of the major improvements with the Gamma is its enhanced synthetic vision displays which incorporates sensors that create high quality images of the airfield and surrounding terrain. These images can serve to safely guide the pilot to ground in any weather conditions. This image projected to the pilot would be very similar to a computer flight simulator. However, upon using this metaphor the director cautions “if there is a glitch in the software [of the game] it’s not an issue, but in an aircraft...the integrity of that picture is extremely important.”

The complete overhaul of the avionics system was set about by changes in market demand. According to one Gamma program section chief, a competitor had created a product with an avionics suite that had outperformed that of the Gamma. He says “in the business jet world you always want to have the top of everything.” This pressure to produce the highest quality products for the long term can make it very difficult for developers as they are forced constantly anticipate changes in market demand. Furthermore, the aerospace industry is a relatively slow moving industry so not anticipating a change can take years to recover from.

The problems surrounding the recovery from a competitor's new development is evident with the creation of the Gamma. The aircraft producer's main rival had recently unveiled an improved aircraft design that the aircraft designer could not compete, due to its vastly improved avionics suite. Executives from the aircraft realized that they needed to respond quickly to this new design or the aircraft producer would lose valuable market share. The solution was to use an existing aircraft's fuselage while completely changing the avionics suite in an effort to better their main rival.

One important thing to note, however, with changing the entire avionics suite of an aircraft is that it is a major undertaking. One manager likened it to "doing a brain transplant." His explanation was that as the avionics suite contains all of the electronic equipment necessary for the control of the aircraft; it is very much its brain. He compares the difficulty of replacing the avionics of the aircraft with that of replacing a human's brain because of the complexity involved and the unacceptability of errors.

2. Project Team Context

The present section gives a closer look at into the individual contexts of the five project teams. Table 3 presents a background of each project team's roles and responsibilities as well as the aircraft program which they are a member of. Following table 3 will be an introduction of each project team documenting all of the individualized characteristics of the group including any successes or hurdles they have had to overcome. Secondly, four contextual factors or behavior forming attributes (Ghoshal and Bartlett, 1994) will be used as a means of

circumscribing the working context of each project team. Finally, the results of this analysis will be given with a final ranking of each project team’s performance at the end of the section.

Table 3 Project Team Roles and Responsibilities

Program/ Team Name	Alpha/ Propulsion	Alpha/ Wing	Beta/ Structures	Beta/ Systems	Gamma/ Avionics
Role:	Integrator	Design	Integrator/Design	Integrator	Integrator
Responsibility:	Propulsion, Air systems, Power plant, Fuel, Pylon	Outer- wing, Rib Joint, Stress	Structures, Installation, Air systems, Interiors	Flight Testing, Landing gear, Hydro- mechanical systems	Avionics, Electrical systems

The contextual attributes included in this research include: stretch, trust, accountability and support. Stretch encourages members to strive towards more difficult objectives rather than easier ones. Trust encourages members to rely on one another and to expect that commitments will be met teammates. Accountability encourages all employees to meet the commitments that either they have set for themselves or are set for them. Finally, support encourages helping out your fellow employee (Gibson and Birkinshaw, 2004, Ghoshal and Bartlett, 1994).

In this section, the four contextual dimensions proposed by Ghoshal and Bartlett (1994) to be used as part of a theoretical framework to explain the reality of what is occurring in each of the project teams. These four factors are used by researchers to describe a contextual reality. They are not conscious management tools Therefore, these characteristic were used only as a basis for explaining the context within each group.

2.1 Propulsion Team

The propulsion team is charged with three major sections of the aircraft. The first section under their responsibility is the power plant or the engine. The second section is the aircrafts air systems. These include fire extinguishing, auxiliary power, lightning strike protection and any environmental control system on the aircraft such as heating and pressurization. The third and final section is the pylon which is the suspension device installed on the wing that serves to attach it to the engine.

The belief of those working on the propulsion project team is that they are part of a program that is of particular importance to the organization. This feeling translates to the members of this project team in several ways. From the moment where financial difficulties began to plague the industry, the upper management of the firm made it very clear that this particular program was protected from any cuts that may be felt within the rest of the company. This provided quite a bit of reassurance to the Alpha program members while ensuring that there would be little stress of losing their positions.

As mentioned previously, the Alpha program has recently improved upon on an inter-group collaboration process called the Integrated Product Development Team approach. This process incorporates a flatter hierarchy as well as co-location with various members working on the same program such as suppliers, sales staff and designers. This is a concept the director and his managers remains very excited about. However, as it goes against what has been done for many years at the company, one manager commented on how “you cannot change people’s attitudes overnight.” He further goes on to say that “when people come on to the program if they

are not comfortable with this as a concept, this is not the right program for you to be working on.”

This flatter hierarchy is evident in the way that the firm has organized its office space. The only evident distinction between a director or manager and an integrator is a few guest chairs in front of their desk. There are no solid walls or office doors and many of the managers state that they have an “open door policy”. All of this is to ensure that there are high levels of communication between relevant groups and individuals.

2.1.1 Stretch

With regards to organizational stretch, defined as setting goals that exceed the capabilities of a particular employee, each member of this project team felt increasingly stretched as the project completion date draws near. They seemed to feel stretch on account of the amount of work that they must accomplish each day. As one member put it “we feel stretched in time, not expertise.” This means that stretch goals were put in place to deal with a scarcity of employees working for his project team, rather than a method of developing employees.

The fact that the aircraft is a clean-sheet design means there are unknowns at every stage in the program. Issues can come up without warning and force employees to scramble for solutions. This ensures that schedules may not always accurately portray what is necessary to get the program to the next stage of development. It is often these unknowns that often contribute to the amount of stretch necessary to meet their schedule objectives.

2.1.2 Trust

The relationship between employees and management tended to be quite productive in this project team. As one integrator puts it “my manager often asks my opinion on reviews of designs.” Trust was also favored because all members who work as integrators or managers have the fact that they are all engineers in common. This solidarity among professionals is an evident reason for such high levels of trust in the group. Moreover, the fact that the Alpha program is deemed a protected program with no budget cuts planned for the rest of its development signifies to employees that they had a sense of job security.

2.1.3 Accountability

Accountability where members step forward and claim ownership for their work and are willing to see it through to completion provides an added layer of security to the aircraft design process. Each one of the interviewed project team members agreed that that accountability was present. As one integrator states “we are not controlled...we have an objective and we are accountable to make it happen.” Also, a manager stated that “We have been very good at ensuring that each employee takes ownership of their own work...If there is success, they will receive the accolades, if there is failure, it’s on them as well.” This comment reinforces the idea of accountability as each component is tasked to a particular employee and when the work is done well they are praised, however, the same can be said if there were defects in their work as responsibility would be put squarely on that individual.

Along with trust, the accountability within this project team seems to be linked to the majority of employees being professional engineers by trade. This commonality among

employees assures managers that employees act professionally and are willing to stand by their commitments even if it means coming in and working unpaid overtime hours. This understanding between manager and employee creates feelings of empowerment where some authority is transferred to lower levels and they are encouraged to question all aspects of their work to gain further understanding.

2.1.4 Support

There seems to be relatively high levels of support provided to the employees of the group by the upper management. The director states “You have to visibly support your employees as long as you are convinced that they are working towards the overall program goal. If [the goal is] aligned [with business objectives], they have my full support and I will go a long, long way to make sure that they get what they need.” This is felt throughout the group and the necessary roadblocks are taken care on in a decent amount of time.

2.1.5 Summary of the Propulsion Team working context

Overall, this project team provides its employees with a very positive working context. The employees generally feel stretched in time but not in expertise. Trust levels between management and subordinate are high and employees are willing to take full ownership for the completion of their tasks. Finally, support is provided throughout the group and roadblocks are removed by management whenever possible.

2.2 Wing Team

The wing team is tasked with the design, manufacture and certification of the wing for the Alpha program. Their work includes stress testing, the ribs or interior of the wing as well as creating demonstrator and test wings for analysis. This United Kingdom group is the only European project team interviewed for this program. As they are distantly located from headquarters, it is expected that their context would be quite unique. It became evident when discussing the context with this particular project team the members seemed to share relatively homogeneous concerns. As mentioned before in chapter 3, each project team members was asked about a particularly important change that had occurred in the past six months. The majority of members of this project team used their recent switch to a more matrix-type structure as their example of a major challenge or change faced over the past six months. This change was not only significant in size but there were strong feelings regarding the way in which it was handled.

The general feeling towards the change to a matrix structure was that it was not clearly stated at the beginning and that “some people were being told different things than others” as one manager puts it. In addition, the top manager mentioned that the change came at a bad time and has upset the flow of information among groups, while another manager states that “people [in this project team] are moving between functions and were expected to turn up in new roles without good clear descriptions of responsibility.”

2.2.1 Stretch

Members within this project team believed that they were quite stretched as many were forced to switch responsibilities very quickly on account of the major organizational change that took place in the project team. This has translated into a lot of stress as employees wrestle with completing their original mandates while learning their new positions. Employees also felt that they faced a constant challenge making sure that schedule targets were met. There was also a major effort on the part of management to provide an opportunity for advancement in the company through a newly improved succession planning exercise.

2.2.2 Trust

The feelings of trust within the project team appeared mixed where some believing that it is lacking, while others believe that it is an implicit aspect of their work. As one manager states “If I can’t trust that they are doing the right things, it’s not good because in the type of work we do there needs to be trust built in.” Another manager contends that “the fact that we have differences in opinion and we have conflicting priorities is probably several symptoms that a lack of trust brings.” These differences in opinion regarding the trust between managers and employees make it difficult to get an accurate grasp on the extent to which it is present within this project team.

2.2.3 Accountability

Upon analysis, accountability tended to be one of the main themes surrounding this project team’s shift to a matrix structure. The focus was to provide customers with a better product as well as improved customer service. This more open structure provided a means of

lowering hierarchical barriers and ensuring that information was more readily transferred across task boundaries. The structure, furthermore, ensured that there were fewer places to mask unacceptable performance and provided the added safeguard that each employee must stand for their own work.

With regard to the new companywide employee incentive program, accountability played a large role in its success. As employees were no longer being paid for overtime hours, management had to rely on employees to take ownership in their work and see it through to completion. This change in the way that employees were compensated required high amounts of accountability from all levels. However, this was not completely present in this project team.

2.2.4 Support

Support seemed to be readily available as the managers contended to keep “open door policies.” The integrators felt that the firm provided them with plenty of opportunities for training courses and continuing education. There is commonly held belief that management is there to help remove barriers, however, this does not occur at all times. As this project team is in the process of doing a succession planning exercise where managerial replacements were groomed in advance for the positions that would take in years to come. On account of this exercise, there have been directives from management to make significant improvements to the way in which support is given to employees, with a particular emphasis on those being groomed for promotions.

2.2.5 Summary of the Wing Team working context

With regard to the quality of the working context, this project team ranked lowest out of all other interviewed project teams. The group felt they overly stressed and stretched in many different directions due to recent changes. There were mixed responses regarding project team trust. The motivating factor behind this project team's structural change was to increase accountability. This being said, perceptions of accountability among project team members were ranked relatively low, however, many have said that they felt it was improving. Finally the most positive factor regarding the working context of the project team was the presence and availability of support.

2.3 Structures Team

The structures team is tasked with a variety of integration and design roles for the Beta program. Their primary role is the overall structure of the aircraft which includes the composite material design for the program. Their second function is the installation of sections of aircraft. This particular project team was faced the major obstacle of keeping their area of the aircraft on schedule while their keystone composite materials supplier filed for bankruptcy. This caused shockwaves across the entire Beta program. However, this project team was the most affected as they had been tasked with coordinating with this bankrupt supplier to produce the structures and fuselage of the aircraft. News of this abrupt bankruptcy caused management to scramble to find a way to keep the program alive. The surprise of this unexpected event also caused some unease among members of this project team and rumours about the uncertain future of the program began to circulate.

It was decided after a thorough analysis of all available options that the aircraft producer, but more specifically, the structures project team would take on the responsibility of designing and producing the composite structures. This decision demanded a massive new hiring initiative as well as a request for employees with familiarity with composite material design within the company.

To add to the complexity to the working context of this project team, they have also had to deal with high levels of turnover in their upper management ranks. According to the director of this project team, the reason for many of these personnel changes stem from a lack of performance from the top to the bottom of the hierarchy. With the major changes faced by this project such as the transition from an integrator to a design team it is obvious that as they tried to get themselves back on schedule, there would be very little room for error in the future.

2.3.1 Stretch

This project team felt that they were pushed way beyond what was reasonable as their group continued to be chronically understaffed. “The goals that are asked of us are not always considered unreasonable. It’s just that we are stretched because there are not enough of us to get those goals done.” Due to very difficult schedule objectives, many considered it a stretch taking care of their responsibilities on time. From what could be gathered during the interviews, managers only seemed to try and give their employees more difficult goals during times of crisis. However, many employees already seemed stretched with the amount of work they had to accomplish each day.

2.3.2 Trust

Trust in the management and employee levels of this project team appeared relatively high at the time of the study. It was evident upon interviewing this group that this had not always been the case. During the transition period where their main supplier had gone bankrupt, there were a lot of upper level changes. With some stability present for the first time since the program's inception, there is an effort on the part of management to begin building trusting relationships with employees once again.

2.3.3 Accountability

Accountability was found to be very high in this project team. Most of those interviewed believed that this was the case because of the way they were organized. In this matrix structure everyone is "held accountable for their work", goals are very clear, it's "easy to find out if someone is not meeting expectations and "there is very little place to hide" according to one manager. In addition, with the change in incentive system, there has not been a noticeable drop in productivity as employees are willing to work unpaid overtime hours to meet schedule objectives.

2.3.4 Support

The perceptions of support within the project were relatively high. The one area, however, where talk tended to move towards the negative was during discussions regarding support from other project teams. The issue with these members was that with each project team dealing with their own schedule objectives, other teams placed little importance on supporting one another, even though it would be of mutual benefit. The demand to provide support for both

their group as well as others provides an accurate portrayal of the difficulty dealing with competing objectives. It has become evident that project teams cannot effectively meet their schedules without the support of other groups. From the discussions this seems to be an area of focus across the Beta program that members are trying to improve cross-group relationships for the good of the program.

2.3.5 Summary of the Structures Team working context

Members of this project team felt so stretched in terms of what was being asked of them that many felt that rather than improving, they would continue to fall farther behind on schedule objectives. Trust was moderate because of high levels of turnover at the management level. The project team ranked very high in accountability as each felt responsibility towards their work. Finally, support from management was considered to highly present, although work is still being done to improve inter-group support.

2.4 Systems Team

The systems team is tasked with, among other things, the hydro mechanical systems of the aircraft including landing gear and environmental controls of the aircraft such as heating and pressurization. They are also in charge creating a mock-up of the aircraft and flight testing it for certification. To put it simply, this project team is tasked with creating all of the working systems of the aircraft.

The team's director has made directed his focus more towards emphasizing a culture focused on success as a company rather than success as a team or group. His reasoning is was with so many suppliers providing parts and so many integrators trying to make each of these fit,

there must be a more concerted effort to provide support for those who need it regardless of their team affiliation. However, he states that with the current way that performance is measured in the organization, collaboration is not appreciated nearly enough.

Unlike the structures project team, this Beta program project team did not have to make substantial changes to their operations upon the bankruptcy of the programs largest supplier. As such, this project team was able to continue going about their tasks with no interruptions. However, as they became aware of the crisis in the structures project team many felt that they had no control over the outcome of the program. Once the decision had been made that the Beta program would not be stopped, there was a major push on the part of management to get the entire program back on schedule. This effort according to their director “could sometimes compete with individual employee development and training goals.”

2.4.1 Stretch

It was unanimously agreed by the project team members that they felt stretched in terms of the work they were asked to accomplish. The director of the group believed that it was important because it pushed his employees to do more than they thought capable. Conversely, another employee believed it was best used as a time management tool. Stretch compels employees to make the best decisions regarding what needs to be done immediately and what can be dealt with at a later date. Both are accurate outcomes of stretch, but it becomes evident with this project team that the lens changes from stretch being about efficiency for front line works to productivity for managers.

2.4.2 Trust

When asked about trust levels within the systems project team, the director responded by saying that they were above average compared to his past experiences on other project teams. He reasoned that one of the factors for trust not being more prevalent was that the majority of those in positions of power in the project team have been recently hired as replacements for unproductive managers. With so many members of the project team being new to the group there was little time to accurately form trust bonds among the employees. One of the managers also explained how important it was to have people in positions of authority below him that he can trust. This feeling of trust within the project team has contributed to less stress being placed on any individual.

2.4.3 Accountability

According to a manager there was “a lot of personal ownership on tasks...people start to work on tasks earlier.” They were also willing to work unpaid overtime if their projects fell behind. There also seemed to be a fair amount of personal reflection on behalf of the managers when issues have arisen. The director explains this by saying “One thing I do before I hold people accountable is I always try to double check to see if they failed because I did not do my part correctly.” If the expectations are not met even after this reflection, problems are discussed privately rather than airing grievances for the entire project team. This ensures that work is corrected without embarrassment. Furthermore, as personal task ownership levels are high in this group, employees are willing to put extra hours into to making things right even if they are not being compensated for this work.

2.4.4 Support

The primary responsibility project team management, according to the director is to “eliminate roadblocks” and “do anything required for staff members to succeed.” However, there seems to be issues with following through on these responsibilities. One manager discusses how time constraints often lead to difficulty “giving the face-to face interaction that [employees] deserve.” In addition, the director feels that sometimes he does not follow his own advice as “support to my superiors is always expected to be at a higher level than the support I show to my direct reports employees.”

It seems counter intuitive for managers and directors must to respond immediately to superiors while not following up adequately with subordinates. It does not; however, appear to be a localized phenomenon only in this project team. The fact that one’s career is dependent on the goodwill of superiors evidently plays a major role in this. Nevertheless, by not adequately providing support for subordinates, these managers run the risk suboptimal results that may jeopardize promotions in a more direct way.

2.4.5 Summary of the Systems Team working context

The systems team produced a somewhat positive context for its employees as stretch was considered important but was reasonable. Trust between members, although moderate, is improving as employees get to know one another better. Accountability is high and support is considered to be strong although it seems to be stronger when it is provided to someone in the position above the employee rather than the other way around.

2.5 Avionics Team

This project team was created for the purpose of developing, along with their main supplier, a new avionics suite for an existing aircraft's structure while ensuring a seamless integration. An avionics package denotes all of the electronics involved in flying the aircraft. These include communication, navigation and display equipment. The goal is to create an aircraft that will be both easier to fly for the pilots and safer for all travelling on board.

Tasked with improving a previous design, the avionics project team is faced with a different set of issues than any other of the four project teams have had to deal with. The primary issue for this Gamma project team is that they need to adapt to having a relatively small amount of fully dedicated employees on this project. Rather, managers must rely predominately on a pool of engineers that must be shared with other projects. As one manager puts it "Trying to bring together these people and keep them working on one program is very difficult because it's the same key individuals that needed on all programs."

Another issue is that the entire structure for the aircraft has already been designed must be reused. This creates a major challenge as all innovations must fit into the original structure of a previous aircraft. This, in a way, makes the work more difficult because there have been no allowances given for changes to the existing fuselage design other than the addition of a few extra antennae. By being confined to a certain set of dimensions this both hinders development of further innovations to the aircraft and sets constraints for employees during the course of the program.

What makes this project team's work easier is that they need only to coordinate with one supplier as the major change is in the avionics of the aircraft. This ensures that once an

agreement is made with that one supplier, work can continue smoothly without coordination memos being sent out to all other stakeholders. This difficulty with integrating parts from various suppliers has been a contributing factor recently to many delays in aircraft production schedules. However, as costs continue to rise, the reality of mitigating financial risk through the risk-sharing partnership model becomes an ever more important aspect of doing business in the aerospace industry.

2.5.1 Stretch

One of this project team's managers adequately sums up the groups feelings about stretch "There is a lot of [stretch], we ask a lot of our employees and we expect a lot of ourselves." For the most part there does not seem to be an overly burdensome amount of stretch in this project team although as a section chief explains "by virtue of team's small size we are stretched". There are several indicators, however, that provide insight into how employees may be stretched far more in the future. The first of these reasons is change in the compensation package where employees are no longer being paid for overtime. This has the potential to create issues with schedules as employees decide to return home after fulfilling their minimum time requirements. This paired with the knowledge there is already more work to do than manpower puts this project in potential jeopardy.

2.5.2 Trust

Trust between management and employees in this project team appeared high on many levels. There is sense of trust because every employee on this team comes from a similar engineering background together with trust that has developed by working together on the

projects for several years. This overall high level of trust within the project team has translated into very positive outcomes.

2.5.3 Accountability

During the development of the aircraft which would later become the fuselage for the Gamma program, accountability was “viewed as a means of reward and punishment, if you meet this [objective] you will be rewarded, if not, you will be punished.” The new approach taken in the Gamma and proceeding programs is ensuring that ownership is taken for all tasks and if difficulties arise it is the responsibility of the person with ownership to bring it to the attention of the whole team.

One section chief believes in accountability so much that his way of dealing with his staff is “basically, set divisions as the team lead and then get out of the way.” This accountability through empowerment has created an atmosphere where it is perfectly fine to bring up issues as long as you are looking out for the best of the project. However, with only a few employees working full time on this project there is difficulty making sure that temporary employees produce what is expected of them, especially since overtime hours are no longer paid out.

2.5.4 Support

With the growing difficulties integrating with members of the organization and supplier base, there has been a major push within the entire project team to provide as much support to employees as possible. This initiative has taken time, effort and help from external consultants to understand how to better support their employees. The difficulty with providing support for this project team is that there are only a very small number of fully dedicated employees working on

this team. The rest come from a group of core engineers that get shared with several other programs. As the employees change ever few days the support demands change as well making it difficult to tailor any support structure. This paired with trying to coordinate the comings and goings of changing personnel only adds more difficulty to the process.

2.5.5 Summary of the Avionics Team working context

Trust was generally agreed upon by employees to be present within this project team. Many employees had spent years working together on different programs. Perceptions of stretch seemed to be relatively high, although manageable for this project team. Accountability, although moderate, seems to be improving within the project team. Support appears only moderately provided by management as they are forced to spend most of their time focusing on finding adequate temporary staff to keep their schedule targets. Below in table 4 is a summary of the results from each of the five project teams as well as their overall rating.

Table 4 Project Team Contextual Factors and Rankings

	Alpha Propulsion*	Alpha Wing†	Beta Structures*†	Beta Systems*	Gamma Avionics*
Stretch	Very High	Very High	Very High	High	High
Trust	High	Moderate	Moderate	Moderate	High
Accountability	High	Moderate	Very High	High	Moderate
Support	High	High	High	High	Moderate
Overall Rating:	1st	5th	T-2nd	T-2nd	4th

*Denotes an integration team

†Denotes a design team

3. Organizational Slack

In order to garner a greater understanding the level of slack available in each project team, interviewees were asked about the difficulties involved in dealing with a potential staff reduction. From this they were asked how seriously it would affect the project teams output over the next year (Nohira & Gulati, 1996). The responses were analyzed in this section. In addition, the inverse relationship between perceptions of organizational slack and stretch was examined.

3.1 Propulsion Team

Only one of the project team's members believed that there would be no effect given 10% reduction in staff. The rest of the members felt that a reduction of this magnitude would affect them negatively at varying degrees of severity. Some went as far as to say that "it would kill" and that the group at the moment was "right at the peak" "already short" and "right on the brink of scheduling". While others felt that it would be tough and that "objectives would need to be prioritized in that situation". There was a general feeling that in the case of such a crisis where a number of employees would have to be transferred to another task it would lead to a greater possibility of burnout for those left behind. The reasoning is that schedules would remain the same while a reduction in number of employees would lead each employee having to carry more of the workload. Furthermore, the Alpha program is currently in its conceptual design phase, which is considered a pivotal time for any aerospace program as design drawings become finalized. As there is little time to spare all available personnel is needed during this "do or die" phase.

3.2 Wing Team

Of the four members from this group the project team leader believed that there would be major issues if the team's staff was reduced to levels 10% below what they were at the time of the interview. His reasoning was that he was already having difficulty with making the amount of engineering hours assigned to the project fit with what needs to be accomplished. Of the remainder of the group, one manager believed that it would not have a significant effect on performance. The remaining two members felt that no significant effects would be felt unless project team strength was reduced by 10% or more.

3.3 Structures Team

The responses regarding the perception of slack were particularly mixed with this project and seemed dependant on the hierarchical position of the employee, as the responses ended up forming an inverse U-shape. The head of the project team believed that the entire project would be profoundly affected. His reasoning was that without any reductions his schedule "at the edge of the cliff." Thus, a workforce reduction would have a disproportionate effect on the remainder of the group. The two managers of the group both believed that it would not have a significant effect on output and one mentioned that "I would rally the team and find ways of keeping the commitments going," while the other believed that reduction levels would have to reach 10% to feel significant effects. Agreeing with the director, the two integrators believed that they already did not have enough time and trouble would imminent if the project team lost more staff members.

3.4 Systems Team

One of the managers of the systems team sums up the group's feelings very well "With every program that I have worked on it seems that we are staffed with fewer so you must be leaner and meaner and you have to be smarter when you work." This suggests that as time goes by the slack resources provided for each program becomes closer to the minimum allowable as cost-cutting and waste reduction takes on increased importance. With this in mind, it is evident that regardless of the number of employees involved, the schedule goals must be reached. As such, it is the opinion of the group that in the case of a reduction of staff the overall end date of the program would not be affected. The effects of this change, however, would be felt in the companies' other initiatives such as employee development and training and continuous improvement objectives.

3.5 Avionics Team

When asked what a reduction in staff levels would do to the project team's performance the director replied "that is where the management earns their keep by addressing those issues." There was a common sentiment that the project team would be able to overcome a shortfall in staffing levels and it would not throw their schedule into trouble. All of those interviewed agreed that it would cause some difficulty; however, they believed that they would somehow get back on schedule either by reducing the amount of deliverables or through the acquisition of additional resources. Table 5 below documents the question asked to each individual, the responses as well as their slack perception rating.

Table 5 Evaluation of Project Team Organizational Slack and Stretch Comparison

Question: Assume that due to some sudden development, 10% of the time of all people working on your project team has to be spent on work totally unconnected with the tasks and responsibilities of your team. How seriously will your output be affected over the next year?					
	Alpha Propulsion	Alpha Wing	Beta Structures	Beta Systems	Gamma Avionics
Slack Reduction Perception	8: Seriously Affected 1: Not Seriously Affected	1: Seriously Affected 3: Not Seriously Affected	3: Seriously Affected 2: Not Seriously Affected	0: Seriously Affected 3: Not Seriously Affected	0: Seriously Affected 3: Not Seriously Affected
Overall Rating (Perception of Available Slack)	5th	3rd	4th	T-1st	T-1st
Perception of Stretch	Very High	Very High	Very High	High	High

The results of table 5 suggest that the systems and avionics project teams both share the perception that they would not be seriously affected by a reduction in staff. The wing group ranked third having only one employee believe that their productivity would be seriously affected. This was followed by the structures project team where over half of interviewees believed that they would be seriously affected. Finally, the propulsion team ranked lowest on perceptions of available slack as eight of the nine members believed that they would be seriously affected by a drop in personnel.

It is interesting to note that when comparing project team perceptions of organizational slack with their perception of stretch, the results mirror one another. The two project teams tied for the highest perception of available resources also had the lowest levels of perceived stretch. Conversely the project teams in the bottom three in terms of slack perception ranked very high in

terms of stretch. This provides evidence to suggest that in this organization, the perception of slack resources is inversely related to perceptions of stretch.

4. Ambidexterity

4.1 Propulsion Team

The inception of this program began with a decision by the firm's top management that a fresh way of doing business should be explored. From that point, a group of vice presidents and directors were brought together and were asked to develop a structure to carry out this new vision. The approach they took according to one director is "if you could decide and do anything you want, what would we change?" The reason for this major change was that functions within programs were organized "pretty much like fortresses or silos" where "there was not good communication across functions...there was a lot of protectionism of information and solutions were not looked at in terms of what was best for the customer or the firm as a whole."

One of the suggestions brought forward by this particular group was to make sure that the members of each project team be co-located with support personnel and, when possible, supplier representatives. It was expected that proximity would improve communication and learning as well as enable individuals to make decisions much faster. "We're putting more quality into the design. When your people tell you that, you know you have done something right" says the project teams' director.

This transition, as part of the Alpha development process, can be considered to be a change in organizational configuration that is expected to enable contextual ambidexterity to flourish. Through this new structure, employees were enabled to increase their cross-group

collaboration, while being empowered to bring up new approaches without the fear of reprisal from management.

Several years ago during the Alpha program's introduction to the market, the program suffered a major setback when inadequate purchase interest forced executives in the organization to reconsider going forward. Top management then decided to put the entire project on hold, pending further design changes and optimization of the aircraft. This was seen as a major blow to everybody involved in the program and forced the programs management to make cuts to the majority of staff working on the project. One particularly ambidextrous act performed by the management team in response to this event was to use their contacts within the organization to find spaces and relocate each of the affected employees to various other programs within the firm. Along with this placement was an assurance that once the aircraft was fully optimized they would be able to find work on this program once again.

Once the day came when the aircraft producer's top management agreed to move forward with the optimized Alpha aircraft design, the reaction to the aircraft improved and initial orders for the plane were made. Soon after, a ramp up was initiated and hiring began in earnest. Around that time, the management team kept their promise and offered employment to any of the once laid-off employees. The better part of them chose to come back to the program because of the way they were treated during the programs darkest period. This ingrained trust also contributed to a much smoother ramp-up of employees as many had worked on the program before so they could aid in bringing completely new employees up to speed.

This group decision to take care of each and every member of project team shows their willingness to adapt to less than ideal situations while aligning itself with the interests of the firm

as a whole by retaining highly trained staff by transferring them to other programs within the organization. This event also shows foresight and belief that the project would once again require these employees. From this standpoint keeping them within the organization seemed like the best means of accomplishing this.

Upon launch of this program, a massive hiring initiative took place to bring the project to full program status. All interviewed members felt that the transition from a small group of employees to a full program went relatively smoothly. This is quite an accomplishment seeing as how they went from an optimization staff of between 50-100 employees to current levels reaching an upwards of 1,300. Nonetheless, there were still issues with transferring information accurately across this growing group of employees and suppliers. From this dilemma of how to improve communication, two ambidextrous solutions arose from members of the project team.

Prior to working on the Alpha program, one section chief had spent many years working for a large aerospace supplier. After having worked for the supplier for five years he had acquired an intimate knowledge their personnel and who to go to for assistance on a particular problem. When he recently changed employers and moved to work for the aircraft producer, he realized that he had lost this intimate knowledge of experts within the organization and who would be best suited to provide assistance on problems that would arise

During a continuous improvement brainstorming session with the project teams' director, the above mentioned section chief discussed his difficulty finding experts within the firm to help him with his work and how other new members of the project team faced similar hurdles. From this discussion, he was tasked by the director to producing contact list that each new project team employee would receive as part of their welcome package. This initiative to improve the ability

of the project team to contact experts and key personnel documents how the employee and the project itself is willing to listen and adapt to issues that come up from employees. In addition, this improvement to inter-group communication is a method of making veteran personnel more approachable for new employees in the project team in need of advice and mentorship.

The second ambidextrous solution from these brainstorming sessions was from an integrator who discovered serious inefficiencies in the way that information was transmitted between integrator employees and their supplier. The integrator was then teamed up with a project team Information Technology specialist and put in charge finding a potential solution. By streamlining the process so suppliers could insert their own data without having to send information to the firm for input, the two members improved the overall efficiency of the procedure “tenfold”. Furthermore, because of its success, this process was adopted and implemented across the entire Alpha program. This improvement shows ambidexterity because by making just a few changes to an existing process the project team was able to create a workable solution that was standardized across the entire program.

Across the entire Alpha program new ideas are being tested and implemented at every stage, as one manager puts it “so many people wanted to change and improve just for the sake of change.” This mindset stands in stark contrast to the actions of a truly ambidextrous firm as past knowledge is discredited without thought as opposed to being incorporated into new thinking. This emphasis on changing all things reached a breaking at a project team meeting point early in the program when one employee stopped the group and said “just wait a second, do you realize what you are doing and how you are mixing up everybody who has to pay attention and remember all of this stuff? We must go back to basics, before we decide that we want to change

something, let's talk about why?" Basically, this employee likened what was happening to "throwing the baby out with the bathwater." This employee's statements began to change the mentality of people who thought that they needed to change every aspect of the group. If it had worked in the past and it continues to do so, then it should be left alone.

In an effort to formalize the change process, the director of the project team began to ask for improvement suggestions from his employees that would be discussed as a group. On a monthly basis, the director and his management team would then discuss the feasibility and implementation of these suggestions. As one section chief states it was "sort of a brainstorming session...highlight[ing] all of the areas of concern." From this meeting, a top ten list would be produced and volunteers would provide their own timeline for implementing one of the decided upon changes.

This move to make improvements to the project team in a more organized and formal way illustrates how the project team's management is trying to evaluate the necessity of each suggestion before it gets accepted. Acceptance is generally given to the proposals that are most disciplined. This discipline can translate into the amount of effort, time or money needed to fully realize the proposal. In addition, there is also another layer of discipline implemented in this vetting process where existing capabilities are examined to decide whether a completely new way of doing things is necessary or if minor changes can bring about a solution. The project team has made a positive step forward by taking a more measured approach to improvement initiatives as trying to improving everything at once may be equally detrimental as doing nothing at all.

4.2 Wing Team

The United Kingdom project team seemed to be affected by serious communication issues among the various levels of the hierarchy. According to interviewed project team members, these communication issues stemmed from two major triggers. The first and most important was their shifting to a different style of matrix structure. The main difference to many employees was the creation of a chief engineer's position rather than having individual heads of the various groups within the project team. The rationale behind the creation of this new role was to improve communication between this group and headquarters. The creation of this new position has reshuffled the role of many of the department heads and has created some initial problems regarding communication and delegation of responsibility. The second change stemmed from the project team finishing the first phase of their contract for the wing.

Both of these changes illustrate this project team making an effort to integrate with headquarters and the rest of the company. The data collected during the interviews indicated that both of these changes were not handled in the most appropriate manner as many employees were left unclear about their responsibilities as well as the rationale behind the change.

With one manager, this communication breakdown became evident by him having to deal with the fallout from being put in charge of employees from other groups with projects ongoing. His solution was to become a broker who would meet with the employee he would need as well as their current manager in order to get them both on board. This individual interaction with the employees and their managers was used in addition to setting up meetings with both groups to discuss responsibilities and how to make both groups happy before problems occurred.

By acting as a broker on behalf of his new subordinates, the transition between groups began to improve. With his project team recently completing a major section of their development, it was inevitable that changes needed to take place and staff would need to be moved. He also ensured that his new employees took care of their responsibilities before they shifted roles. This served to ensure that relationships among project team members would not be affected by this sudden transition.

Another ambidextrous move brought forward by a wing project team manager was to implement a succession planning exercise where high potential employees would be groomed for advancement. This decision was an attempt at “giving people the opportunity and putting people in positions that were developmental for them.” Management believed that it would only be successful if the high potential employees were provided with adequate mentorship and support. By developing employees from within they are taking existing employees with an intimate knowledge of the organizational environment and molding them into the next generation of leaders. The conscious decision to begin this process came from the immense growth and transition faced by this project team, but only serves to aid the organization over the long term.

4.3 Structures Team

In September of 2008, the structures project team and the Beta program as a whole was faced with a major crisis, as the main structures supplier on Beta aircraft filed for bankruptcy. This ended up being a major surprise to all those within the program and as such, there were no contingencies prepared for this eventuality. Once this news began to disseminate itself around the project team a lot of fear began to propagate that the program would be cancelled. What the

director and his management team did was immediately look around the industry to see if there was another supplier capable of taking on the work. After an examination of the various options, it was decided according to the director that “the best choice was to go ahead and consolidate our own internal resources and augment those by hiring new people.”

This chosen path was only able to function due to the internal connections and linkages formed by the director of this project team. The bankruptcy was made even more difficult for the project team because they were unable to strengthen the firms’ abilities by hiring employees from the bankrupt company. This was due to the suppliers host nation’s strict bankruptcy laws that prevented such moves. This change also depended on daily updates to make sure that the fear of losing the program was kept at bay.

Furthermore, members of the project teams’ middle management had to cope with this change in strategy as they would have to adapt from having a smaller workforce of predominately integrators to a much larger group of designers. This project team was able to meet this challenge effectively by including many upper level employees in the discussions and enabled them to deploy all decisions quickly and efficiently.

These challenges both demonstrate the ambidextrous abilities of this project team. The project team was able to successfully transition from integration to design in a short amount due to the adaptability of the staff members. In terms of alignment, the decision to become a designer fits extremely well because without the sacrifice of this project team, the program would have simply been discontinued.

As this project team is scattered between Canadian and American offices it was interesting to note how members were able to cope with the distance between members. One way

in which management served to bring these two distant groups together was to have the Vice President spend 50% of his time at each office. This serves to make sure that the strategy of both groups remains aligned while the entire group adapts to the globalization of the company.

The systems installation group acts as a broker between systems and structures groups because they are in charge of making sure that all of the various parts fit together perfectly during manufacturing. As they play such a pivotal role in the overall success of the Beta program, it was decided by the management team that they would be splitting their time between the two centers of operation as well. The plan was to have the systems installation group work in Canada for the first portion of the program to be closer to the work being done on structures. Once they had a handle on the work being done by the Canadian project team, the installation group would move be moved to the United States to be closer with the systems team. This ensures that all installation work will remain seamless as this group has had significant contact with both project teams working on the design of the Beta program. As the head of the entire program, the vice-president through these actions is promoting the need to adapt to the fact that the program is being worked on in two separate areas and is aligning his actions with those of the project team by attributing equal importance to each of the two bases of operations.

When speaking to one of the integrators on the installations project team he mentioned how he is responsible for three separate subsystems within the aircraft. He further went on to say that “each one has their own demands that I have to fulfill and sometimes you have to neglect one to work on the other.” Upon further discussion he says that he is really doing the work of two integrators due to a lack of personnel and that “there are others in the group that are doing the work of three or four.” This willingness of the project team employees to take on multiple

roles suggests an apparent lack of slack and how integrators willingly adapt to the realities of this program by being so stretched. Furthermore, their understanding that without their continued hard work, the goals of the project team would not be reached suggests alignment as they are all working towards the same objective.

4.4 Systems Team

The director of the systems project team was brought in to help improve the way in which the group met its commitments. In his effort to change the culture from one that was “officious and stuck to one that is more entrepreneurial and innovative” he decided to consciously act as a broker. He opted to be very inclusive and began to ask for input on how best to go about solving their project team’s problem with meeting commitments. This initial self-described charter contained a list of cultural changes that he believed needed to be implemented immediately within the project team. In his discussions with the rest of his project team he said that the final copy that would be transmitted to the group was “70% mine in terms of the core ideas....As far as the path that we would take for the change, I think it was 30% mine and 70% my team.” The decision to include project team members in the charter process documents ambidexterity as an existing idea was improved by the collective feedback of the group. In addition, the buy-in to this change was improved immensely by letting members have a say in what would be included in the charter as well as the implementation.

A manager working on hydro mechanics for the systems project team shows that he is more than comfortable combining various roles in order to help his project team. Originally, he was a manager who was tasked with leading the programs hydraulic systems. These two separate

roles proved to be overly difficult because he had to take care of both administrative and technical issues at the same time. His solution was to bring both of those positions together to form a landing gear lead position. The responsibility of this position encompasses all of the administrative and strategic work for this section of the aircraft. His solution for the technical work was to delegate that work to another individual who would focus solely on that aspect of the project. By trusting this individual with all of the technical responsibilities this manager demonstrates that his desire to adapt to the ever-changing needs of his project team by taking on new roles.

One particular employee demonstrating ambidexterity on this project team was the manager in charge of flight testing. His position is one that provides essential data to every other member of this program. Because the project was the first clean-sheet design for this type of aircraft for the firm in over a decade, he made sure that his team relied on the flight test center of the aerospace producer to provide this new program with the well established tools, processes and experience.

The first thing this individual did at the beginning of the project was to go through the information of past programs so that he would be able to have a better idea of how to align his activities with those of the project team and the organization. He mentioned that “What we did on this program was go through all the lessons learned and see if they were still applicable or not. Also, we made sure that we were addressing them so we would not repeat some of the mistakes that we have done in the past.” By examining these past lessons learned he is showing a level of adaptability because he remains open to new ideas while continuing to believe that a strong sense of the past is a source of competitive advantage.

In a discussion with the systems group and many other stakeholders it was found that there was an issue about where to put the egress chute in the cockpit. The egress chute is the pilots exit door during an emergency. It is normally placed in the center of the cockpit but this would not work for this particular aircraft due to the arrangement of the flight control system. Instead, this manager challenged his team to design something that work for all stakeholders. The solution decided by his team that would best suit the situation had the egress chute placed to one side of the cockpit. Some stakeholders, however, were not happy with this decision. Finally, as he puts it “we started working with the stakeholders and we found that if we moved it further back and to the side, it might be alright. We built a mock-up, ran through it and everybody ended up being happy.” This example keeps with the true definition of ambidexterity because he and his team were given a challenge to design and place the egress chute where it would pass certification while still fitting within the parameters of the new cockpit design. In an effort to find this solution, this manager and his group were able to put a new spin on an existing idea and still manage to get the design cleared with all stakeholders.

4.5 Avionics Team

The approach to managing this project team according to the director of the program “has moved towards a much more holistic view of management and a much stronger long-term focus.” He is careful not to be too judgmental of management approaches of the past as they were very successful. Rather he states that “You can have a strong long-term vision and it can have a real effect on the plans of the company in the coming years, yet still have a focus on what is happening today without undermining the strength of the organization and ability to achieve

stakeholder goals.” These comments show how this project team is making an effort to learn from their past to better be able to use this knowledge to deal effectively with new challenges.

This demand to constantly learn to make better decisions goes beyond the project team level and has translated into examining other organizations to uncover how they effectively deal with challenge and change. The director states that “We have spent a fair amount of time studying how strong companies produce quality products such as Toyota in Japan and how they shape their culture.” With this analysis of other companies the director concluded that “one of our challenges is to retain a level of focus on one major issue while still remaining focused on how we get there.”

An ambidextrous project team change occurred when it was decided that all wiring engineers would be amalgamated into one wiring Center of Excellence. Before this change, each aircraft family had an independent wiring group. The reasoning behind this change was because demand for wiring specialists can vary considerably. By bringing all wiring resources together it served to smooth out the variance in demand. Furthermore, now that all wiring experts are now coordinated with one another the company has decided to implement one working platform for each member. This further ensures that any member can work on any of the organizations programs.

The change to create one wiring group for an array of aircraft using a common work platform demonstrates ambidexterity as the project is trying to adapt to the current economic situation by trying to hire fewer wiring contractors. By having one group of full-time wiring specialists able to work on all aircraft, they can better manage the needs of the various programs while lowering overall costs on temporary wiring specialists. This ability to save money on

contractors demonstrates an ability on the part of the project team to take several existing groups who were successful and improving it in a way that it frees up cash for future developments.

4.6 Ambidexterity Ranking

The evidence presented above lead to the identification of four different ambidextrous behaviors. These behaviors, which are somewhat similar to those identified by Gibson and Birkinshaw (2004b), are the following:

- Initiator: One who becomes alert to opportunities even if they are outside the confines of their job (Gibson and Birkinshaw, 2004b)
- Broker: One who is always looking to build linkages with stakeholders (Gibson and Birkinshaw, 2004b)
- Innovator: One who seeks to improve existing organizational capabilities in an effort to gain a competitive advantage for their organization
- Multi-tasker: One who is comfortable taking on more than one role in an effort to accomplish something (Gibson and Birkinshaw, 2004b)

Ambidexterity was measured by examining the extent to which each of these four behaviors presented themselves with each project team. According to Gibson and Birkinshaw (2004b) these behaviors contribute to contextual ambidexterity and illustrate how the competing objectives of alignment and adaptability can be united at the individual level of a project team.

4.7 Ambidexterity Rating

Two expert raters examined each of the project teams' documented ambidextrous solutions and compared it to the definition of ambidexterity. Their inter-rater reliability ranked

highly with an alpha of .94, well above the standard Cronbach's alpha of .70. The results show that the Beta program's systems project team produced the best quality ambidexterity scores with an ambidexterity evaluation average of 7.6 out of 10. This was followed closely by the Beta program's structures project team with a score of 7.5 and the Alpha program's propulsion project team with a score of 7.4. In fourth place was the Gamma's avionics project team with a score of 7.0. Finally, the Alpha program's wing project team came in with a score of 6.6.

Table 6 Ambidexterity Evaluations

	Alpha Propulsion	Alpha Wing	Beta Structures	Beta Systems	Gamma Avionics
Average Ambidexterity Evaluation /10	7.4	6.6	7.5	7.6	7.0
Ambidexterity Evaluation Rating:	3rd	5th	2nd	1st	4th

Upon analysis of the ambidextrous diversity ranking, three project teams produced a three way tie for first place. Each was found to show three of the four types of ambidextrous behavior. The Alpha's propulsion team showed initiator, innovator and broker type behaviors. The remaining two project teams in a tie for first were both members of the Beta project. The structures team showed the behaviors of initiator, broker and multi-tasker while the systems project team had documented cases of initiator, broker and multi-tasker in their project team. Alpha's wing project ranked fourth out of the five teams with documented cases of broker and initiator behaviors. Finally, Gamma's team ranked fifth showing only the initiator behavior. Presented in tables 7-11 below is a breakdown of the triggers faced by each project team as well as the ambidextrous solutions used to deal with each of these challenges. Each ambidextrous

solution is further broken down by the four ambidextrous behaviors and then each project team is ranked based on how many behaviors they exhibit.

Table 7 Propulsion Project Team (Alpha Program – Canada)

Ambidexterity Ranking: Tied-1st

Trigger	Ambidextrous Solution
Significant job cuts to program pending optimization	Broker - New positions in the organization found for all employees made redundant during aircraft optimization
Atmosphere where “change for the sake of change” was deemed acceptable	Initiator - Structure was added to the change process through the director’s implementation of monthly brainstorming sessions where members could discuss how to best go about making improvements to the work being done
A recently hired employee had trouble contacting experienced members of his project team regarding questions he had about his work	Initiator - During recently mandated monthly brainstorming sessions, this employee raised this issue and he was tasked with creating a contact list that would be given to each new employee thereafter
The transference of information between the project team and their supplier base was greatly slowed by the inefficiency of their coordination memo process	Innovator - During recently mandated monthly brainstorming sessions, a team consisting of an integrator paired with an IT specialist worked on and improved the process tenfold. After the success of the initiative it was decided that it would be adopted project wide

Table 8 Wing Project Team (Alpha Program – United Kingdom)

Ambidexterity Ranking: 4th

Trigger	Classification/ Ambidextrous Solution
First phase of project completed Major transformation after phase completion forces employees to be transferred to new groups before all of their responsibilities have been met	Initiator - Entire project team restructured to meet new demands Broker - New group leader worked alongside his new employees and their previous managers to make sure that all previous responsibilities are being met and that the transition between groups is as smooth as possible
Low morale on account of large transitions/growth	Initiator - A succession planning exercise is developed to provide growth opportunities for high potential employees while at the same time preparing for future project team expansion

Difficulties communicating with headquarters	Broker- Aligned themselves with headquarters by implement matrix structure similar to that currently being used in the organizations Canadian and American offices.
----------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 9 Structures Project Team (Beta Program – Canada/ United States)

Ambidexterity Ranking: Tied-1st

Trigger	Classification/ Ambidextrous Solution
Bankruptcy of key supplier of composite materials	Initiator- Immediately began search for capable supplier replacement. Final decision made was to consolidate resources within the project team and design composite structures in house
Bankruptcy of key supplier of composite materials	Broker- Included all directors, managers and project managers in the strategy and decision making for quick turn-around
Work being done concurrently in two separate locations (Canada/ United States)	Broker- Decision for vice-president and systems installations group to share time evenly between two centers, in an effort to increase standardization
A critical lack of highly trained personnel able to fill vacant positions within project team	Multi-tasker- Integrators across the project team are tasked with doing the work of what normally would be given to multiple employees

Table 10 Systems Project Team (Beta Program – United States)

Ambidexterity Ranking: Tied-1st

Trigger	Classification/ Ambidextrous Solution
Project team-wide cultural change that places more emphasis on meeting commitments made	Initiator- Director produced a charter of change and asked for employee feedback regarding how best to implement it
The realization by one manager that he was not providing adequate support to his subordinates	Multi-tasker- Changing his role to take on the strategic work needed for two positions while promoting someone below him to deal with administrative responsibilities and providing support to project team members.

First clean-sheet design by subsidiary of organization in over a decade	Initiator - Managers examined lessons learned from previous projects to ensure mistakes were not repeated
New design of cockpit forces the placement of the pilot egress chute to be moved	Broker - All alternatives for placements of chute were considered, mock-ups were designed and all stakeholders were consulted to ensure consensus on its new placement

Table 11 Avionics Project Team (Gamma Program – Canada)

Ambidexterity Ranking: 5th

Trigger	Classification/ Ambidextrous Solution
The director's realization that his project team's focus on meeting short term goals was causing issues with accomplishing long term objectives	Initiator - Learning from past management practices and other successful companies to create a more long-term thinking project team.
Major variations in demand for wiring engineer specialists	Initiator - Amalgamation of wiring groups from three airplane families to create a wiring Center of Excellence where all specialists are taught a common method to design wiring systems for the various aircraft

5. Performance

Table 12 Project Team Performance

	Alpha Propulsion	Alpha Wing	Beta Structures	Beta Systems	Gamma Avionics
Deliverables Completed ÷ Deliverables Baseline Expected	-	96.2%	96.4%	90.7%	86.3%
Overall Rating:	-	2nd	1st	3rd	4th

As mentioned in Chapter 3, schedule adherence performance was measured using archival performance data provided by the each participating project team director. Each project team was asked to provide a ratio of the deliverables they had accomplished by August 10th, 2009 compared to the amount of deliverables forecasted to be completed by that date. Although each project team started work at a different point in time, this measure of performance is a means of getting a snapshot at how each project team had performed as of a certain date. This performance measure also provides a fairly reasonable comparison among the various groups as each project team is assessed based on their own program forecasts.

Although all project teams provided some form of performance data, only four of the five teams provided comparable information. The data supplied by the Alpha program's propulsion team failed to match the criteria asked for by the researcher. The data provided focused the project team's trends for the future rather than on concrete

attainment of deliverables. For this reason, the information provided by the propulsion project team has been left out

The results show that the Beta's Structures project team had the highest adherence to schedule over the given time period completing 96.4% of their scheduled deliverables. Following the structures team was Alpha's Wing project team. The second highest performing project team was the Alpha's Wing project with a 96.2% average.

One thing to take note of concerning the Wing project team, however, is the timing of this particular metric. When asked to make available the performance data for his project team, the top manager made it clear when that all calculations were done previous to the major organizational changes that brought about a change in direction that forced their project team to go "off-plan". The program needed to go "off-plan" due to an aircraft level change that transformed many of the expectations of the wing project team. As such, employees were required to adapt to this transition. The top manager also mentioned how this supposed trigger lowered the number of deliverables completed in the following months. The majority of project team members chose this change as the most significant in recent memory. Therefore, this very high deliverable rate does not fully represent this project team's performance, especially considering the difficulty faced after this major organizational change.

Following the performance of the Alpha's Wing project team is the Beta's Systems group with a completed deliverables average of 90.7%. In fourth place came the Gamma's Avionics team an 86.3% baseline completion average. Finally, the Alpha

programs propulsion team was not able to provide comparable data for this particular metric and as such was not included in the analysis.

Chapter 5: Discussion and Conclusion

The object of this research was to evaluate the contextual ambidexterity of five project teams involved in three separate aerospace programs conducted by a major global aircraft producer. More specifically, the aim of the research presented here was to examine the impact of ambidexterity on a project team's performance as well as examine the impact of working context, organizational slack and the environment on ambidexterity.

1. Interpretation of results

Consistent with the findings of Gibson and Birkinshaw (2004) regarding the importance of working context on the ambidexterity, project teams with a positive working context was more likely to produce a more diverse array of ambidextrous solutions to potential ambidextrous triggers of challenge and change. Each project team interviewed, to some extent, showed that they were able to reconcile these competing objectives to bring about an ambidextrous solution to a change. This provides further support to the notion that project teams are able to work simultaneously on paradoxical strategies while moving towards a common goal such as schedule adherence.

Table 13 summarizes the results that were presented in the previous chapter including perceptions of slack, evaluations of the various contextual factors, an ambidexterity performance rating as well as a schedule adherence performance rating.

Table 13 Summary of Project Team Results

	Alpha Propulsion	Alpha Wing	Beta Structures	Beta Systems	Gamma Avionics
Perception of Available Slack Rating	5 th	3 rd	4 th	T-1 st	T-1 st
• Stretch	Very High	Very High	Very High	High	High
• Trust	High	Moderate	Moderate	Moderate	High
• Accountability	High	Moderate	Very High	High	Moderate
• Support	High	High	High	High	Moderate
Overall Working Context Rating:	1 st	5 th	T-2 nd	T-2 nd	4 th
Ambidexterity Diversity Rating	T-1 st	4 th	T-1 st	T-1 st	5 th
Ambidexterity Evaluation	3 rd	5 th	2 nd	1 st	4 th
Schedule Adherence Performance Rating	-	2 nd	1 st	3 rd	4 th

The conceptual framework presented in chapter two focuses on how project teams do not need to separate in order to best go about resolving competing goals. Rather, these project teams have decided to cross-functionally integrate into the project team. By collocating themselves with supplier and organizational representatives from various departments, these project teams have overturned the whole idea of structural separation. In the interviews, the most common reason behind this transformation into a broader, horizontally integrated team structure was to further improve communication among hierarchical levels of the project team.

Time and again the importance of communication and its relationship with the contextual element of trust became one of the primary antecedents of contextual ambidexterity in all project team. When employees were kept informed on what was

happening in their project team, they felt more comfortable bringing about ambidextrous solutions as they felt more trusted by their supervisors.

This research provided further evidence of the impact of project team context on the quality of ambidextrous solutions and, in turn, on schedule adherence performance. Those project teams according to the results section with the most supportive working context and highest available slack resources were the most likely to perform best and come up with the most innovative ambidextrous solutions.

There was also an inverse relationship between the perceptions of slack resources and the perceptions of stretch. Members who feel stretched in the amount of work they must accomplish generally feel like there are fewer resources available in the project team to accomplish everything that must be accomplished in order for the program to remain on schedule.

Upon analysis of the five project teams, four different ambidextrous behavior categories were identified. These include the initiator, broker, innovator and the multi-tasker and were found in differing capacities across the five teams. As indicated earlier, these four behaviors follow closely with the behaviors discussed in the Gibson and Birkinshaw (2004b) article on the subject of contextual ambidexterity. In keeping with Gibson and Birkinshaw (2004; 2004b), four contextual ambidextrous types were identified during this research. The results of this research differ on one of these four behaviors. The Gibson and Birkinshaw's (2004b) work lists a cooperator behavior; however, work lists a initiator, multi-tasker, cooperator and innovator behaviors;

however, according to the results of this research the behaviors of cooperators and brokers were too similar with one another. Instead, another behavior entitled innovator was created as many ambidextrous solutions produced an innovation that would later be transferred across the project team and even the entire program.

Each of these four individual types was found to be present within the project teams although no team showed all four behaviors. These four behaviors represent ways in which an individual can bring about an ambidextrous solution. These behaviors show that there can be more than one way to reach ambidexterity in an organization. There were cases where project teams pooled their resources to meet a particular organizational change, while there are other examples of project team members finding innovative solutions to a challenge put forth by management. Furthermore, the more diverse ambidextrous behaviors in the project teams, the more they adhere to predetermined schedules.

There was also a strong relationship between the diversity of ambidexterity within a project team and the quality of their ambidextrous solutions. The three teams who tied for first place in ambidextrous diversity with three behaviors ranked in the top three once again when judges evaluated each of their ambidextrous solutions. This suggests that project teams that can bring about the highest quality ambidexterity solutions go about them in a variety of ways

Working on an aerospace program brings with it an array of challenges that must be faced every day. Project teams must be able to effectively deal with these

changes in a way that existing competencies are complimented by new ideas and practices. It is believed that if project teams can create a working context where these kinds of ideas are nurtured, the issues that present themselves will be more effectively dealt with. In addition, by creating trigger responses that remain grounded in existing capabilities while using new ideas, the outcomes are expected to be both easier to implement and more effective.

According to Gibson and Birkinshaw (2004b) ambidextrous employees are characterized by sharing three common traits which manifest themselves in the four previously mentioned ambidextrous behaviors. The first is that they feel free to act beyond the restrictions of their work for the purpose of acting in the interest of their organization. These individuals are also sufficiently informed in company matters to act without seeking permission or support from superiors. Finally, they encourage action and include others in new opportunities that fit with overall organizational goals. The need for these three behaviors is further evidenced by the variety of ambidextrous solutions brought forward and implemented by the various project teams. The great majority of these solutions required the initiator to embody these three behaviors concurrently.

Although there were examples of each of the four behaviors and three common traits, the particular behavior that ensured a greater majority of ambidextrous solution success was the ability to include others in meeting challenges by acting as a broker. Time and again, this ability to use ones knowledge and connections to become a broker

proved pivotal for ambidextrous solutions. This is not surprising, seeing as how the majority of the work done by each project team is collaborative in nature.

Performance data provided by four of the five project teams was found to be highly consistent with the conceptual framework proposed in this research. There was evidence to suggest that the project teams with the most supportive contexts served to produce more diverse ambidextrous solutions in addition to higher levels of schedule adherence performance. Performance was found to be somewhat related to the amount of perceived slack resources within the project team suggesting that additional resources may play an important role in the attainment of schedule objectives. If project team members feel like they have the additional resources

2. Managerial Implications

The results of this research have several managerial implications. First, the results show that ambidextrous solutions can provide a means of effectively dealing with challenges and changes that organizations face every day. Having individuals within an organization who feel empowered to effectively deal with the sometimes competing demands of their position provides a basis for project teams to become more successful at dealing with complexity. This complexity can arise during decision making or resource allocation exercises. In addition, by examining and reflecting upon traits that has made the organization successful in the past and using that knowledge to answer future questions, it makes decision makers less likely to repeat previous mistakes.

During the process of in-depth interviews with the various project teams, several additional indicators for contextual ambidexterity were discovered. The first was the managerial focus on large scale goals rather than smaller more detailed goals. Giving employees the ability to choose their own path when given broad objectives seemed to provide much richer ambidextrous solutions. Not only does this provide empowerment and motivation for employees to find solutions but because they may have a more intimate knowledge of the challenges they face, they may be in the best position to develop a solution. Furthermore, when employees were included in decision making it makes them more likely to understand the main objectives of the firm so that they can be more focused and effective in adapting to new any challenges that present themselves.

Throughout the interviews, one of the most discussed challenges among all project team members was the company's change of incentive scheme from one that pays out overtime to one that gives out bonuses at the end of the year based on the organizations financial success. Although many understood that this was a way for the firm to cut costs, many expressed concerns that this change to design team compensation would set schedules behind. Many saw the benefit of this kind of scheme for those in the manufacturing area of the aircraft, however, integrator and design teams may suffer from this as much of the motivation to spend additional hours improving designs have been lost. Directors, managers and section chiefs depend on overtime to keep on schedule during pivotal design stages and when unexpected issues become apparent. With integrators, however, there was some talk about how this benefits them by promoting improved their work-life balance. It is current too early to tell whether these bonuses,

which will be paid out early next year, will appease managers who are now forced to negotiate with staff regarding working unpaid overtime and whether schedules will fall behind as feared. I would be of interest additionally to examine whether a project team's positive working context had any effect on commitment of its employees to work unpaid overtime hours in an effort to meet schedules.

Ambidexterity according to scholars is organization's ability to perform seemingly conflicting tasks or pursuing disparate things simultaneously (Lubatkin, Simsek, Ling and Viega, 2006). In this research there was evidence to suggest that this definition holds up with this sample. There is, however, an additional aspect that sets ambidexterity apart from other ways of effectively dealing with organizational change. By integrating past experience and abilities with new ways of thinking, there is a certain amount of discipline being put into the change process. Ambidexterity attempts to find the common ground between inertia and, as one manager mentions, "throwing the baby out with the bath water." By implementing discipline and rigor into the change process, existing capabilities that still serve a purpose are retained and improved, while new ideas are judged against past errors so as to avoid repeating them.

The final managerial implication would be to create a much more efficient and streamlined means of compiling schedule performance data. Seeing as how this information is of importance to people outside the program, it would be ideal to have a way to accurately compare programs taking into account their size and budget. It is obvious that due to the size of the organization this would need to be a concerted effort.

However, this change seems like a natural progression for a company making an effort to reduce waste in all areas of the organization.

Not having an accurate, company or program-wide method of documenting schedule data seems to be an issue that must be addressed within the organization. It seems counter-intuitive that the most important performance measure for development programs be done in such dissimilar ways. This is especially important seeing as how these performance metrics must be interpreted by company executives outside the project team.

3. Contributions

This study contributes to the ambidexterity literature by providing additional insight into what factors enable and inhibit ambidexterity. Prior to Gibson and Birkinshaw's (2004) work on contextual ambidexterity no researcher had fully examined the mechanisms of what truly makes a business unit contextually ambidextrous. This research goes one step further by examining ambidexterity at the project team level where these mechanisms can be observe in greater detail.

This research also documents the importance of organizational change and challenges to bring about ambidexterity and ambidextrous solutions. Without the presence of a trigger, there is little impetus to strive towards innovation. These triggers can be further complimented by contextual, environmental and resources factors to improve the way in which solutions can be brought to culmination.

Over the course of this research, it became evident that a time element exists within this concept. Not only must an individual or project team remain aligned and adaptable but they also must integrate existing capabilities and ideas with the new realities. This pairing of the old and the new provides a way to rationalize what is occurring throughout the process of an ambidextrous solution. However, this need to reconcile two groups of objectives gives an indication of how just how difficult it is to enable effective contextual ambidextrous project teams and individuals.

O'Reilly and Tushman (2004) compared ambidextrous managers and organizations to Janus, the two headed Roman god of doorways, beginnings and endings is often depicted as having two faces looking in out in opposite directions. Similar to Janus, ambidextrous individuals must learn the ability to look into the past and future at the same time. The ability to look both backwards at the ways in which their organization has been successful in the past, while at the same time, looking forward to what the future holds provides a method of successfully dealing with challenge and change.

This research provides insight on the importance of focusing on ambidextrous solutions during times of great upheaval and change. By grounding problem solving solutions in past organizational knowledge, while at the same time, focusing on the future provides employees and management with a means of coping with new realities. Change is by no means a simple process and the more complex it becomes; the more important it is to make sure that the decisions made to address these change keep aligned with the goals of the organization while adapting to changing realities.

4. Limitations

Several limitations of the current study must be noted. Firstly, the research was relatively small with five project teams studied. Although several project team members were interviewed, the material collected may not provide an accurate representation of everything happening in any one particular project team. It must be noted, however, that recruiting participants was challenging given that each project team members interviewed was working full-time on their aerospace program.

The sample was also one of convenience as each senior project team member was asked to provide the names of a few of their direct report employees. This process was continued until members from the various levels of the project team's hierarchy were contacted to participate. This may have contributed to a volunteer bias; however, the questions were very general in nature and the true outcome of research was not initially evident for respondents.

Issues pertaining to external validity include the fact that the study took place at one organization with a specific focus on the aerospace industry. This provides a representative sample for new product developments in this particular organization. However, caution must be used when transferring these results across different industries with varying levels of environmental uncertainty.

Another limitation in this research was the variability among project team performance data. Whereas it was quite an achievement to obtain confidential performance data from the various project teams, the information provided sometimes

differed in terms of depth and accuracy. While all project teams provided information, one project team provided data on future trends which did not serve as an accurate means of comparing their past performance. This seemed to be due to the fact that in this organization performance data is not compiled by a central authority. Rather, the each project team director selects their preferred method of disseminating performance information to their superiors. Some choose graphs documenting what has happened in the past while some choose to explain trends and whether they are improving at meeting objectives or not. This way of keeping schedule data seems to be a rather confusing way of keeping track of the most important variable for new project designs. As such, it was suggested in the managerial implications section above that this issue be looked into further.

5. Implications for future research

The results of the current study suggest several avenues for future research. This research emphasizes the importance on not only studying the antecedents and effects of ambidexterity, but to open the “black box” of ambidexterity to examine its mechanisms. Many researchers have made it their focus to study organizational ambidexterity in various forms, but few have truly studied how it occurs and why. This research provides a first step for this examination of the inner workings of ambidexterity by going in depth with several comparable groups to tease out how ambidexterity occurs and how it manifests itself.

Further studies can use this same in-depth analysis and translate it across a larger sample of project teams and companies to gather further information on how ambidextrous solutions are created. This research only examined ambidexterity within one organization; by extending this research across an entire industry, or group of industries, the implications of this work would be more generalizable. Seeing as how this organization operates in risk sharing partner framework with suppliers, interesting future research could be done on effects of the ambidexterity of Original Equipment Manufacturer (OEM) on suppliers.

Once further focused analyses had been done on a variety of firms, a large scale survey that would serve to provide the means of comparing various groups could be conducted. Such a survey could examine the ability of individuals within a project team to combine new ideas and processes with proven ones while reconciling the adaptability/alignment tradeoff.

Another area of research interest would be to examine project teams with a less homogenous makeup of employees. Every member of each project team came from an engineering background. The extent to which ambidextrous solutions would be used in a setting with a more heterogeneous project team consisting of more employees would be expected to differ to a project team member's background is similar. A subsection of this research avenue would be to examine importance of a professional designation, such is the case with engineers and accountants, on project team ambidexterity. Professional employees are expected to adhere to certain standards. This may play a role in the amount

of freedom they perceive to have when pursuing ambidextrous solutions. In addition, as this sample of employees was heavily male-oriented, future research could look at how gender may affect ambidextrous solution approaches.

In conclusion, this research built on the contextual ambidexterity literature by examining the project teams as the unit of analysis. Interview findings suggest the importance of slack resources and its relationship with stretch. In addition, slack was found to be related to project team context as well as the diversity and likelihood of ambidextrous solutions to challenges and change. The individual ambidextrous solutions seemed to be brought about by four behaviors including: initiator, broker, innovator and multi-tasker roles. Findings also point to the importance of a proper balance between alignment and adaptability goals and, at the same time, examining the past while preparing for the future. This concept of contextual ambidexterity, with its balance of time specific and outcome based goals provides manager and researchers with a promising way of developing competitive advantages.

References

- Adler, P.S. (1999). Flexibility Versus Efficiency? A Case Study of Model Changeovers in the Toyota Production System. *Organization Science* 10, 1, 43–68.
- Albert, A., & D. A. Whetten. (1985). Organizational Identity. In *Research in Organizational Behavior* (263–295, Vol.7). Greenwich, CT: JAI Press.
- Ahuja, G., & Lampert, C. (2001). Entrepreneurship in the Large Corporation: A Longitudinal Study of How Established Firms Create Breakthrough Inventions. *Strategic Management Journal*, 22, 521-543.
- Aulakh, P., Sarkar, M. (2005). Strategic Ambidexterity in International Expansion: Exploration and Exploitation of Market, Product, and Organization Boundaries. *Academy of Management Best Paper Proceedings – International Management Division*, IM31-37.
- Auh, S., & Menguc, B. (2005). Balancing Exploration and Exploitation: The Moderating Role of Competitive Intensity. *Journal of Business Research*, 58: 1652-1661.
- Bandeh, J., G., Kaye, T., Wolff, S., Trasolini, & A. Cassidy. (1996). *Developing Community Capacity: Module One*. San Francisco, CA: The Healthcare Forum.
- Bass B. (1990). Bass and Stogdill's Handbook of Leadership. (3rd ed). New York, NY: Free Press.
- Beckman, C.M. (2006). The Influence of Founding Team Company Affiliations on Firm Behavior. *Academy of Management Journal*, 49, 4, 741-758.
- Beer, M., & Nohria, N. (2000). Cracking the Code of Change. *Harvard Business Review*, 78, 3, 133–141.
- Benner, M.J., & Tushman, M.L. (2003). Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited. *Academy of Management Review*, 28, 2, 238-56.
- Berthon, P., Hulbert, J.M., & Pitt, L.F. (2004). Innovation or Customer Orientation? An Empirical Investigation. *European Journal of Marketing*, 38, 9/10, 1065-90.
- Bourgeois, L.J. (1981). On the Measurement of Organizational Slack. *Academy of Management Review*, 6, 29-39.

- By, R. T. (2007). Ready or Not. *Journal of Change Management*, 7, 1, 3–11.
- Cheng, J. and Kesner, I. (1997). Organizational Slack and Response to Environmental Shifts: The Impact of Resource Allocation Patterns. *Journal of Management*, 23, 1-18.
- Covin, J.G., & Slevin, D.P. (1989). Strategic Management of Small Firms in Hostile and Benign Environments. *Strategic Management Journal* 10, 1, 75–87.
- Danneels, E. (2002). The Dynamics of Product Innovation and Firm Competences. *Strategic Management Journal*, 23, 1095-1121.
- Dess, G.D. & Beard, D.W. (1984). Dimensions of Organizational Task Environments. *Administrative Science Quarterly*, 29, 52-73.
- Dew, N., Goldfarb, B. and Sarasvathy, S. (2006). Optimal inertia: When Organizations Should Fail. *Ecology and Strategy*, 23, 73-99.
- Duncan, R.B. (1976). The Ambidextrous Organization: Designing Dual Structures for Innovation. In Kilman, R. and Pondy, L. (Eds), *The Management of Organizational Design* (pp. 167-88). New York, NY: North Holland.
- Evans, S.J. (1991). Strategic Flexibility for High Technology Maneuvers: A Conceptual Framework. *Journal of Management Studies*, 28, 69-89.
- Fiol, C.M., & O'Connor, E.J. (2002). When Hot and Cold Collide in Radical Change Processes: Lessons from Community Development. *Organizational Science*, 13, 5, 532-546.
- Floyd S., & Wooldridge, B. (1996). *The Strategic Middle Manager*. San Francisco, CA: Jossey-Bass.
- Ghoshal, S. and C. A. Bartlett (1994). Linking Organizational Context and Managerial Action: The Dimensions of Quality of Management. *Strategic Management Journal*, 15, 9, 1-112.
- Gibson, C.B., & Birkinshaw, J. (2004). The Antecedents, Consequences and Mediating Role of Organizational Ambidexterity. *Academy of Management Journal*, 47, 2, 209-226.
- Gibson, C.B., & Birkinshaw, J. (2004b). Building Ambidexterity into an Organization. *Sloan Management Review*, July, 15th, 2004.

- Greenwood, R., & Hinings, C. R. (1996) Understanding Radical Organizational Change: Bringing Together the Old and the New Institutionalism. *Academy of Management Review*, 21, 4, 1022–1054.
- Hambrick, D. C. (1994). Top Management Groups: A Conceptual Integration and Reconsideration of the Team Label. In Staw, B.M. & Cummings, L.L. (Eds.), *Research in organizational behavior* (2nd ed.), (171-214). Greenwich, CT: JAI.
- Hambrick, D.C., & D'Aveni, R.A. (1988). Large Corporate Failures as Downward Spirals. *Administrative Science Quarterly*, 33, 1-23.
- Hamel, G., & Prahalad, C.K. (1994). *Competing for the Future*. Cambridge, Massachusetts: Harvard Business School Press.
- Han, M. (2007). Achieving Superior Internalization Through Strategic Ambidexterity. *Journal of Enterprising Culture*, 15, 1, 43-77.
- Han, M., Celly, N. (2008). Strategic Ambidexterity and Performance in International New Ventures. *Canadian Journal of Administrative Sciences*, 25, 4, 335-349.
- He, Z., & Wong, P.-K. (2004). Exploration and Exploitation: An Empirical Test of the Ambidextrous Hypothesis. *Organization Science*, 15, 481-496.
- Huy Q. (2001). In Praise of Middle Managers. *Harvard Business Review*, 79, 8, 73-79.
- Jansen, J.J., Van Den Bosch, F.A., & Volberda, H.W. (2006). Exploratory Innovation, Exploitative Innovation and Performance: Effects of Organizational Antecedents and Environmental Moderators. *Management Science*, 52, 11, 1661-74.
- Jansen, J.J., Van Den Bosch, F.A., & Volberda, H.W. (2005). Exploratory Innovation and Ambidexterity: The Impact of Environmental and Organizational Antecedents. *Schmalenbach Business Review*, 57, 351-363.
- Jaworski, B.J., & Kohli, A.K. (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 57, 53-70.
- Jones, R.M. (1999). *Mechanics of Composite Materials*, New York, NY: Hemisphere Publishing.
- Judge, W.Q., & Blocker, C.P. (2008). Organizational Capacity for Change and Strategic Ambidexterity: Flying the Plane while Rewiring it. *European Journal of Marketing*, 42, 9/10, 915-926.

- Judge, W. and Elenkov, D. (2005). Organizational Capacity for Change and Environmental Performance: an Empirical Assessment of Bulgarian Firms. *Journal of Business Research*, 58, 7, 893-901.
- Kerr, S., and Landauer, S. (2004). Using Stretch Goals to Promote Organizational Effectiveness and Personal Growth: General Electric and Goldman Sachs. *Academy of Management Executive*, 18, 134–138.
- Klarner, P., Probst, G., & Soparnot, R. (2008). Organizational Change Capacity in Public Services: The Case of the World Health Organization. *Journal of Change Management*, 8, 1, 57-72.
- Kyriakopoulos, K., Moorman, C. (2004). Tradeoffs in Marketing Exploitation and Exploration Strategies: The Overlooked Role of Market Orientation. *International Journal of Research in Marketing*, 21, 3, 219-240.
- Langer, E.J. (1989). *Mindfulness*. Reading, MA: Addison-Wesley.
- Latham, G. P., & Locke, E. A. (2006). Enhancing the Benefits and Overcoming the Pitfalls of Goal Setting. *Organizational Dynamics*, 35, 4, 332-340.
- Lawson, M. (2001). In Praise of Slack. *The Academy of Management Executive*, 15, 125-135.
- Lengnick-Hall, C.A., Beck, T.E. (2005). Adaptive Fit Versus Robust Transformation: How Organizations Respond to Environmental Change. *Journal of Management*, 31, 5, 738-757.
- Lewin A.Y., Long, C., & Carroll, T. (1999). The Co-evolution of New Organizational Forms, *Organization Science* 10, 535-550.
- Lewis, M. W. (2000). Exploring Paradox: Toward a more Comprehensive Guide. *Academy of Management Review*, 25. 760-777.
- Levinthal, D., & March, J. (1993). Myopia of Learning. *Strategic Management Journal*, 14, 95-112.
- Li, C., Lin, C., & Chu, C. (2008). The Nature of Market Orientation and the Ambidexterity of Innovations. *Management Decisions*, 46, 7, 1002-1026.
- Lubatkin, M. H., Simsek, Z., Ling, Y., & Veiga, J. F. (2006). Ambidexterity and Performance in Small- to Medium Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration. *Journal of Management*, 32, 5, 646-672.

- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2, 71-87.
- March, J.G., & Simon, H. A. (1958). *Organizations*. New York: Wiley.
- Marshall, C., & Rossman, G. B. (1995). *Designing Qualitative Research*. Thousand Oaks, CA: Sage Publications.
- McKelvey, B., & Aldrich, H. (1983). Populations, Natural Selection and Applied Organizational Science. *Administrative Science Quarterly*, 28, 101-128.
- Miller, D. (1982). Evolution and Revolution: A Quantum View of Structural Change in Organizations. *Journal of Management Studies*, 19, 2, 131-151.
- Miller, D., & Friesen, P.H. (1982). Innovation in Conservative and Entrepreneurial Firms: Two Models of Strategic Momentum. *Strategic Management Journal*, 3, 1, 1-25.
- Morgeson, F.P., & Hofmann, D.A. (1999). The Structure and Function of Collective Constructs: Implications for Multilevel Research and Theory Development. *Academy of Management Review*, 24, 249–265.
- Nohria, N., & Gulati, R. (1996). Is Slack Good or Bad for Innovation? *Academy of Management Journal*, 39, 1245–1264.
- O'Reilly, C., & Tushman, M. L. (2004). The Ambidextrous Organization. *Harvard Business Review*, 82, 1–9.
- Oxtoby, B., McGuinness, T., & Morgan, R. (2002). Developing Organizational Change Capability. *European Management Journal*, 20, 3, 310–320.
- Petitgrew, A.M. (1985). Context and Action in the Transformation of the Firm. *Journal of Management Studies*, 24, 6, 649-670.
- Pfeffer J., & Salancik, G. (1986). *The External Control of Organizations*. Marshfield, MA: Pitman.
- Rajlich, V., & Gosavi, P. (2004). Incremental Change in Object-Oriented Programming. *IEEE Software*, 2-9.
- Reger, R., Gustafson, L., DeMarie, S., & Mullane, J. (1994). Reframing the Organization: Why Implementing Total Quality is Easier Said than Done. *Academy of Management Review*, 19, 565-584.

- Rice, J. (1994). The First Step Toward a Health Assessment: Define the Community. *Trustee*, 16–17.
- Schilling, M. (2005) *Strategic Management of Technological Innovation*. New York, NY: McGraw-Hill/Irwin.
- Senge, P. (1990). The Leader's New Work: Building Learning Organizations. *Sloan Management Review*, 7-23.
- Singh, J.V. (1986). Performance, Slack, and Risk Taking in Organizational Decision Making. *Academy of Management Journal*, 29, 562-585.
- Smith, W. K., & Tushman, M. L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science*, 16, 522-536.
- Staber, U., & Sydow, J. (2002). Organizational Adaptive Capacity: A Structuration Perspective. *Journal of Management Inquiry*, 11, 4, 408–424.
- Stead W.E., Stead J. (1992). *Management for a Small Planet*. Newbury Park, CA: Sage.
- Taylor, A. (2008, July 25). Rick Wagoner Tries to Catch a Falling Knife - and Fails. *Fortune Magazine*. Retrieved from http://money.cnn.com/2008/07/15/news/companies/taylor_gm.fortune/index.htm.
- Tushman, M.L., & O'Reilly, C.A. (2006). *Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change*. Thousand Oaks CA: Sage Publications.
- Tushman, M., & O'Reilly, C. (1997). *Winning Through Innovation*. Boston: Harvard Business School Press.
- Tushman, M., & O'Reilly, C. (1996). Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *California Management Review*, 38, 4, 8-30.
- Vice, D. A., & Malseed, M. (2005). *The Google Story*. New York: Delacorte Press.
- Victor, B., Boynton, A., & Stephans-Jahng, T. (2000). The Effective Design of Work Under Total Quality Management. *Organizational Science*, 11, 1, 102-117.
- Volberda, H. W. 1996. Toward the Flexible Form: How to Remain Vital in Hypercompetitive Environments. *Organizational Science*, 7, 4, 359–374.

- Volberda, J. and Lewin A. Y. (2003). Co-evolutionary Dynamics Within and Between Firms: from Evolution to Co-evolution. *Journal of Management Studies*, 40, 2111–2136.
- Volberda, H. W., Van Bruggen, G.H. (1997). Environmental Turbulence: A look into its Dimensionality. M. T. A. Bemelmans, ed. *Dynamiek in Bedrijfsvoering*. NOBO, Enschede, the Netherlands.
- White, S., & Linden, G. (2002). Organizational and Industrial Response to Market Liberalization: The Interaction of Pace, Incentive and Capacity to Change, *Organization Studies*, 23, 6, 917–948.
- Weaver, J. (1994). Implementing the Vision: Growing a Healthy Community Initiative. *National Civic Review* 86, 1, 61–67.
- Womack, J., Jones, D. and Roos, D. (1991). *The Machine that Changed the World*. Harper-Perennial, New York
- Yin, R. K. (1994) *Case Study Research: Design and Methods* (2nd ed.), Thousand Oaks, CA: Sage Publications.

Appendix 1

Questions and Themes for Interviews:

Sociographic questions:

Name: _____

Gender: _____

Experience in the Aerospace Industry: _____

Years of experience with the company: _____

Number of positions held within the firm: _____

Educational Background: _____

Current Program: _____

-Package: _____

-Engineering Discipline: _____

- (Manager or **Director**) Can you explain employees or teams are under your direct supervision?
- What is your main objective/goal in your work life? (ex. Stability, growth)
- What are your beliefs about organizational change?

Change questions:

- Can you tell me of a particularly important change that had been implemented within your group during the past 6 months? Details
- Is it still in the process of being implemented, is so what are the timelines?
- Who instigated this change?
- Can you comment on how the information about this change was transmitted, was it clear?
- (Manager/Director)What were the ways and methods in which you tried to improve group “buy in” to this change?
- (Manager/Director) In your opinion, how was it initially received by your employees?
- How did you react personally to this change?
- Were there things that remained unchanged, please comment?

Performance Questions:

- Are you given a schedule and cost parameters for this project?
- Over the past (six months) how has your team performed in terms of adhering to these schedules? **What is success?**
- Over the past (six months) how has your project team performed in terms of adhering to these cost parameters? **What is success?**
- Who is your main customer (internal or external)

Ambidexterity Questions:

- (Manager or *Employee*) Are the management practices in your project team working coherently to support the overall objectives of the project team?

- **(Director)** Do you feel that the management practices you put in place work coherently to support the overall objectives of your project team?
- **(Manager or Employee)** Do these same management practices cause your project team to waste resources on unproductive activities?
- **(All)** I would like you to comment on what in your mind would represent some competing objectives in your position?
- **(All)** Do people in your project team (including yourself) feel that they often end up working on cross-purpose activities because of these competing objectives?
- **(Director or Manager)** Do you challenge your employees to address outmoded traditions and practices? **Given time to do it?**
- **(Employee)** Do you feel challenged by the management of your group to bring up outmoded practices and tradition? **Given time to do it?**
- **(All)** If yes, can you give me an example?
- **(All)** How well do you find your project team is at responding to change?
- **(Director or Manager)** As changes occur, do your business priorities remain a relatively stable concept, or do they evolve?
- **(Employee)** Do you feel like the priorities passed down from your **Manager** and **Director** remain relatively stable or do they evolve as changes occur?
- **(All)** During your stated change, were there any “old ways of doing things” that were kept? If so, why?
- **(All)** During the transition, how did your project team perform on their daily operations unrelated to this change?

Slack Questions

- Assume that due to some sudden development, 10% of the time of all people working on your project team has to be spent on work totally unconnected with the tasks and responsibilities of your team. How seriously will your output be affected over the next year?
- Assume that due to a similar development your project team’s annual operating budget is reduced by 10%. How significantly will your work be affected over the next year?

Environment Questions:

- Can you comment on the key challenges of the aerospace industry as a whole and whether they are affecting Bombardier Aerospace as a whole but more specifically your project team?
- **(Director)** Are the project teams under you affected by your competitors?
- **(Manager)** Is the project team under you affected by your competitors?
- Is there any internal competition for resources?

Context Questions: Comment On

- Stretch
- Discipline (Accountability)
- Support
- Trust