Spring 2009

The Interaction of Motivational Orientation and Social Context in a Flight Setting

Noelle D. Brunelle

Embry-Riddle Aeronautical University - Daytona Beach

Follow this and additional works at: https://commons.erau.edu/db-theses

Part of the Applied Behavior Analysis Commons, and the Aviation Commons

Scholarly Commons Citation


https://commons.erau.edu/db-theses/19

This thesis is brought to you for free and open access by Embry-Riddle Aeronautical University – Daytona Beach at ERAU Scholarly Commons. It has been accepted for inclusion in the Theses - Daytona Beach collection by an authorized administrator of ERAU Scholarly Commons. For more information, please contact commons@erau.edu.
THE INTERACTION OF MOTIVATIONAL ORIENTATION AND SOCIAL CONTEXT IN A FLIGHT SETTING

by

NOELLE D. BRUNELLE
B.S., Embry-Riddle Aeronautical University, Extended Campus, 2000

A Thesis Submitted to the
Department of Human Factors and Systems
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Human Factors and Systems

Embry-Riddle Aeronautical University
Daytona Beach, Florida
Spring 2009
UMI Number: EP31988

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI Microform EP31988
Copyright 2011 by ProQuest LLC
All rights reserved. This microform edition is protected against unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346
THE INTERACTION OF MOTIVATIONAL ORIENTATION AND SOCIAL CONTEXT IN A FLIGHT SETTING

By

Noelle D. Brunelle

This thesis was prepared under the direction of the candidate’s thesis committee chair, Dr. Elizabeth Blickensderfer, Ph.D., Department of Human Factors & Systems, and has been approved by members of the thesis committee. It was submitted to the Department of Human Factors & Systems and has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Human Factors & Systems.

THESIS COMMITTEE:

[Signatures]

Elizabeth Blickensderfer, Ph.D., Chair
Christina Frederick-Recascino, Ph.D., Member
Michael Wiggins, Ph.D., Member

[Signatures]

MS HFS Program Coordinator
Department Chair, Department of Human Factors & Systems
Associate Provost for Academics
Abstract

The purpose of this study was to explore the effects of motivational orientation and social context on decisions made during flight. Cultural dimensions such as power distance, uncertainty avoidance and individualism have been found to correlate with aviation accident rates. Self-determination theory provides a schedule of social contexts and cues that support, control or thwart individual motivation, with the task-focused properties of intrinsic motivation and the external (group) focus of extrinsic motivation similar to descriptions of the cultural dimensions of individualism and collectivism. In addition, studies have demonstrated contextual cues may be used to prime cognitive goals, behaviors and strategies. The motivational orientation of 48 instrument pilots was measured prior to their participation in a simulated flight exercise that contained contextual primes to continue into or turn away from adverse weather conditions. Externally motivated participants were observed to be vulnerable to external suggestions. This vulnerability has the potential to affect decisions made in flight. Risk assessment programs and reducing controlling factors in the flight environment can be used to mitigate this phenomenon.
# Table of Contents

Abstract ........................................................................................................ iii
List of Tables .................................................................................................. vi
List of Figures ................................................................................................. vii
Introduction ................................................................................................... 1
  Culture and Norms ....................................................................................... 5
  Social Identification ...................................................................................... 8
  Culture and Aviation .................................................................................... 11
Motivation and Pilot Performance ................................................................. 14
Self-Determination Theory ........................................................................... 14
Social Context and Motivation .................................................................... 17
Uncertainty, Stress and Coping ...................................................................... 22
Priming the Social Context for Action .......................................................... 25
The Present Study .......................................................................................... 29
  Hypothesis 1 ............................................................................................... 30
  Hypothesis 2 ............................................................................................... 30
  Hypothesis 3 ............................................................................................... 31
Method............................................................................................................. 31
  Experimental Scenario ............................................................................... 31
  Measures ..................................................................................................... 35
    Independent Variables .............................................................................. 35
      General Causality Orientations Scale ...................................................... 35
      Contextual Primes .................................................................................. 35
    Dependent Variables ............................................................................... 36
      Creativity / Flexibility ........................................................................... 36
      Proceed / Divert Decision .................................................................... 36
  Participants .................................................................................................. 37
  Procedure .................................................................................................... 38
Results ............................................................................................................ 42
  Hypothesis 1 ............................................................................................... 42
  Hypothesis 2 ............................................................................................... 44
  Hypothesis 3 ............................................................................................... 45
    Hypothesis 3a .......................................................................................... 45
    Hypothesis 3b .......................................................................................... 46
    Hypothesis 3c .......................................................................................... 47
  Demographic Data Analysis ....................................................................... 48
Discussion ....................................................................................................... 49
  Hypothesis 1 ............................................................................................... 49
  Hypothesis 2 ............................................................................................... 51
  Hypothesis 3 ............................................................................................... 53
Limitations of the Study ............................................................................... 58
  Measurement of Motivational Orientation ................................................. 58
    Shifting z-scores ..................................................................................... 58
    Level of Motivation ................................................................................ 58
LIST OF TABLES

Table 1. Motivational Orientations, Associated Behaviors and Social Influences 20
Table 2. Experimental Design 30
Table 3. Means and Standard Deviations for Number of Strategies Considered 43
Table 4. Motivational Levels in Action 55
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.</td>
<td>Flightcrew Performance Model (Helmreich &amp; Fouchee, 1993)</td>
<td>4</td>
</tr>
<tr>
<td>Figure 2.</td>
<td>Mean Number of Strategies Considered, by Motivational Orientation</td>
<td>42</td>
</tr>
<tr>
<td>Figure 3.</td>
<td>Mean Number of Strategies Indicated, by Motivational Orientation and Priming Condition</td>
<td>44</td>
</tr>
<tr>
<td>Figure 4.</td>
<td>Percentage of Participants Selecting the “Divert” Strategy, by Prime Received</td>
<td>45</td>
</tr>
<tr>
<td>Figure 5.</td>
<td>Percentage of Intrinsically Motivated Participants Selecting a “Divert” Strategy</td>
<td>46</td>
</tr>
<tr>
<td>Figure 6.</td>
<td>Percentage of Extrinsically Motivated Participants Selecting a “Divert” Strategy</td>
<td>47</td>
</tr>
<tr>
<td>Figure 7.</td>
<td>Percentage of Impersonally Motivated Participants Selecting a “Divert” Strategy</td>
<td>47</td>
</tr>
</tbody>
</table>
Introduction

On the afternoon of March 29, 2001, Gulfstream N303GA arrived at Los Angeles International Airport (LAX) following an eleven-minute staging flight from Burbank, CA, where the aircraft was based. The aircraft was scheduled to later fly to Aspen-Pitkin County Airport, CO and then return to Burbank. Aspen is a resort town in the Rockies known for skiing, breathtaking mountain views and celebrities. The airport is frequented by corporate and private jets and due to the high density of traffic (on key holidays, there is a lottery for arrival slots) noise abatement procedures have been put into effect. These procedures (known as Stage III) include the limitation that aircraft with engine signatures above a certain decibel level are restricted to operations between 7:00 am local (Mountain) time and one-half hour after sunset. At the time, the engines utilized on the Gulfstream III exceed this noise signature, but “hush kits’ are available that when installed reduce their sound to within Stage III criteria. N303GA did not have these “hush kits” installed (NTSB, 2003).

The aircraft was being operated under Part 135 (On-Demand Air Taxi) flight rules and had been chartered specifically for this flight. The principal passenger, through his assistant, had arranged for the flight to deliver the principal and 14 of his friends to an extensively planned birthday dinner. Earlier in the day, the charter operator had advised the customer that there was a possibility the flight might not be able to get into Aspen due to weather. In response, the principal had directed his assistant to call the charter company and advise them his party would not be redirected as he had spent a “substantial amount” on the dinner. The principal was a first-time customer of this charter operator and was later described as a “natural-born” salesman (NTSB, 2002).
The pilot, co-pilot and cabin (flight) attendant were all well-liked and respected by their peers. The captain was new to the company, having worked for them for less than six months. Previous to his current employment, he had worked for a charter airline, and the chief pilot there described his performance as above average. However, the captain of 303GA had resigned from the airline (termination with the option to resign) for refusing to accept a flight he felt would extend his duty day beyond legal limitations (NTSB, 2002).

The flight was scheduled to depart for Aspen at 1530 Pacific Time. This departure time had been selected to accommodate the flight to Aspen, deplaning of the passengers and the departure for Burbank prior to the curfew. The passenger had been advised the latest the flight could depart LAX was 1545 as the aircraft was required to operate during daylight hours. The customer was advised the reason for this restriction was “safety” rather than the noise abatement curfew. The principal had previously arrived at Aspen at night in similar aircraft and was reported to have told his assistant that “he had flown into Aspen before at night in this kind of plane, tell them I’ve done it before and we’re going to do it (NTSB, 2002 p. 50).”

The instrument approach into Aspen is one of the more challenging in the United States. The airport itself is located in a “bowl,” an area of lower terrain surrounded by mountains that in this case reach over 11,000 feet. The approach is made from the north, with aircrews following a radio (localizer) course over the mountains toward the bowl, with the aircraft stair-stepped from 13,000 feet to an altitude approximately two thousand feet above the airport. At this point (known as a “minimum descent altitude”), some four miles from the airport, pilots must decide whether the visibility and weather conditions between them and the airport will permit a safe arrival. If these criteria cannot be met, the pilot must execute a “missed approach” procedure, in this case a 150-degree right-hand turn to an outbound heading, allowing a climb to regain
altitude in an area of lower terrain. It is interesting to note that Aspen is one of thirteen airports in the United States with an instrument procedure that terminates at a height above airport that exceeds the minimum weather requirements for visual flight (NTSB, 2003).

At 1535, the crew of N303GA called their dispatch office to advise them the passengers were not yet at the aircraft. At this time, the crew was requested to advise the passengers that there would be an additional $1300.00 fee if the aircraft had to overnight at Aspen. The passengers, with the exception of the principal and one other arrived at the aircraft at 1545. Shortly afterwards the principal passenger called his assistant. He stated that one of the passengers had informed him that the pilots had said they might not be able to make it in to Aspen due to the late departure. Further, the principal requested that the charter company tell the crew that they should wait for his arrival to make statements regarding the flight and until then to “...have him [the pilot] keep his mouth shut and his remarks to himself (NTSB, 2002, p.49).” This information was relayed to the crew who, in turn, expressed to their company that they felt they had done something wrong. The principal passenger arrived at 1605 and the aircraft was reported airborne at 1611 (1711 Mountain Time) (NTSB, 2002).

During the flight, the crew encountered rapidly deteriorating conditions. Initially the crew was heard (on the CVR) expressing their reservations regarding the approach, and as they continued towards Aspen they overheard three aircraft execute the missed approach. After conferring with the charter company and a passenger who had been seated in the cockpit the crew continued, verbalizing no plans to divert should they not see the airport. The aircraft impacted terrain one-half mile short of the runway, killing all on board. The time was 19:02 Mountain Time, four minutes after the curfew (NTSB, 2002, 2003).
The National Transportation Safety Board (NTSB) determined the probable cause of the accident to be "the flight crew’s operation of the aircraft below minimum descent altitude without appropriate visual reference for the runway (NTSB, 2003)." But what would cause two pilots, each holding an Air Transport Pilot License and with a combined 27 years and 15,400 hours of flight time between them to deviate from procedures in such a manner?

Ideally humans would use logical methods to make decisions; goals and preferences would be clearly defined, an exhaustive understanding of all alternatives would be available and accurate measures of both probability of success could be generated for each potential strategy so the strategy maximizing outcome could be selected and implemented (Simon, 1983 as cited in Reason, 1990). Alas, this is not possible, and internal and external influences can add errors of perception, recall, recognition and judgment to the process (Reason, 1990). Human error is inevitable, and in aviation it can be catastrophic.

The flight environment is an open and dynamic interaction of man, machine and the environment. The flightcrew performance model (Helmreich & Fouchee, 1993) captures crew behavior as a three-step process (See Figure 1). According to this model, crew performance

![Figure 1. Flightcrew Performance Model (Helmreich & Fouchee, 1993)]
inputs, including individual, group, organizational, regulatory and environmental factors influence crew and mission performance functions. These functions then influence crew performance and affect individual, group and mission outcomes. Elements of the system interplay, activating latent and generating active failures affecting safety of flight. This model is similar to two other models of behavior: social identification theory, which seeks to explain the impact of group norms on member behavior and self-determination theory, which provides insight into how social context influence individual motivation and behavior. Capturing and understanding the relationships between these theories has the potential to provide safety practitioners new tools for managing risk in aviation environments.

Culture and Norms

Each of us “carries patterns of thinking, feeling and potential acting” resulting from the social environment of childhood and life experience (Hofstede, 1991, p.4). These patterns are a reflection of the surrounding culture, include the collective programming distinguishing groups or categories of people from one another and are manifested as symbols, heroes, rituals and values. National cultures can be subdivided into smaller groups (professionals, students, families, etc.) with each of these groups sharing their own heroes, rituals and values. Individuals may belong to more than one group, as group membership and social networking provide an advantage in resource acquisition and social support (Cialdini & Trost, 1998). One method of measuring culture (developed by Hofstede) utilizes measurements of power distance, individualism versus collectivism, masculinity versus femininity and uncertainty avoidance to describe ideology. A culture’s identity and ideology (be they of a nation or small group) reflect choices made by the majority. Aviation is a domain that can be easily recognized as having a distinct culture with its own language, heroes, rituals and expectations.
Values are manifested into behaviors with the use of norms (Hofstede, 1991). Social
norms are patterns of thinking feeling and behaving that are endorsed by a group and expected of
its members (Turner, 1991). These customs, rules, traditions, values and shared standards
(Sherif, 1966) prescribe appropriate, expected and desirable attitudes and conduct within the
group. Norms also guide social behaviors not included in laws (Cialdini & Trost, 1998) and are
assumed to have evolved from early survival tactics utilized within the group or culture. Groups
and individuals utilize social norms to select effective actions, build and maintain social
relationships and manage their self-concept. Social norms derive their power from their value to
the group and exist only if shared with others, with the strength of a norm determined by
communication opportunities, uniformity of the norm within the group, and importance the
group places on the norm (Cialdini & Trost, 1998). Strong norms even have the ability to
motivate “health-threatening” behaviors (Crandall, as cited in Cialdini & Trost (1998)). In
aviation, “health-threatening” behaviors could include the hazardous attitude of invulnerability,
performing private “airshows” for friends and continued visual flight into instrument conditions.

Two forms of influence that can modify individual behavior are normative social
influence and informational social influence. Normative influence describes the pressure to
“conform with the positive expectations of another” (Deutsch & Gerard, 1955, p. 629) and uses
the process of power to induce conformity (Turner, 1991). Thus when responding to normative
influence, individuals perform actions to comply with authority, out of concern for consequences
and with a focus on pleasing others. Informational influence is defined as “influence to accept
information obtained from another as evidence about reality” (Deutsch & Gerard, 1955, p. 629).
Informational influence is considered “true influence,” and individuals respond to informational
influence when they have accepted and internalized shared social norms (Turner, 1991). As an
individual is socialized into a group, normative and informational influence cause group norms
to be internalized and become expectations we have for ourselves, or personal norms (Schwartz,
1977). These personal norms are then used to guide behavior in situations of uncertainty when
physical reality tests cannot provide an adequate course of action. The use of norms to guide
behaviors provides subjective validity, feelings of confidence, appropriateness, correctness and
social desirability in uncertain or otherwise ambiguous situations (Turner, 1991).

Numerous studies have demonstrated the ability of both groups and valued authority
figures to affect the behavior of individuals through the use of normative processes. Additional
research indicates norms can be activated even when an individual is alone. By manipulating the
environment and observing the behaviors of others, Kallgren, Reno and Cialdini (2000) were
able to clarify the individual properties of different types of norms. Descriptive norms
communicate what is appropriate in a situation and provide information that is situation specific.
Injunctive norms specify what is approved by valued others and stimulate robust prosocial
behaviors across a wider range of settings (Reno, Cialdini & Kallgren, 1993; Kallgren et al.,
2000). Norms, though usually present are not consistent across situation; it is the most focal or
salient norm that generates the greatest influence in a situation. Thus it is possible, through
either intentional or inadvertent actions (such as a stern look from a senior pilot when pulling out
the checklist), to cognitively prime (trigger) the use of a particular norm (Cialdini, Reno &
Kallgren, 1990). Some aviation accident reports include descriptions of events that could be
interpreted as examples of pilots submitting to internal and/or external pressures to conform to
the social norms surrounding them, even when they conflicted with existing physical conditions.
Social Identification

The influence of a primed norm can be affected by the strength of cultural, situational and personal norms (Cialdini et al., 1990). A good deal of research has been performed to better understand how these group pressures affect individual behaviors. Most theories explaining the influence of cultural and social norms, such as Fishbein and Ajzen's theories of reasoned action and planned behavior (as cited in Terry & Hogg (1996)) involve dual processing and utilize one theory to explain public behavior and another to explain private behaviors. Social identification theory, however, proposes a single process to explain the effects of social influences on decision-making processes (Terry & Hogg, 1996). This process, known as referent informational influence, consists of three interdependent components: the construction of a skeletal social identity (self-categorization), the presence of ingroup norms, and the assignment of these norms to the self (Abrams & Hogg, 1990). According to this model, normative effects are strengthened as an individual selects and joins a group, assimilates group norms and cognitions, and repeatedly rehearses and performs group-sanctioned behaviors. Social identification theory describes these processes with the sub-theories of self-categorization, social cognition and social identity.

First, self-categorization theory focuses on the structural forces in play during group membership and the assignment of group norms to the self. The central premise of self-categorization theory is that group behavior can best be explained as individuals acting as members of a group rather than as individual persons (Hogg & Mullen, 1999; Turner, 1991). Individuals select which groups to join by comparing themselves with definitions groups have for themselves, choosing to join those groups with definitions that are most aligned with his/her personal perception of self. These definitions can include hierarchical rankings and abstract
levels of class inclusion (Oakes, Haslam & Reynolds, 1999). In aviation, examples can include fighter pilot, pilot and non-pilot (such as baggage handler or cabin crew). Group leaders and heroes are those individuals whose behavior and attitudes most closely model the group consensus.

Social cognition is the study of how people navigate physical, procedural and social space (Hutchins, 1995). As individuals communicate with a group, they develop a mental model of the environment that is similar to or shared with other members of the group. These models include shared beliefs, norms and standards that are used by group members to develop relationships, coordinate tasks and predict behavior (Operario & Fiske, 1999; Klein, 2003; Endsley, 1999). As an individual becomes assimilated into a group, his or her cognitions, behaviors and feelings become depersonalized and become aligned with those of valued others in the group (Turner, 1985). Having shed personal beliefs that are incompatible with group beliefs and defining themselves with group norms rather than personal convictions, an individual uses this new frame of reference to guide behaviors (Terry, Hogg & Duck, 1999; Hutchins, 1995).

The premise of social identity theory (the third component of social identification theory) is that individual behavior is a reflection of their societal unit. According to social identity theory, an individual's self-concept is influenced by self-categorization in larger social groups, with the most salient self-categorizations being gender, race and nationality, followed closely by work-related identity (Operario & Fiske, 1999; Terry, Hogg & Duck, 1999). Once an individual selects a group affiliation, the emotional value of the groups' norms guides his/her behavior by rewarding prototypical behavior with positive self-evaluation and self-esteem. As a result, as group membership becomes more salient, and individual mental processes become vulnerable to normative group phenomena. These group phenomena include better recall of in-group
messages (McGarty, 1993 as cited in van Kippenberg, 1999), greater motivation to process in-group messages, stronger attitude changes following in-group messages (Mackie et al., 1990, as cited in van Kippenberg, 1999), and the enhancement of ingroup-normative behavior (van Kippenberg, 1999). These internal normative structures can be strengthened when an external source with more power (such as a professor, employer or valued peer) seeks to influence an individual who is economically or otherwise dependant on this powerful other (Abrams & Hogg, 1991).

Applying these theories of social norms to aviation, the environment an individual pilot elects to operate in (military, sport, air transport, general aviation) is influenced by his or her socialization before and during training. As a result, decision-making processes are guided by the context and culture surrounding the current operation. In times of uncertainty or ambiguity (such as in-flight emergencies or deteriorating weather) an individual pilot reflects on strategies that proved successful in the past or, if none are available, may look to the real or imagined attributes of salient leaders, heroes or other prototypes to provide examples of the judgments, attitudes and behaviors best used to resolve the situation (Turner, 1991). Critical decisions are often made in an environment that includes conflicting descriptive and injunctive norms, any of which can be primed by an authority figure at any time. In the complex, dynamic, time-pressured environment of flight choosing wisely the first time is critical, as an mistake made early in the trouble-shooting process can trigger subsequent errors (Jensen, 1996). Additionally, once a course of action is verbalized (such as declaring an intent to press on to dispatch, ATC or other team member), commitment to this action is increased (Lipsitz, Kallmeyer, Fergeson & Abas, 1989; Freedman & Frazier, 1966).
Culture and Aviation

National cultures can be described using four cultural dimensions, individualism, uncertainty avoidance, masculinity/femininity and power distance (Hofstede, 1991; Soeters & Boer, 2000). Individualism is measured on a scale from individualism to collectivism. Individualist cultures favor the individual over the group, be it social or organizational, with members placing value on personal freedom and privacy. Collective cultures place more emphasis on relationships, with the individual dependant on work and social groups for their security. Uncertainty avoidance describes a society’s orientation towards responses to unfamiliar situations. Uncertainty avoidance is defined not as the avoidance of risk, but rather the avoidance of the unexpected. Cultures high in uncertainty avoidance seek to avoid threats and uncertainty with the use of regulations and sanctions on individual behavior. Power distance refers to the distribution of power in a society. In societies with large power distance, power is distributed unequally, with a superior having considerable power and influence over a subordinate. In societies with low power distance, superiors and subordinates interact more as equals, sharing information and, if necessary, the subordinate correcting the superior. The fourth cultural dimension, masculinity, measures societal values on a scale from masculine to feminine. Historical analysis of both commercial and military aviation accident rates indicate three of these dimensions, individualism, uncertainty avoidance and power distance, can be correlated with accident rates. Masculinity was not found to correlate with aviation accident rates.

Russell (1993) found that in commercial aviation, accident rates were negatively correlated with individualism, that is, as a culture became more group oriented, the accident rate went up. In individualist cultures, the focus is on the task at hand, with failures generating guilt felt by the individual (Soeters & Boer, 2000). In collectivist cultures, individual task
performance reflects on the group, with mistakes bringing shame to the entire group and having the potential to affect group membership (Hofstede, 1991, Soeters & Boer, 2000). Thus in times of uncertainty, pilots in collective cultures seek out strategies designed to maintain group affiliation, such as hiding one’s mistakes, following the orders of a superior or foregoing personal initiative to adhere to the norms of the group. During in-flight emergencies or other non-normal aviation events, responses that do not focus on the task at hand may preclude successful resolution of the event.

Commercial aviation accident rates were positively correlated with high power distance (Russell, 1993). Cultures with high power distance are characterized by limited communication opportunities between superiors and subordinates, with sanctions imposed on the subordinate foolish enough to contradict a superior (Hofstede, 1991). Low power distance cultures encourage the free flow of information between subordinate and superior, with the subordinate willing to contradict the superior when necessary. Flight deck operations are hierarchical in nature, with the captain perceived as the master of the “ship.” Crew Resource Management (CRM) programs include segments on interpersonal communication strategies, with the intent that the increased flow of information in the cockpit resulting from the reduced trans-cockpit power gradient will lessen the potential for uncorrected errors.

Analysis of hull loss accident rates of NATO (military) air forces indicates results that were slightly different than those observed in their commercial counterparts (Soeters & Boer, 2000). (The North Atlantic Treaty Organization (NATO), at the time of the cited analysis, consisted of fourteen nations in North America and Europe.) Individualism was strongly negatively correlated with hull loss accidents, that is, the more collective a society, the greater the incidence of hull loss events. The positive correlation between power distance and hull loss
was also present but was less pronounced than was observed in commercial aviation. In this analysis, uncertainty avoidance was also found to positively correlate with hull loss. Military aviation, with its greater complexity in airframes and more risky missions, relies on adherence to procedure to standardize operations. Cultures scoring low in uncertainty avoidance allow the individual to use personal creativity, intuition and persistence at task to resolve problems at the local level while societies with high scores in this dimension focus on rule-based solutions. In-flight emergencies are by their very nature unexpected, are often ill defined; non-programmed (situations where a checklist is not available) and complex (situations where more than one emergency occurs at once) emergencies are those most likely not have formal procedures for resolution. In addition, as these occurrences interact dynamically with the environment, they require rapid diagnosis to resolve. Crew socialized to focus on rule-based, group problem solving may be ill-equipped to manage these critical events.

Further analysis of the NATO data indicated interactions between the cultural values as well with accident rates clustered around two cultural trait clusters. Countries with individualistic cultures with a greater tolerance for uncertainty avoidance experienced the fewest hull losses; this may be because pilots from cultures exhibiting individualism appeared to focus more on professional motives, allowed information to flow more freely between ranks and required less rigidity during problem solving. The other trait cluster involved countries with collectivist cultures with high levels of uncertainty avoidance and high power distance. Pilots in these collective cultures, oriented towards organizational control and institutional thinking, appeared to rigidly focus on rules, procedures and formal communications. Countries with this cultural perspective experienced a much higher rate of hull losses (Soeters & Boer, 2000).
Motivation and Pilot Performance

Differences in pilot performance may be attributable to social environments that encourage or inhibit individual motivation. Researchers are interested in motivation because it explains the "why of behaviors (Deci & Ryan, 1985) while it is of concern to managers because "motivation produces” (Ryan & Deci, 2000). Motivation can be either encouraged or inhibited by internal and external forces acting on an individual, thus the study of motivation focuses on interactions between an individual and their surrounding social environment. Research in this area has enabled practitioners to affect changes in behavior and performance in sport, academic and medical domains. In particular, the self-determination theory of motivation provides an explanation as to how cultural contexts and specific social interactions influence individual motivation and behavior.

Self-Determination Theory

Motivation is composed of two dimensions, energy and direction (Deci & Ryan, 1985). The energy component of motivation is focused on needs, both internal and external (Deci & Ryan, 1985) and can be characterized as the "driving force" behind an individual’s participation in an activity (Frederick-Recascino & Hall, 2003, p. 401). The direction component of motivation describes the processes and structures an individual utilizes to ascribe meaning to internal and external stimuli (Deci & Ryan, 1985) and influences which interests energy is projected towards (Frederick-Recascino & Hall, 2003). Self-determination theory views an individual as an active being with internal needs and drives providing energy for his or her actions (Deci & Ryan, 1985, p. 4).

According to this theory, individuals are naturally oriented towards growth, and growth is either supported or undermined by social context (Ryan & Deci, 2002). Individual growth and
Motivational Orientation and Social Context 15

optimal functioning is predicated on the satisfaction of three needs: autonomy, competence and relatedness. Autonomy refers to an individual experiencing choice and perceiving themselves as the source of their behavior (Ryan & Deci, 2002; Baard, 2002). When individuals are acting autonomously, their perceived locus of causality is internal and performed actions are the result of personal interests and integrated values. The opposite of autonomy includes experiences of control, such as pressure and coercion, and an external locus of control (Skinner & Edge, 2002; Deci & Ryan, 1985). Competence describes the feeling experienced when an individual effectively interacts with their environment such as when a challenging task is completed or desired outcomes are achieved (Baard, 2002; Ryan & Deci, 2002). Ineffective interactions naturally reduce this feeling, and generate experiences of incompetence. Relatedness describes the experience of feeling mutual respect and reliance on, or secure communion or unity with other individuals or groups (Baard, 2002; Ryan & Deci, 2002). When the sense of belonging resulting from feeling connected to and cared for by others is not present, an individual feels isolated and alienated (Ryan & Deci, 2000, 2002). The satisfaction of these needs promotes self-determined functioning (Deci & Ryan, 1985) and is associated with greater well-being in individuals (Ryan & Deci, 2002).

Motivation is not a dichotomous variable an individual either has or doesn't have. Rather, an individual’s motivation towards an environment or activity is influenced by their experiences of autonomy, competence and relatedness and falls on a continuum between performing an activity out of sheer joy and the complete absence of intention. Intrinsic motivation is the term used to describe an individual performing an activity for the inherent pleasure and satisfaction it provides (Deci & Ryan, 1985). Intrinsic motivation is based on the innate needs for competence and self-determination and is hallmarked by an internal locus of
Amotivation, located at the opposite end of the motivation scale, describes a state where an individual lacks intent and effect. Individuals experiencing amotivation do not perceive a relationship between their activities and an outcome and this act passively and out of the sense of being at the mercy of uncontrollable external forces (Deci & Ryan, 1985; Vallerand & Ratelle, 2002). Extrinsic motivation describes the experience of performing an activity not for enjoyment or satisfaction, but rather for the presumed admiration, power, sense of worth or external reward that may be provided (Deci & Ryan, 1985; Kasser, 2002), and has been subdivided into four levels bridging amotivation and intrinsic motivation. In external regulation, the extrinsic state most resembling amotivation, individuals perform an activity to obtain a reward (such as money or pleasing others) or to avoid punishment (such as a reprimand (Vallerand & Ratelle, 2002; Ryan & Deci, 2000)). In this state, individuals lack self determination and are acting completely at the direction of external forces. Introjected regulation, the state in which internalization of external regulations begins, individuals act out of obligation, to feel better about themselves or to avoid internal pressures such as guilt or shame. Identified regulation describes the state in which externally driven behaviors and goals are consciously recognized as valuable. Individuals exhibiting identified regulation act out of choice and are relatively self determined; it is in this state that the locus of causality transitions from external to internal. The most autonomous type of extrinsic regulation is integrated regulation. In this state, activities are still performed for external outcomes or at the direction of another, but external goals and values are fully accepted as ones’ own (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand & Ratelle, 2002).

Individuals may experience these motivational states on global, contextual and situational levels (Vallerand & Ratelle, 2002). At the global level, motivation reflects an individual’s orientation to the environment, and this motivation (be it intrinsic, extrinsic or amotivated) can
be expected to be consistent across situations. Contextual motivation describes the orientation towards distinct activities (such as school, sport or aviation) and though relatively stable, can be influenced by social factors and contextual consequences. At the situational level, individuals respond to environmental consequences while performing tasks and as a consequence, motivation is malleable. While performing a specific activity, motivation is top-down, with motivation at lower levels (situational, contextual) affected by motivation at the next higher level. Motivation can also be recursive (bottom-up), with situational experiences having the ability to affect contextual and global orientations over time. These processes make it possible for an individual to have different motivational orientations towards different activities, or even the same activities at different times (Vallerand & Ratelle, 2002).

Social Context and Motivation

One goal of self-determination theory (Deci & Ryan, 1985, 2000; Ryan & Deci, 2002) is to understand the effects of social context on individual growth and behavior. Social context, the social environment surrounding an individual, provides the interaction opportunities within which the psychological needs of autonomy, competence and relatedness are experienced. Situations allowing choice foster intrinsic motivation by accepting an individual's needs and feelings and providing non-evaluative feedback. As a result of these interactions, autonomous individuals experience self-worth based on genuine self-validation rather than identification with their accomplishments, and meet subsequent experiences with openness and unfiltered observation of the situations and environments they encounter (Hodgins & Knee, 2002). The internal locus of causality that characterizes this orientation allows choiceful (top-down) interactions with the environment, resulting in greater enjoyment (Hodgins, Koestner & Duncan, 1996 as cited in Hodgins & Knee, 2002) and greater life satisfaction (Kasser, 2002).
Autonomous orientations are expressed using behaviors including increased creativity, cognitive flexibility, task persistence and more efficient use of information (Deci & Ryan, 1985); less distortion in recall, filtering, in-group bias and use of stereotypes (Hodgins & Knee, 2002) and greater consistency of behaviors (Deci & Ryan, 1985). Intrinsically motivated individuals also seek out optimum challenges and their self-confidence makes them more resistant to external pressures. Pilots acting from this orientation can be expected to continuously expand their understanding of aviation and fly out of sheer enjoyment.

Uncontrollable and unpredictable environments fail to support autonomy, effectiveness and relatedness and generate feelings of incongruence and ineffectiveness (Deci & Ryan, 1985). Repeated exposure to these types of environments can result in an individual adopting an amotivated, or impersonally oriented level of motivational regulation. Amotivated individuals perceive outcomes as beyond their control, solely the result of external forces that are unable to be influenced by personal efforts (Hodgins & Knee, 2002; Deci & Ryan, 1985). This orientation is then expressed by unintentional functioning including erratic, ineffective and inconsistent behaviors, vacillation, defensiveness and helplessness. It has been suggested that pilots exhibiting the hazardous attitude of resignation (lacking control over their fate) are those most likely to discontinue training (Lester & Bombaci, 1984). In self-determination theory, these pilots would likely be assigned the impersonal causality orientation.

Controlled (extrinsic) orientations arise from a conflict between the individual and some “controller,” be it another person, environmental stimuli or his or her internal self. This conflict causes an individual to try to accommodate the controller in some manner and thus become disconnected from their own needs (Deci & Ryan, 1985; Hodgins & Knee, 2002). Extrinsicly motivated individuals act to reduce the dissonance between their personal needs and the supports
present in the environment. This dissonance shifts an individual’s locus of causality from internal to external (Kasser, 2002). Individuals experiencing a control orientation use strategies designed to reduce external threats such as the loss of rewards or disapproval by others produced by failure. Not only do controlled individuals not choose goals in line with their needs, they also demonstrate less persistence and creativity towards tasks, more frequently utilize stereotypes, heuristics and selective information processing and memory, and are more likely to exhibit self-serving biases (Deci & Ryan, 1985). These individuals are responsive to controls and imperatives such as “should,” “have to,” “ought to,” and “must,” and their reactive emotions make them susceptible to both self-aggrandizement following successes and guilt and shame following failure (Deci & Ryan, 1985).

Many of the conditions in the aviation realm have been demonstrated to shift motivational orientation from an intrinsic to extrinsic frame in other (non-aviation) environments (see Table 1). Flight training is performed one-on-one in a close environment; surveillance, evaluation and feedback have been shown to undermine internal focus. Flying is also a regimented, goal-oriented process performed in a dynamic and sometimes hazardous environment; deadlines, goals and the avoidance of punishment (in sports training, physical injury; in aviation, disapproval by others or sanctions by employers) increase control on an individual by focusing his/her attention on external contingencies rather than the task at hand. Aviation is also a very competitive domain with many pilots competing for a limited number of military, corporate or airline positions. This competition generates a focus on winning, and self esteem may become tied to outcomes. Monetary rewards and norms for payment (such as those present in the professional realm) have been found to generate less enjoyment and satisfaction with an activity, to decrease expressed creativity and decrease time spent on task.
Motivational Orientation and Social Context

Table 1. Motivational Orientations, Associated Behaviors and Social Influences

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Regulatory Style</th>
<th>Perceived Locus of Causality</th>
<th>Relevant Regulatory Styles</th>
<th>Displayed Behaviors</th>
<th>Contextual Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic</td>
<td>Intrinsic</td>
<td>Interna</td>
<td>Interest</td>
<td>Secure self-worth</td>
<td>Experiences that support autonomy, competence and/or relatedness</td>
</tr>
<tr>
<td></td>
<td>Regulation</td>
<td></td>
<td>Enjoyment</td>
<td>based on &quot;basic&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inherent</td>
<td>needs, shared</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Satisfation</td>
<td>values</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Self-determined</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seek optimal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>challenges</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Enhanced performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>persistence</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and creativity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Openness to new</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>experiences</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Less defensiveness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower emotion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reactivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cooperation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commitment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Self-reflective</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>take responsibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>for actions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Secure bonds with</td>
<td></td>
</tr>
<tr>
<td>Extrinsic</td>
<td>Integrated</td>
<td>Interna</td>
<td>Congruence</td>
<td>Vulnerable self-worth</td>
<td>Experiences that undermine autonomy, competence and/or relatedness</td>
</tr>
<tr>
<td></td>
<td>Regulation</td>
<td></td>
<td>Awareness</td>
<td>based on &quot;ego&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Synthesis with</td>
<td>investments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seek relationships</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>based on extrinsic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>needs such as image,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wealth, social</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>standing and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>natural in response</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to external controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and pressures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Act to avoid guilt,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>anxiety, obligation,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>punishment and/or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>shame</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Perform for reward,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and/or because activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>is deemed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>valuable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Demonstrate ability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to maintain feelings of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>worth</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Conformity, Compliance,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Submission</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dependence</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rigidly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Self-handicapping</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outward directed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>anger and blame</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lack of trust in one's</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>own judgment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rely on others for directions and opinions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Feelings of being controlled or a reaction</td>
<td></td>
</tr>
<tr>
<td>Extrins ic</td>
<td>Identified</td>
<td>Interna</td>
<td>Personal</td>
<td>Experiences that undermine autonomy, competence and/or relatedness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulation</td>
<td></td>
<td>Importance</td>
<td>Pressures towards specified outcomes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Consious Valuing</td>
<td>Conditions that honor perceived efficacy</td>
<td></td>
</tr>
<tr>
<td>Extrins ic</td>
<td>Irrorjected</td>
<td>Somewhat External</td>
<td>Self-Control,</td>
<td>Relationship based on performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulation</td>
<td></td>
<td>Ego-involvement</td>
<td>Tangible rewards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Internal Rewards</td>
<td>Threats</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and Punishments</td>
<td>Deadlines</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Directives</td>
<td></td>
</tr>
<tr>
<td>Extrins ic</td>
<td>External</td>
<td>Externa</td>
<td>Compliance</td>
<td>Pressured evacuations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulation</td>
<td></td>
<td>External Rewards</td>
<td>Perceived pressures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and Punishments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amotivation</td>
<td>Non-Regulation</td>
<td>Impersonal</td>
<td>Nonintentional</td>
<td>Experiences that thwart autonomy, competence and/or relatedness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nonruling</td>
<td>Lack of choice</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Incompetence</td>
<td>Experiences of incompetence</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lack of control</td>
<td>Experiences of neglect or exclusion</td>
<td></td>
</tr>
</tbody>
</table>

Social context may also affect experiences of competence (Elliott, MacGregor & Thrash, 2002). Competence describes the need to successfully investigate and master tasks and is satisfied not only by obtaining the desired result but also by the feelings of effectiveness that accompany an accomplishment. Competence is acquired through a combination of accomplishments and socialization experiences and is encouraged or thwarted by a mix of physical features, activity levels, abilities and surroundings. Competence may be experienced in one of three forms: task-referential competence, past-referential competence and other-referential competence. Task-referential competence references the task itself, such as when a flight student...
successfully performs a flight maneuver for the first time. Past-referential competence focuses on the development of skills and improvement over past performance, such as when a student recognizes improvement over earlier attempts at a task. Other-referential competence compares individual (self) performance to that of others (interpersonal evaluation), such as when a student feels pride when accomplishing a task ahead of peers. Task- and past-referential competencies are process oriented; they require direct and immediate feedback regarding task accomplishment. Past-referential feedback is less immediate as feedback is received slowly over time. Other-referential competence is unique as it is not solely focused on the task, but also includes the feedback from the external social environment. Individual preferences are based on early life experiences, with some individuals (such as children encouraged to compete with siblings and/or peers) developing a preference for a particular referential orientation over others. Individuals with a preference for other-referential competence would be expected to be particularly susceptible to social influences.

It is not always necessary to apply direct constraints to undermine individual motivation as social context has also been demonstrated to have strong effects on motivational orientation. Direct social controls, such as surveillance and feedback can be perceived as either controlling (reducing intrinsic motivation) or informational (maintaining or enhancing intrinsic motivation) depending on the individual’s subjective interpretation of interpersonal cues. The social contagion model states an individual’s motivational orientation can be influenced by their interpretation of the surrounding social environment, including the motivational orientation of others with whom they interact (Wild & Enzle, 2002).

The social contagion model is a three-step process wherein an individual’s perceptions of the motivations of others shape his or her interpretation of events. During interactions (such as
when a teacher presents a lesson to a student, or a pilot interacts with their employer) subtle cues within the situation indicate to an individual the quality of both task involvement (interest, pleasure, work) and interpersonal relations (controlling, informational) during subsequent experiences. These expectations result in the individual later responding to similar situations with the same motivational frame. It has been demonstrated that during teaching tasks (such as those experienced during initial, indoctrination and recurrent flight training) participants instructed on a task by teachers exhibiting intrinsically motivated behaviors (teaching because they enjoy or value the experience) demonstrated greater creativity and exploratory behaviors. Participants taught the same task by a teacher demonstrating extrinsically motivated behaviors (stating they were performing the task for monetary reward) showed lower levels of interest, task enjoyment, learning and mood. These behaviors were later transferred to a second generation of learners (Wild, Enzle, Nix & Deci, 1997; Wild & Enzle, 2002). Creativity and exploratory behaviors are attributes needed by pilots when managing unusual cockpit events (such as equipment malfunctions or unexpected environmental conditions), with the lack of these having the potential to block desired outcomes (successful completion of the flight).

**Uncertainty, Stress and Coping**

Uncertainty may be the most fundamental force motivating groups and group behavior (Hogg & Mullen, 1999). Uncertainty can arise in situations where an individual anticipates or experiences incongruity or disagreement between their individual beliefs, attitudes, behaviors or feelings and those with whom they are expected to agree (Abrams & Hogg, 1990; Hogg & Mullen, 1999). Uncertainty and ambiguity are experienced as uncomfortable because they are associated with a loss of individual control (Hogg & Mullen, 1999). When it is not possible for a person to reduce uncertainty with physical tests (such as referring to cockpit instruments or
Motivational theories view uncertainty through the lens of the fundamental needs of an individual. Uncertainty is stressful because it places an individual in unpredictable or uncontrollable situations for which they may not have the competence, decisional autonomy or social support to maneuver effectively (Skinner & Edge, 2002). But stress does not always have to generate adverse consequences. Rather, stressful events provide opportunities to develop coping tools and interpersonal relationships (Skinner & Edge, 2002). If earlier interactions were resolved effectively, an individual will view new experiences as challenges, while incompetent or ineffective experiences generate confusion, pessimism and a desire to escape (Skinner & Edge, 2002).

Coping is the process used by an individual to prolong interactions or reduce stress in situations where competing task and social goals cannot be met or their successful completion is otherwise blocked (Skinner & Edge, 2002). In these conflicted or uncertain situations, stressors, which can be categorized as either challenges or threats, trigger conscious or unconscious emotional or behavioral action strategies depending on whether they are perceived as experiences of autonomy or control. These strategies, or “action tendencies” often originate in childhood, develop over time and are based on an individual’s perception of the environment (such as being observed out of curiosity rather than for purposes of control), rather than actual
conditions. It is during these conflicts and negotiations that external goals can become internalized.

Action tendencies tend to cluster around two experiences: loss of control (chaos, characterized by unpredictability or incongruity) and coercion (experiences of pressure, force, manipulation or other forms of hostility or interference), which individuals can approach with either a spirit of concession (if you can’t beat them, join them) or defense. When chaotic experiences are met with a spirit of concession, the resulting behaviors, including cooperation, acquiescence and deference have been labeled as accommodation; when using this approach situations are met with openness and flexibility and result in cooperation or other methods of accepting the constraints of the situation. When chaotic situations are met with defense, an individual displays a posture of negotiation. Negotiation involves the prioritization of goals, recognition of the conflict between personal goals and the goals of others is recognized with creativity applied so high-priority personal goals can be achieved while the goals of others can also be supported. When a coercive situation is met with an attitude of defense, the result is opposition. As a result, the goals of others are blocked with the use of defiance, rebellion, explosion or revenge, which often have the adverse effect of escalating the situation.

Perseverance is used to describe adopting a strategy of concession in the face of coercion. This strategy lacks the flexibility exhibited when a situation is perceived as chaotic and its rigid forms of problem solving result in compliance, conformity and submission to the goals or needs of others rather than those of the self. An unfortunate symptom of this strategy is that an individual can continue to pursue goals that are no longer attainable (such as when severe weather precludes safe arrival at an airport) at the expense of other, more important goals (preservation of the lives on board) (Skinner & Edge, 2002).
Priming the Social Context for Action

Cognitive priming processes are similar to those of priming a combustion engine, as materials introduced into the cognitive environment become available for immediate and rapid processing when work is required. Like fuel available when an engine is sparked, knowledge and interpretations of information can be stored for stimulation by contextual cues. These stimuli can then activate a series of connected modes in memory, generating related behaviors (Sternberg, 1999). This type of model processing is the underlying principle of Line Oriented Flight Training (LOFT) during which simulated in-flight scenarios are used to train aircrews to rapidly respond to abnormal conditions.

Goals can be acquired and activated in the same manner as habituated skills. That is, following repeated exposure to a goal in a specific context, the goal can become activated at a later time when similar stimuli are present. This process occurs both inside and outside conscious awareness. Participants receiving a nonconscious prime for high performance on a word-find puzzle have demonstrated increased performance, increased persistence at task and had a greater likelihood of returning to the task when interrupted than a control group (Bargh, Gollwitzer, Lee-Chai, Barndollar & Trotschel, 2001). It also appears goals are absorbed in reference to those with whom we have relationships, with the psychological presence of referent figures having the ability to elicit performance in line with the standards and goals shared by partners.

Chess masters (Reason, 1990), firefighters and neonatal intensive care unit nurses (Klien, 2003) are all effective because they are able to consciously recognize piece, environmental cue and symptom combinations as having known solutions and utilize these strategies to obtain successful outcomes. This type of priming, the use of situational cues to elicit the “solution” to
an abnormal event, is similar to the contextual priming of answers in problem-solving tasks. Gibson (2004) observed that participants who interact with physical items (such as an apple) relevant to the solution of a subsequent puzzle (the word apple located in a word-search puzzle) more frequently solved the later puzzle and were more likely to report intuition as a factor in the solution. In a study of VFR pilots experiencing deteriorating weather during a simulated flight, those who had been primed with the benefits of diverting were more likely to divert than those who received primes describing the losses associated with such an action (O’Hare and Smitheran, 1995).

There is an increasing belief among safety practitioners that accidents are not solely failures of the individual but rather the result if weaknesses of the systems that surround them (Reason, 1990; Lauber, 1993). Reason (1993) proposes that accidents are the result of latent errors committed by or failures permitted by management that result in barriers to protect the system from active errors not being present at the local level. According to his model, decisions at the organizational level, including resource management, organizational culture and climate and operational processes and oversight have a trickle-down effect on the operation of the organization. These decisions create the potential for supervisory lapses, including inadequate supervision (in the form of lack of proper training and oversight), planned inappropriate activities (including excessive tasking and/or poor risk management), failure to correct known problems (inappropriate behavior and/or safety hazards) and supervisory violations, such as failing to enforce rules or permitting a crew to accept an unnecessary hazard. As a result, preconditions, such as physical and technological limitations, poor planning and communication and the condition (mental, physiological and physical) of employees increase the potential for
human error (unsafe acts) to occur during day-to-day operations. Thus accidents often tell us more about an organization and its’ operating practices than they do the pilots (Johnson, 1993).

Adverse consequences are often the result of the best of intentions. All aircraft operators, from the private pilot on a pleasure flight to the airline captain on a scheduled route must balance the moral mandate of safety and the economic mandate of efficiency (Smith, 2001; Maurino, 1999). The Federal Aviation Administration has established minimum weather criteria for Part 121 (Air Carrier) and Part 135 (Commuter and On-Demand Air Taxi) flight operations. Part 121 regulations state that a flight cannot be authorized for instrument flight operations if weather reports and forecasts indicate the weather at the destination is or will be above approach minimums at the estimated time of arrival (FAA, 2008a). Instrument flight weather criteria are included in each Part 135 certificate holder’s operations specifications; culture can influence whether these minimums are aligned with the FAA minimums or are higher to accommodate expected operating conditions or an increased margin of safety (FAA, 2008b). While the weather at Aspen as the pilots of Gulfstream N303GA approached the airport was reported to be better than the FAA established minimums, three aircraft ahead of them were unable to complete the approach, with one of these pilots later reporting they had encountered snow showers on the approach (NTSB, 2002). These conflicting indications may have created a conflict (uncertainty) in the minds of the Gulfstream pilots regarding whether a “safety” or “efficiency” strategy should be utilized.

Uncertainty has been described in social influence literature as a social construct that occurs when an individual experiences disagreement between themselves and others (Turner, 1985). Self-categorization in a group (such as a flying operation) is an important element of an individual’s self concept (Terry, Hogg & Duck, 1999). As a result, the expectations of other
members of the group can be used as valid responses to ambiguous situations. When these expectations are combined with a desire to be included or maintain membership in the group, they can exert a powerful influence on the individual (Turner, 1991; Abrams et al., 1990). During periods of uncertainty, individuals not only consider the costs and benefits of potential courses of action, but also how others would perceive these responses. (This could potentially include the expectations and perceptions of passengers.) Pleasing others can often be an important element of the decision-making process (Terry, Hogg & Duck, 1999). Once an individual is focused on the reaction of others, they can become “slavishly” responsive to the influence and pressures exerted by the group (Turner, 1991). In this light, it is not difficult to detect the many social forces acting upon the crew of Gulfstream N303GA as they began their final approach.

When faced with uncertain or dynamic conditions, such as those generated by unpredictable weather, a pilot (or crew) aims to select the option that maximizes tangible gains (such as personal convenience, pleasing others or maintaining a schedule) while minimizing risk to the passengers and craft. Awareness of what is valued and expected in an operating system is important because research into priming, the influence of environmental cues on individual behavior, indicates not only can memories and behaviors be primed, but goals, plans and problem solutions can be primed as well (Bargh et al., 2001; Fitsimons & Bargh, 2003; Gibson, 2004).

Because of the potential for priming effects, it is important for organizations to be aware which norms, goals and behaviors their members have internalized. In 2005, the co-pilot of a low-cost European carrier became concerned when his captain was not able to establish their Boeing 737 on the instrument approach into Rome Italy’s Campiano airport. After attempting to
determine whether the captain was incapacitated the co-pilot recognized the aircraft was entering a “potentially unsafe” condition and initiated a go-around. Investigation revealed the captain had returned to work within days of the death of his son (Learmount, 2006). In this case the norm to maintain normal operations appears to have overridden other more personal needs.

Other examples of social cues influencing outcomes can be found in other aviation accident reports. In 2000, the pilots of an Alaska Airlines MD-83 detected a flight control malfunction during a flight from Puerto Vallarta, Mexico to San Francisco, CA. The crew, prompted by maintenance and dispatch personnel on the ground to return to Los Angeles to facilitate in-house repairs, overflew several suitable airports once they had turned southbound. Fifty miles north of Los Angeles, the horizontal stabilizer trim system (pitch control) failed, and the aircraft and its 88 passengers plunged into the Pacific (NTSB, 2003a). Another event which may have been influenced by an organizational norm to maintain operations occurred when the reluctance of company dispatchers to evacuate their airline’s aircraft from a hub in the face of severe thunderstorms resulted in serious damage to over 25 company aircraft in less than one hour, closing the airport and delaying thousands of passengers (Smith, 2001). In addition, a review of general aviation accidents indicates there is a significant increase in fatal accidents when passengers are present (Goh & Weigmann, 2002).

The Present Study

The present study seeks to examine the effects of motivational and contextual primes during aeronautical decision-making. A 3 x 3 fully factorial design was used. The first independent variable, motivation, had three levels (as determined by scores of the General Causality Orientations Scale): autonomous, controlled and impersonal orientations. The second independent variable, contextual prime, consisted of a “proceed (efficiency)” prime, a “divert
Motivational Orientation and Social Context

(safety)" prime and a neutral prime (control group) (see Table 2). Self-determination research indicates individuals with controlled orientations will display less creativity and flexibility than their intrinsic peers, and also be more likely to conform to the expectations of others. Research of priming effects indicates the presence of contextual cues (messages in the environment) during problem solving leads to the selection of similar goals and solutions.

Table 2. Experimental Design

<table>
<thead>
<tr>
<th>Motivational Orientation</th>
<th>‘Proceed’ (Efficiency) Prime (P)</th>
<th>‘Divert’ (Safety) Prime (D)</th>
<th>Control Group (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous (Intrinsic)</td>
<td>PA</td>
<td>DA</td>
<td>CA</td>
</tr>
<tr>
<td>Controlled (Extrinsic)</td>
<td>PC</td>
<td>DC</td>
<td>CC</td>
</tr>
<tr>
<td>Impersonal (Amotivated)</td>
<td>PI</td>
<td>DI</td>
<td>CI</td>
</tr>
</tbody>
</table>

The following hypotheses will be examined:

Hypothesis 1: Motivational orientation will be related to creativity and flexibility exhibited by participants. Creativity and flexibility were measured using the number of problem solutions (strategies) participants reported they considered during the task. Intrinsically motivated participants were expected to report considering a greater number of potential solutions than extrinsically or impersonally oriented participants.

Hypothesis 2. The prime will influence the strategy participants select. In this case, participants receiving the “divert” prime were expected to be more likely to divert and those
receiving the "proceed" prime were expected to be more likely to proceed in reference to the control group.

**Hypothesis 3** There will be an interaction between motivational orientation and prime

More specifically:

**Hypothesis 3a** Intrinsically motivated participants are expected to divert regardless of the prime they receive

Intrinsically motivated participants were expected to recognize that due to forecast weather, it would be unlikely they would be able to "get in to" Crystal River Airport and that it would be more reasonable to meet their "passengers" at another local airport. Therefore, intrinsically motivated participants were expected to divert in greater numbers than extrinsically or impersonally oriented participants, regardless of the presence (or lack thereof) of the primes.

**Hypothesis 3b** Extrinsically motivated participants are expected to comply with the prime they receive

Extrinsically motivated participants are expected to focus on external social cues and respond to these cues rather than task or environmental cues. Thus extrinsically motivated participants receiving the "divert" prime are expected to divert, while those receiving the "proceed" prime are expected to proceed.

**Hypothesis 3c** Amotivated participants are expected to comply with the prime they receive, though to a lesser extent than extrinsically motivated participants and a greater extent than intrinsically motivated participants.

**Method**

*Experimental Scenario*

A simulated flight scenario was used to study the relationship between motivational orientation and subtle cues in the social environment. This flight scenario consisted of a flight
from Daytona Beach FL (KDAB) to Crystal River FL (KCGC). The flight was framed as an “Angel Flight,” with participants tasked to “fly” to Crystal River where they were to pick up an eight-year-old girl and her mother and transport them to Atlanta GA where the daughter would receive ongoing cancer treatments. The clock in the lab was set to begin at 7:55 in the morning, with participants instructed that it was preferred the flights be completed before dark. A Cessna 172 was the simulated aircraft as this is the aircraft most frequently used for primary single-engine training in the Daytona Beach area. A standardized weather scenario was used for all participants. Pre-flight weather was made available to all participants using a printed Flight Service Station Standard Weather Briefing. These weather materials were prepared so the most recently issued Terminal Area Forecast was two hours old and indicated that an area of morning coastal fog was situated over the west coast of Florida (including Crystal River) but was expected to improve slightly by the estimated time of arrival. Weather materials are presented in Appendix A.

The flight task was carefully selected to maximize uncertainty while minimizing opportunities for programmed responses. To simulate operational forces in the simulator environment, an “angel flight” task was selected. “Angel flights” are non-emergency medical transport flights provided to qualifying patients by volunteer pilots free of charge to the passengers. This type of flight was selected because not only can “angel flights” operate under Part 91, Part 125 and Part 135 operating rules, but pilots have indicated angel flights are one of the top three reasons (following home-holidays and search-and-rescue) for taking greater risks in flight (Driskill, Weissmuller, Ouebe, Hand, & Hunter, 1998). Pre-flight materials defined the mission as “flying” to Crystal River Airport, “onloading” a patient and family member, and proceeding to Atlanta for life-saving medical treatment, all within an allotted time period.
The selection of Daytona Beach and Crystal River airports for this task was the result of careful consideration of several factors. As participants were to be recruited from the local area, Daytona Beach, the primary tower-controlled Instrument Flight Rules (IFR) airport in the area was selected as the point of departure. Crystal River was chosen as the destination airport because it most closely fit the requirements set by the researcher. These requirements included that the route of flight not parallel and major highways or interstates (as this would make transport of the patient via automobile the optimum choice), that the selected airport have at least one sister airport (within 10 to 15 flying minutes) with an instrument approach and that the airport be located in an area capable of experiencing rapidly fluctuating (or in this case stagnant) weather conditions. The driving route from Daytona Beach to Crystal River requires using secondary roads, Crystal River is within 25 nautical miles of Inverness, Dunellon and Ocala airports, and its’ coastal location leaves it prone to weather fluctuations or stagnation. Descriptions of the task were included in participant instructions.

The simulator task began with the participant in the aircraft, on the ground at Daytona Beach, FL where Automated Terminal Information Service (ATIS), Clearance Delivery, Ground Control and Tower Control services were available. The scenario drove participants to “call” Clearance Delivery for their IFR clearance; upon calling, all participants were given the same flight routing regardless of the course they had planned. Once airborne participants were fist “handed off” to Daytona Beach Departure (where they were radar identified), then to Jacksonville Approach for the remainder of the flight across Florida. Over the course of the 50 nautical miles between Daytona Beach and Ocala FL (the initial approach point on the Crystal River approach) participants could overhear controller instructions to another aircraft, a twin-engine Cessna, as they first came away from Crystal River Airport on a “missed approach,”
attempted a second approach and then proceeded to land (presumably successfully) at Ocala Airport. Over the course of the scenario, the weather degraded, with participants entering “IFR conditions” 5 miles east of Ocala. Three miles west of the Ocala airport, those participants not in the control group were presented with a prime to either continue to the airport (proceed) or meet the passengers at another location (divert). Participants in the control group did not receive a radio call. Shortly after this, the participant received information that updated weather information was available. Throughout the exercise, “current” weather (including a pilot report of observed conditions (PIREP) from the pilot of the Twin Cessna who could not get into Crystal River) was available to the participant via a simulated radio call to Flight Service (FSS), Flight Watch, Automated Weather Observing System (AWOS) or Automated Surface Observation Systems (ASOS). When accessed, these materials indicated that the weather at Crystal River was still below the required minimums for the approach. The scenario script consisting of the air traffic control script, weather materials and schedule of weather inputs is included as Appendix B.

The experiment was considered ended upon selection of an alternate airport or the acceptance by the participant of a second approach to the destination airport. Participants were then either allowed to fly the instrument approach to their alternate airport or were directed to “land” at a nearby airport. Following the flight segment, participants were given a short questionnaire allowing them to describe reasoning methods they used during their participation. Flight segments were videotaped to allow review at a later time.
Measures

Independent Variables. The independent variables in this study were motivation at the personality level as determined by the General Causality Orientations Scale (GCOS) and the contextual prime applied by the researcher.

General Causality Orientations Scale. The General Causality Orientations Scale (GCOS) is a pen-and-paper test designed to measure individual motivational orientation at the global level. The test consists of 17 vignettes describing social or achievement-oriented opportunities, each with three responses, one corresponding to each of the three motivational orientations. Respondents identify, using a seven-point Likert scale, the likelihood they would respond to each option presented. Scores are tabulated by summing responses on each subscale, transforming the totals to z-scores and comparing them to other respondents in the sample. Initially, participants completed the GCOS as part of the study session. However, earlier volunteers tended to be predominantly intrinsically motivated; later volunteers were screened via e-mail prior to scheduling the session. A copy of the GCOS is provided in Appendix C.

Contextual Primes. Once the motivational orientation of a participant was determined using the GCOS, they were randomly assigned to one of three priming groups: a 'proceed' (efficiency) group, a 'divert' (safety) group and a control group. Participants in the “proceed" and “divert" groups were exposed to contextual primes twice during the experiment. The first prime was embedded in the participant instructions provided during the flight planning segment of the study. While all participants received the same introduction, general description of the Angel Flight program and description of the flight task, instructions given to the participants in the “proceed” group included additional paragraph regarding the need to adhere to treatment schedules and the reliability of the Angel Flight program to maintain those schedules while the
instructions provided to participants in the “divert” group included a paragraph describing the impeccable safety record of the organization and additional safety-related guidelines. These instructions are presented as Appendix D.

A second communication reinforcing the original prime was presented to participants as they began the approach into Crystal River. This prime consisted of a radio call from Jacksonville Approach; “proceed” participants were requested to provide their estimated time of arrival at Crystal River while participants in the “divert” group received the information that weather at the intended destination was “still foggy” and that their passengers were requesting whether they should meet at a different location. Participants in the control group did not receive an in-flight prime. The in-flight primes can be located on page 73 of Appendix B.

**Dependent Variables.** The dependant variables measured in the study included creativity and flexibility, and the participant decision to either proceed to or divert from Crystal River Airport.

*Creativity / Flexibility.* This variable was measured by a numeric count of the number of strategies developed, including both the original and new courses of action as self-reported to a question in the debriefing questionnaire.

*Proceed / Divert Decision.* This was measured using dichotomous scale of proceed or divert. Participants electing to change their intended airport of landing prior to reaching the missed approach point (MAP) of their first approach to Crystal River Airport were categorized as “divert” while all others (pilots electing to proceed to their pre-determined alternate airport at or after the missed approach point, and pilots accepting a second approach to Crystal River) were categorized as “proceed.” The frequencies of these decisions were tabulated.
Participants

Forty-eight (48) pilots were recruited from flight schools in the Daytona Beach area for this segment of the study. Participants were required to hold a minimum of a single-engine instrument airplane rating; 35 pilots reported holding additional ratings including commercial, flight instructor, instrument instructor, multi-engine and seaplane ratings. Pilots who reported holding an Air Transport Pilot License or who had previous military, airline, charter or corporate experience were excluded from the study.

Demographic information was available for 41 of the participants. The age of these participants ranged from 19 to 29 years, with an average age of 21.8. Three of the participants were women. These pilots had accrued total flight times ranging from 107 to approximately 1700 hours with a mean of 395.85 hours (SD = 348.95 hours). Participants reported instrument times ranging from 4.7 to 200 hours (mean = 64.92). It should be noted that these numbers may have been affected by reporting error; there is some discussion among the pilot community whether instrument experience obtained in a simulator or simulated in an aircraft should be included in “total” instrument time. In addition, participants with more flight experience appeared to approximate their reported flight times.

Reported cross-country experience ranged from 28.9 hours to 750 hours with a mean of 105.74 hours. It should be noted only six participants reported accruing more than 200 hours of cross-country experience (240, 240, 250, 250, 350 and 750); when these pilots were sequestered from the sample, the mean cross-country time drops to 64.43 hours. Finally, 26 participants reported obtaining instrument time outside the training environment, and 28 participants reported obtaining cross-country time outside the training environment.
Procedure

Each participant participated in a single three-hour session consisting of four segments: intake, flight planning, the flight scenario and debriefing. Prior to the session, participants were asked to fill out a demographic questionnaire. This form (Attachment E) was used to gather background information and included participant age, gender, total flight time, ratings held and instrument and cross-country flight experience. Participants were also advised the session would include a simulated flight between Daytona Beach and Crystal River airports in a Cessna 172 aircraft.

Upon arrival at the session, participants reviewed and signed the informed consent (Attachment F), provided the demographic questionnaire and completed the GCOS. While the researcher scored the GCOS, participants were allowed approximately fifteen minutes to become familiar with the operation and handling characters of the flight simulator. An ELITE simulator programmed to simulate a Cessna 172 was used for the simulated flight segment. A Microsoft Flight Simulator (2004) interface was configured to display traditional cockpit instruments on a computer-generated screen, and allowed the researcher to manipulate the exterior weather conditions displayed on an 8-foot screen with a Liquid Crystal Display (LCD) projector.

Once the motivational orientation of a participant was determined, they were randomly assigned to one of the three priming groups and the participant began flight planning activities. To minimize researcher influence, the flight planning materials were presented to the participant in a sealed envelope. This envelope contained weather materials, one of the three descriptions of the scenario task and a second sealed envelope containing the in-flight prime. All participants were presented the same pre-flight weather materials. These materials were consistent with a
Flight Service Station (FSS) Standard Briefing as it is received when using the FAA’s DUATS system. The weather portion of the briefing indicated that the weather on the west coast of Florida was below minimums, that the weather in the area was stagnant but that there was a possibility the weather would improve to just above minimums at the estimated time of arrival. These materials included an AIRMET for instrument flight conditions and mountain obscuration for the west coast and panhandle of Florida which had been updated (to extend the period of coverage) twice since its original issue. The briefing also included the information that all Military Operations and Restricted Areas along the route of flight would be “cold” for the duration of the scenario. (Pre-flight weather materials are included as Attachment A.) Participants were told they had “all the time they need” to complete flight planning.

Later subjects completed the GCOS prior to scheduling a session; these subjects accomplished the practice session between the flight planning segment and the simulated flight scenario.

When the participants indicated they had completed their flight plan, the researcher reviewed their flight plan, accepted the sealed envelope and the participant was moved to the flight simulator. Once they had organized their navigational materials, participants were advised of their location on the airfield and were instructed to fly the segment from run-up (pre-flight checks) to shut-down, performing tasks and making radio calls as they would normally do in an aircraft. Upon calling Clearance Delivery for their instrument flight clearance, all participants were given the same revised clearance, a routing that directed them to, once they left the local environment, fly to Ocala VOR on a straight-line path from Daytona Beach before beginning the approach in to Crystal River. As the pilots traversed this path, the weather displayed on the screen slowly deteriorated from ten miles visibility with scattered clouds (visual flight
conditions) to near complete cloud coverage at a point five miles east (prior to) Ocala. Ten miles east of Ocala, all pilots who had not previously initiated a different clearance were cleared for the VOR/DME approach in to Crystal River. The second prime was given when they reached a point three miles west of Ocala. Two minutes later they were advised the AIRMET had been updated for a third time. Updated weather information, including a pilot report (PIREP) for Crystal River Airport) were available to the participant throughout the flight via channels mimicking those in the actual environment.

The instrument approach in to Crystal River begins at Ocala VOR. Pilots begin this approach departing the VOR on a southeast heading (225 degrees) at an altitude of 2,000 feet. They must maintain this altitude until a point 20 DME (slant range nautical miles) west of Ocala VOR, where they are permitted to begin a descent to the minimum descent altitude of 720 feet, which they must then maintain until a point 25.7 DME west. At this point, the aircraft is within visual range of the airport but flying at an angle to the runway. At this point the pilot must either decide to proceed, maneuvering to land on the east/west runway, or, if the runway is not in sight, execute the missed approach. In this scenario, as the approach progressed, the displayed weather decayed until it reached full cloud coverage extending from a height of 700 feet (just below the MDA) with a below-cloud visibility of 2 miles. This was then alternated every five miles with a cloud coverage of 7/8, permitting the pilot to “see” the airport and in some cases the airport. Updated forecasts and observations were available to the participant via radio from Flight Service, Flight Watch, AWOS and ASOS. These inputs, as in the real world, were only available by pilot request.

When the participant reached a point one mile east of the airport, the weather was switched from the 7/8 coverage condition to the 8/8/ coverage condition, precluding “landing” at
the airport. At this point, participants could then ask for a second approach to the Crystal River Airport or for a clearance to an alternate airport. Participants accepting a clearance to an alternate airport were given the clearance and allowed to fly the route, landing in visual flight (VFR) conditions. Participants requesting a second approach were “vectored” back to Ocala, where they were given the appropriate clearance. Shortly after accepting this clearance, the researcher would re-direct these participants to a closer airport, where they would also “land” under VFR conditions. The full scenario script, including air traffic control, weather inputs and weather reports, is available as Appendix B.

Following the simulator segment, participants were asked to complete a post-flight questionnaire exploring their experiences during the scenario (Appendix G) and were given a short debriefing (Appendix H). A cover story was used throughout the session to mask the true intent of the research from participants.
RESULTS

Hypothesis 1: Effects of motivation on creativity/flexibility. The number of strategies considered by participants, as indicated during the post-flight questionnaire ranged from a low of two to a high of six, with a mean of 2.5 ($SD = 0.90$) strategies considered. Of the 48 pilots who participated in the study, 19 were categorized as intrinsically motivated, 13 were categorized as extrinsically motivated and 16 were classified as amotivated. Extrinsically motivated participants exhibited the lowest mean and least amount of variability ($M = 2.15$, $SD = .37$) with amotivated participants showing the greatest mean and the greatest range of variability ($M = 2.69$, $SD = 1.08$) (see Figure 2). Intrinsically motivated participants were in the middle with a mean of 2.58 strategies ($SD = 0.96$). A One-Way ANOVA was performed to determine whether there was a main effect for motivation, as indicated by number of strategies considered. The results ($F (2,45) = 1.41$, $p > .05$) were not significant and the hypothesis was not supported.

![Figure 2. Mean Number of Strategies Considered by Motivational Orientation](image-url)
Although not included in the original hypothesis, it was later supposed that priming condition could affect the number of strategies indicated by participants. To examine this, a 3 x 3 ANOVA was considered, but due to the small samples sizes, the 3 x 3 was discarded in favor of a 2 x 2 ANOVA. The 2 x 2 ANOVA was limited to the intrinsic and extrinsic motivation and the “proceed” and “divert” primes. Participants in the “proceed” condition indicated between two and five strategies, while all participants receiving the “divert” prime indicated they considered only two strategies. The means and standard deviations for number of strategies as a function of motivational orientation and priming condition are presented in Table 3 and graphed in Figure 3. The ANOVA indicated significant effects for both motivation ($F(1, 16) = 4.80, p = .04$) and priming ($F(1, 16) = 7.94, p = .01$) condition. The ANOVA also indicated a significant interaction between motivation and priming ($F(1,16) = 4.80, p = .04$).

<table>
<thead>
<tr>
<th>Motivational Orientation</th>
<th>Priming Condition</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic</td>
<td>Proceed</td>
<td>3.60</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td>Divert</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Extrinsic</td>
<td>Proceed</td>
<td>2.20</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Divert</td>
<td>2.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Follow-up tests were performed. These tests indicated that the intrinsically motivated participants who received the “proceed” prime reported considering a greater number of strategies than those intrinsically motivated participants who received the “divert” prime as well as the extrinsically motivated participants who received the “divert” prime, ($F(1, 16) = 9.80, p = .01$). Thus, it appears that priming interacts with motivation to influence the number of strategies pilots report considering during flight.
Hypothesis 2: Effects of priming on strategy selection. The seventeen participants in the control group received no prime and four of these participants (23.52%) elected to divert. Participants who received the prime to proceed (n=15), eight (53.33%) diverted to a different airport (see Figure 4), and the remaining seven participants either proceeded to their designated alternate or requested a second approach to Crystal River. Of participants who received the “divert” prime (n=16), ten (62.5%) diverted to a different airport. A Chi-Square Test of Independence was performed to determine whether there was a main effect for priming as measured by strategy selection. The results ($\chi^2(2, N = 48) = 5.54, p = .063$) were not significant at the 0.05 level, and the hypothesis was not supported at that level. The result is significant at the $p = 0.10$ level.
Hypothesis 3: Effects of Interaction between Motivation and Prime on Strategy Selection. As specific hypotheses were made regarding each motivational group, separate Chi-Square Tests for Independence were performed.

Hypothesis 3a: Effects of Priming on Intrinsically Motivated Participants. A Chi-Square Test of Independence was performed to determine if intrinsically motivated participants were responsive to the primes. The data showed that 25% of the participants in the control group (2/8) diverted (i.e. chose to turn away prior to reaching the missed approach point), while 60% (3/5) of those receiving the “proceed” prime and 33.33% (2/6) of those in the “divert” group diverted as well. The results of this test was not significant ($\chi^2 (2, N = 19) = 1.666, p > .05$). Thus Hypothesis 3a was not supported.
Hypothesis 3b: Effects of Priming on Extrinsically Motivated (Controlled) Participants.

Extrinsically motivated participants were expected to be susceptible to cueing, that is, extrinsically motivated participants receiving the “divert” prime were expected to divert in greater numbers than their peers receiving either the “proceed” prime or no prime at all. A Chi-Square Test of Independence was performed to determine whether extrinsically motivated participant behavior was related to the prime they received. None of the participants (0/4) in the control group elected to divert (100% continued); 40% (2/5) of the participants receiving the “proceed” prime chose to divert (60% continued) while all extrinsically motivated participants receiving the “divert” prime (4/4) chose to divert (see Figure 6). The results of the analysis indicates the differences in behavior between the groups was significant ($\chi^2 (2, N = 13) = 9.171$, $p = .017$) and the hypothesis was supported. It should be noted that an expected frequencies analysis could not be performed due to the small sample size. In addition, chi-square requires a
minimum expected frequency of five to be a valid computation. While the statistical validity of this significant finding is in question, participant behavior suggests further exploration of this interaction may yield stronger results.

Figure 6. Percentage of Extrinsically Motivated Participants Selecting a “Divert” Strategy

Hypothesis 3c: Effects of Priming on Impersonally Oriented (Amotivated) Participants.

A Chi-Square Test of Independence was performed to determine whether strategy selection by impersonally oriented participants was influenced by the prime they received. Forty percent (2/5) participants in the control group elected to divert, compared with 60% (3/5) in the “proceed” group and 66.66% (4/6) in the “divert” group. While these behaviors were consistent with researcher expectation, the analysis performed to detect differences in behavior between these sample groups did not show a significant effect ($\chi^2 (2, N = 16) = .830, p > .05$). Based on these results, Hypothesis 3c was not supported.
Figure 7. Percentage of Impersonally Motivated Participants Selecting a “Divert” Strategy

Demographic Data Analysis

The demographic information provided by participants was explored for predictive value. Though there appeared to be an association between flight time and the decision to divert, holding a Certified Flight Instructor, Instrument rating was the only demographic variable found to have a significant effect on strategy selection. However, the sample size (n = 4) precluded valid consideration of this finding.
DISCUSSION

The purpose of this study was to examine the effects of motivation and social priming on in-flight decisions. The results will be discussed by hypothesis and followed by a general discussion.

*Hypothesis 1: Effects of motivation on creativity/flexibility.* Creativity and flexibility were measured using the number of strategies participants indicated on the post-flight questionnaire, with intrinsically motivated participants expected to report a greater number of strategies than other participants. The One-Way ANOVA performed to investigate this effect was not significant and this hypothesis was not supported. Three factors may have influenced this outcome. First, instrument flight plans require a pilot to declare an alternate airport when they file their flight plan. Participants were advised in advance to expect to “fly” an instrument flight segment between Daytona Beach and Crystal River and many arrived at the session with a flight plan already prepared. The survey question asked “What strategies did you consider” during the flight; when responding, participants may have limited their in-flight decision-making process to the two (original destination and designated alternate) they indicated on their flight plan, withholding other options they may have considered during their flight planning process. Second, self-reports require a certain amount of self-awareness. Decision-making in a dynamic, time-compressed environment is a rapid and sometimes subconscious process; participants may have considered more options than those they reported but did not consciously recognize these thoughts as valid strategies to be reported. Third, participants may not have remembered or felt comfortable reporting all of the strategies they considered during the flight.

Participant selection may have also had an effect on this result. During previous studies, researchers were able to pre-screen participants, selecting those that exemplified each of the
three motivational orientations for inclusion in a study. Instrument rated pilots are limited in number. During this study, participants were recruited and run through the trial serially as they indicated interest. Thus, when a new participant was added, the mean score for each motivational oriented shifted slightly. Several participants had scores close to the means of more than one orientation, and their motivational orientation shifted between two or more groups as the study progressed. This ambiguity may have been a factor in the observed results.

The results indicate there is an interaction between priming condition and motivational orientation. This finding has some interesting implications within the aviation domain. Pilots sometimes encounter in-flight conditions which require them to make decisions in a time-compressed environment with limited information (Wiegmann & Shappell, 2003). During the scenario included in this study, pilots had the option to respond in many ways: they could have diverted to one of four local airports, continued approaches to Crystal River until the weather cleared or they ran low on fuel, made arrangements prior to departure to meet their passengers at another location or refuse the flight outright. According to Weigmann and Shappell (2003, p. 54), it is during “ill-defined situations” that developing novel responses is most needed.

Participant behaviors in response to the proceed prime indicate it may have been the most ambiguous of the three. (This will be discussed in greater detail in the “Limitations” section.) The findings of this study suggest that when a defined “solution” is presented during an ambiguous situation, the number of alternatives considered may be reduced to the original plan and the suggestion. Thus it could be argued that when specific instructions are provided, even in the form of suggestion, creativity is curtailed. This raises the concern that in an overly structured environment, the constant presence of defined solutions could, over time, erode creativity and
imagination. This could have profound effects during situations, such as compound or ill-defined emergencies, when imagination, creativity and flexibility are needed to resolve the event.

*Hypothesis 2: Effects of priming on strategy selection.* It was expected that priming condition would influence the strategy selected by participants. The Chi-Square Test of Independence performed to determine explore the effects of priming were significant at the 0.10 level.

Twenty-three percent of the participants assigned to the control group chose a “divert” response. This result was not unexpected as pilots are goal-oriented, valuing behaviors including meeting schedules, pleasing people and completing flights as planned (Adams & Thompson, 1989). Without any overt indication to the contrary, participants would likely expect completing the flight to Crystal River to be the preferred outcome of the simulator session.

Sixty-two percent of the participants receiving the “divert” prime chose to execute a “divert” strategy during the session. During a previous study of pilot decision-making (O’Hare & Smitheran, 1995), pilots were exposed to one of two single-sentence “framing manipulations.” One manipulation (“loss” frame) emphasized the costs of diverting (hassles and inconveniences) while minimizing the hazards (unlikely to be in an accident involving injury or damage). The second (“gain” frame) emphasized the benefits of diverting (aircraft and occupants undamaged) and described the likelihood reaching the destination safely as uncertain. These manipulations were presented to participants immediately before they were asked to decide whether to continue a simulated flight or return to their departure point. In this study, 8 of the 12 participants receiving the “loss” frame chose to “press on” while 9 of 12 pilots receiving the “gain” frame chose to return. The current study differed from those in the 1995 study in several ways. First, there was no point where participants were specifically (verbally) prompted to make a “press
Motivational Orientation and Social Context

on"/"return" and therefore the primes were in most cases chronologically displaced from the decision point. Second, a variety of options in the form of nearby airports were available to the pilots. In addition, this study used much milder primes, in the case of the "divert" condition, a paragraph in the instructions emphasizing the safety record of the operator and an "in-flight" advisory that the weather was "pretty foggy" and the suggestion to meet elsewhere. Despite the weakness of these primes, there is still an indication they had an effect ($p = 0.063$). The findings suggest it may require only a few subtle but targeted statements to influence the outcome of a flight.

Fifty-three percent of participants who received the "proceed" prime executed a "divert" strategy. This observed result can be explained in one of two ways. First, the behavior of this group was not statistically different than that of the control group. Thus it is possible the prime did not have an effect, with these findings the result of random variations in behavior. Another possibility is that the prime had an effect opposite of that which was intended. The prime embedded in the "proceed" instructions was intended to model "efficiency," that is, maintaining a pre-established schedule. The priming feature indicated getting "Emily" to Atlanta so the schedule of her cancer treatments could be maintained was important. This overarching goal (to get to Atlanta by sunset) may have trumped the need to meet the passengers at Crystal River. In addition, the in-flight prime ("What is your ETA at Crystal River?") was ambiguous compared to the in-flight prime for the "divert" group which clearly defined the preferred behavior. While this group of participants did not behave as expected, their observed actions can be interpreted as also suggesting subtle cues may have an effect on the strategy selected for a flight.

Other factors which may have influenced the results of this study are flight training environment and experience. This study was performed at a university in Florida,
participants recruited from local flight schools. Florida is primarily a VFR environment, with afternoon thunderstorms the most prominent adverse weather element. Over the course of the study it appeared there was a correlation between receiving training in a location outside of Florida and the decision to divert. Flying in other locations may have provided these participants with the opportunity to perform weather decision-making during weather conditions similar to those in the study. As all participants had received some training in Florida, this variable was not included in statistical analysis.

Statistical analysis suggested total flight time as a predictor of the "divert" strategy. It is likely that as a pilot accrues flight time the more exposure they would have to different flight environments and the greater the likelihood they would be exposed to weather conditions requiring decision making skills. It is through these experiences one becomes aware of one's limitations and their effects. (It should be noted one pilot did not "accept" the flight as the "weather" at Crystal River was below his personal minimums.) Holding a Certified Flight Instructor, Instrument was shown to have an effect on the decision to divert. This may have been the result of an element of training included in this rating. It is also possible that the experience of being responsible for guiding students as they develop weather decision-making skills enhances the skills of the instructor as well.

In summary, further research using a stronger protocol (e.g. one with more specific primes and a defined decision point) could provide a better understanding of how social context impacts decisions made by pilots.

**Hypothesis 3: Effects of Interaction between Motivation and Prime on Strategy Selection.**

According to the three hypotheses regarding the interaction between motivation and social context, intrinsically motivated participants were expected to resist the prime, extrinsically
motivated participants were expected to comply with the prime and impersonally oriented participants were expected to perform in a manner similar to random behavior. Of these hypotheses, only the one regarding extrinsically motivated participants was upheld.

In previous research, intrinsically motivated participants demonstrated greater focus on task than extrinsically and impersonally oriented participants, as a result, intrinsically motivated participants were expected to focus on the "needs" of the flight task rather than the perceived needs of others. A possible explanation for the results is that during this experiment, motivation was measured at the global level. Motivation, however, can exist at two other levels as well, the contextual level and the situational level. It has been demonstrated that individuals can hold different motivational orientations for different life aspects, with these differences affecting performance of activities in these contexts (Vallerand & Ratelle, 2002). A description of how motivational orientation can vary between global, contextual and situational levels can be referenced in Table 4.

Experience with flight and decision-making tasks may have also played a result in these findings. A small group of residents of the Carolina Islands in Micronesia have become experts at open-water navigation, and are able to canoe between islands sometimes days apart without any of the mechanical, electrical or magnetic tools considered necessary by western mariners (Hutchins, 1995). Early explanations included that these skills were the result of heightened natural ability (Gonzales, 2003). However, over time researchers determined that these navigators had been taught from a very early age to recognize subtle environmental cues and use these cues to chart and guide their voyages (Hutchins, 1995). In a similar vein, children who have been abused during childhood have been demonstrated to be more perceptive of body language that their peers who were not (Gladwell, 2002). It may be that the intrinsically
As an example of how global, contextual and situational motivation can manifest within an individual, let us consider the case of Holly. Holly works as a waitress, and takes classes that interest her (usually psychology and sociology) at the local community college. When she is not at work or at school she enjoys hiking, photography and spending time with her friends. One day, Holly decides to take a flying lesson at the small, local airport. She is quite taken by the experience, the beauty of the earth as seen from above, the strength she felt handling the controls and the feel of the wind on the wing. As a result, Holly sets earning her private pilot's license as a personal goal.

During her private pilot training, Holly receives instruction from a retired military pilot in one of the school's three light aircraft. During the Vietnam era, Holly's instructor had trained pilots to fly in combat. As a result, the instruction Holly received was a bit non-standard, including not only lessons on aircraft handling but also a heavy emphasis on risk assessment and decision-making. Holly thrived during training. Her instructor framed learning the maneuvers as "fun," made suggestions how she could improve her performance, and she enjoyed the sense of accomplishment she felt when she mastered new maneuvers. Instruction was preformed with no set schedule; the lessons progressed at the pace with which Holly demonstrated new skills. During training, Holly became friends with other flight students, who introduced her to the history, literature and joy of aviation. They would often fly together, sometimes on trips to aviation museums or to have lunch at another airport and on other occasions just to have fun in the sky. As a result of these experiences, Holly decided she wanted to pursue a career as an airline pilot. She applied to, and was accepted at an aviation university that included the necessary flight ratings in their degree program.

During Holly's first semester at the university, she took classes including aviation psychology and the training needed to test for a Commercial rating. She also became active in several clubs, and quickly made new friends. She excelled in the psychology class, quickly recognizing how the knowledge she was gaining could be used to improve aviation safety. Her flight training, however, was another matter. The training program was rigidly structured, with specific learning tasks and performance outcomes for each flight. Her instructor didn't enjoy teaching, rather he made it clear he was instructing solely to build flight time to qualify for an airline interview. She perceived her post-flight reviews as harsh, with her every lapse or misstep deconstructed in fine detail. Halfway through the semester, she had a cold, which excluded her from flying for over a week. This put her behind in the syllabus, and she felt pressure from both her instructor and the school to "catch up" with the rest of the students. During the make-up sessions, Holly detected her questions regarding flight concepts and her performance added to her instructor's frustration, and that she was more likely to "graduate" to the next lesson if she kept quiet. Holly was able to complete the rating by the end of the term, but she was disappointed in both the process and her performance on the checkride. Holly felt conflict between her love of flying and the regimented training she was receiving at the school and questioned whether she should continue her training. She decided to take a semester off from flying, focusing rather on psychology and safety classes. She also considered whether a degree (and career) in one of these areas would be a better fit.

In this example, Holly's overall motivational orientation is intrinsic; she participates in activities she enjoys and learning new tasks brings her pleasure and satisfaction. Initially she is intrinsically oriented towards aviation as well, but the contextual and situational factors at the second flight school shift her motivational orientation to an extrinsic frame. In the end, she appears to have an impersonal orientation to flight. During the entire process, she has maintained her intrinsic motivation at the global level.
motivated participants in this study did demonstrate greater focus on task, but that for them flying and weather risk evaluations were a relatively new and less-practiced skill, while for their extrinsically motivated peers detecting nuances in the social environment is a well-rehearsed and mastered skill.

The finding that extrinsically motivated participants may have an increased vulnerability to social influence in an aviation task has some interesting implications for aviation operations. One of the organizational factors included in Reason's model (mentioned earlier) is culture. Organizational culture can manifest itself in many ways, from the "Right Stuff" demonstrated by early test pilot and the Mercury astronauts to the "Safety Culture" espoused in Safety Management Systems today. The culture adopted by an organization can affect the policies, level of oversight and weighting of risks used within the organization. Organizational culture can also influence whether this guidance will be followed or ignored. Indeed, the FAA recognized the importance of management actions in a 1989 report discussing risk management in the Helicopter EMS industry that stated "...no matter who the pilot in command... the manager who selects the pilot, sets crew standards, duty cycles, establishes company weather minimums and other operating standards is ultimately responsible for mission safety (Adams & Thompson, 1989, p. iii)." Pilots in the current study were presented with a scenario that required them to evaluate weather risks. Analysis indicates social cues (which are often based on cultural norms) have the potential to affect the strategy selected by a pilot.

The study also indicated motivation, specifically an extrinsic (controlled) orientation, may affect how responsive an individual pilot is to social cues. Extrinsicly motivated employees demonstrate a wide range of behaviors that are valued in a business setting. They are concerned with image and social standing, and as a result often become high achievers (Hodgins...
& Knee, 2002). They are responsive to deadlines, imposed goals and competition (Ryan & Deci, 2002). In addition, their desire the please can lead them to place the needs of others before the needs of themselves (Hodgins & Knee, 2002). However, these positive behaviors can come at a cost. Extrinsically motivated persons more likely to conform to or comply with group expectations, rely on others for directions and opinions and respond to challenges with defensive or aggressive behaviors (Ryan & Deci, 2002; Hodgins & Knee, 2002). Also, their inclination to behave in response to external pressures rather than internal needs can cause them to lack confidence in their own judgment (Hodgins & Knee, 2002).

Conformity can be described as submission to a group norm as the result of social pressure (Turner, 1991). Research has shown that the greater the perceived consensus of a group and the greater number of perceived sources of the norm in the environment, the more likely it is for an individual to conform to the norm and comply with the expected behavior (Turner, 1991). A sense of isolation from the group and public scrutiny of a decision or outcome can also increase compliance (Turner, 1991); in one study (Abrams, Wetherell, Cochrane, Hogg & Turner, 1990, Study 2), 77 percent of participants concurred with an erroneous decision when all other members of the group agreed. The findings of the current study indicate extrinsically motivated participants may be more likely than their peers to conform to social cues present in a decision environment. Flight organizations often count on pilots to be the final arbiter of safety, trusting them to successfully evaluate and manage the effects of dynamic weather, aircraft capabilities and mission pressure on prior to accepting and during a flight. The results of this study indicate some pilots may be more effective at resisting mission pressure than others.
Limitations of the Study

This study had several limitations. These limitations include measurement of motivational orientation, issues with sample size, difficulties with video recordings, the efficacy of the primes and the dichotomous nature of the strategy data.

Measurement of Motivational Orientation.

Shifting z-scores. As mentioned earlier, measuring motivation with the General Causality Orientations Scale (GCOS) involves the use of z-scores. During the GCOS, participants rate the likelihood of their behavior using a seven-point Likert scale. These raw numbers are summed and converted to z-scores using the scores of all other participants in the study. As indicated earlier, during this study pilots were measured and participated in the trial serially as they indicated interest. Thus, when a new participant was added, the mean score for each motivational oriented shifted slightly, affecting the z-scores of all participants. Several participants had scores close to the means of more than one orientation, and their designated motivational orientation shifted between two or more groups as the study progressed. This ambiguity indicates these participants may not be truly representative of the motivational orientation to which they were finally assigned.

Level of Motivation. During this study, participant motivation was measured at the global level, while assigned tasks were performed at the situational level. Thus it is possible that participant orientation towards aviation and/or the simulated flight task was different than that experienced at the global level. Scales, such as the Academic Motivation Scale, the Sport Motivation Scale and the Blais Work Motivation Inventory can be used to measure motivation at the contextual level (Vallerand & Ratelle, 2002). In addition, research (Vallerand & Ratelle, 2002) indicates situational and contextual motivation can be better predictors of performance at
the situational level than global motivational orientation. Had it been possible to measure contextual or situational motivation in this domain, a stronger result may have been observed.

Sample Size

There were a total of nine experimental conditions within the protocol. A cursory power analysis conducted during the proposal process indicated that 20 participants were needed in each priming condition to obtain a power of 0.70. Data collection began in January 2005. By March 2005 a total of 38 participants had completed the protocol. These participants were predominantly intrinsically and impersonally oriented. By March 2005 the participant pool appeared exhausted and the researcher accepted employment outside the state. Data collection resumed in the fall of 2007. As data collection for intrinsically motivated participants had already been completed, during this period participants were pre-screened to ensure they were either extrinsically or impersonally oriented prior to making appointments for their participation. A total of eleven pilots were selected during this period, which would have ensured a minimum of five participants in each experimental condition. However, only ten of the selected pilots kept their appointments.

The researcher returned to the Daytona Beach area during the fall of 2008 intending to resume data collection. At that time it was decided sufficient data collection effort had been demonstrated and that the thesis process should shift to data analysis and defense. Shifting z-scores resulting from the missed appointment during the fall of 2007 resulted in the current distribution of participants over experimental conditions. As a result, the number of participants in each condition during the analysis varied between four and eight.
Difficulties With Video Recordings

All participants were videotaped during the simulator session with the intent to use the information the tapes contained to evaluate measures such as time-to-recognition, persistence at task and the number of sources of information utilized by participants. During the 2005 data collection period, a VHS camera receiving sound via wires linked to the headset system was used to record the simulator sessions. During the 2007 data collection period, a personal Mini-HD camera was placed behind participants within a range that allowed capture of the necessary radio calls. Review of these tapes during the fall of 2008 revealed that five of the VHS tapes did not have sound. In addition, it appears that prior to recording of the Mini-HD tapes, the camera had been damaged in such a way that either the sound or video on each tape could be viewed, but not both. Thus data analysis was restricted to data that was either collected by hand by the researcher during the sessions or self-reported by participants on the demographic and post-flight questionnaires. As a result three hypotheses previously included in the study were discarded.

Efficacy of Primes

To be effective the priming conditions would need to encourage each of the three desired behaviors: the “proceed” prime would encourage participants to proceed to Crystal River regardless of the weather, the “divert” prime would encourage participants to turn away while the control condition would not affect the outcome in either direction. During the study, 76.48% (13/17) of the participants in the control group elected to proceed, as did 46.66% (8/15) of those receiving the “proceed” prime and 37.5% (6/16) of those receiving the “divert” prime. These results indicate that while the “divert” prime likely had the intended effect, the “proceed” and control conditions did not. This outcome may have been influenced by the presence of the “Angel Flight” task and the content of the “proceed” primes.
As indicated earlier, “Angel Flights” are non-emergency medical flights provided to families in need by volunteer pilots. Despite the fact these are by definition not medically critical, respondents to an FAA survey (Driskill et al., 1988) indicated performing this type of flight would encourage them to take greater risks. Thus the inclusion of the “Angel Flight” device in the control condition may itself have acted as a “proceed” prime. In addition, the “proceed” primes did not include specific instructions to continue into the weather, and the results indicate this ambiguity may have acted as a control to a greater extent than the “neutral” priming condition.

Ideally the primes would have been developed by a group of several subject matter experts, and a manipulation check would have been performed prior to the study to ensure the validity of the primes. The primes were developed by the researcher and approved by the committee. Prior to data collection, a small pilot study was conducted. The protocol of the study originally included an afternoon thunderstorm weather scenario and during the pilot study, no participants continued into the thunderstorms. At the time, it was thought the thunderstorms themselves acted as a prime to turn away, and the weather in the scenario was revised to a stagnant cloud cover. A manipulation check of the primes was not performed. In hindsight, participant behavior during the pilot study, particularly in comparison to the prime received, should have been scrutinized more closely.

*Proceed/Divert Response Scale*

During the study pilot responses (strategy selection) was ranked on a dichotomous scale. Participants who elected to turn away from Crystal River (divert to another location or refuse the flight) prior to reaching the missed approach point (MAP) of their first approach to Crystal River Airport were categorized as selecting a “divert” strategy. Pilots who, upon reaching the missed
approach point at Crystal River elected to proceed to their designated alternate of accept a second approach to Crystal River were categorized as utilizing a “proceed” strategy. The use of a dichotomous scale limited data analysis to regression or Chi-Square methods. This factor was later compounded by the low sample sizes, which precluded the use of regression and limited the validity of the Chi-Square analysis. In addition, each participant had only one opportunity to demonstrate his or her divert / proceed decision. Having required participants to perform additional scenarios would have increased the reliability of the assessment.

**Implications for Practice**

The finding that extrinsically motivated pilots may be more sensitive to social cues reinforces the need for management to be aware of what social cues are present in their organization and the effects these cues may have may have on decisions. Part 135 and Part 91 operations sometimes leave the final go/no-go decision to the pilot, without providing any formal guidance beyond the FAA weather minimums. Even when guidance is provided it may not always be adhered to, as was the case at an operation where pilots interpreted the guidance “at pilot’s discretion” as permission they could operate in weather conditions below the company-specified minimums if they felt they could successfully accomplish the task (NTSB, 1988). In their 1988 review of the Helicopter EMS industry, the NTSB reported that pilots they interviewed reported they had “experienced pressure, ranging from mild to extreme, to complete a flight when they felt conditions were not safe (p. 55).” The NTSB concluded that there were few instances where management decisions, including the establishment of a risk evaluation program, did not affect the safety of a program (NTSB, 1988). That said, there are times when individual behavior either can, or can be encouraged to, diverge from that of others. Conformity has been found to drop to as little as five percent when at least one other member of the group
expresses disagreement (Turner, 1991). In addition, the mere viewing of an individual performing a divergent action can increase the probability this action will later be replicated by observers (Cialdini Reno & Kallgren, 1990).

There are two strategies flight organizations could consider to reduce the impact of social influence on operations. The first is to adopt a risk assessment program similar to that outlined in FAA Final Report DOT/FAA/DS-88/7 and elsewhere. These programs provide pilots with a checklist to evaluate the potential risks of a flight. Risk which falls below pre-determined levels can be accepted by the pilots themselves, with higher levels of risk requiring management concurrence before the flight can be dispatched. These programs also include provisions dictating that while management can overrule a pilot’s decision to accept a flight, they cannot override a pilots’ decision not to take a flight.

The second strategy consists of taking steps to reduce controlling factors in the workplace while increasing the presence of intrinsic motivators. Behavioral models used to analyze human error, such as Peterson’s motivation-reward-satisfaction model (1971, as cited in Wiegmann & Shappell, 2003), often include “motivation” as one of the variables influencing pilot decisions and actions. However, in these models the construct motivation is not defined in a measurable manner. Self-determination theory provides a schedule not only of individual characteristics and behaviors, but also a schedule of environmental conditions that can either support an intrinsic focus on task or generate an extrinsic focus on group expectations and norms (such as those included in Table 2.). Thus managers now have a tool which can be used to manage the operating environment at the task level. In addition, this knowledge can be used by investigators to explore the effects of company culture on individual decisions. Implementation of this strategy could include creating the perception that surveillance is performed to improve the
system rather than to control or punish employees, providing feedback in an informational rather than judgmental manner, providing opportunities for challenge and growth and creating the experience of choice when work and life decisions must be made (Deci & Ryan, 1985; Ryan & Deci, 2000, 2002; Vallerand & Ratelle, 2002; Hodgins & Knee, 2002). In addition, including the principles and effects of motivation in training program can increase the awareness of these factors, making them more visible and recognizable by individuals when making decisions.

**Implications for Research**

This attempt at measuring the effects of mission pressure, in the form of individual motivation and social context, provides future researchers with several suggestions (many which have been described earlier in this document). First, for primes to be measured effectively, they must be checked to ensure they are having the desired effects. Second, future researchers may want to consider a single instruction presented at varying strengths (rather than opposing instructions) to determine how much or little suggestion is needed to influence flight-related decisions. Third, to ensure motivational orientation is properly represented, researchers are encouraged to complete recruitment and selection of participants prior to running the study so that individuals most exemplifying each group may be included in the study. Finally, this study indicates this area is ripe for investigation, and researchers are encouraged to explore the effects of motivation, social context and/or social influence on aircrew decisions.

**CONCLUSION**

During the period between September, 1998 and November 2003, the author lost a total of eleven friends and acquaintances to five aviation accidents. Mission pressure was an unspoken element in all but one of these events. In an effort to better understand the effects of social influence on flight operations, the author designed a study to explore the effects of
motivation and priming on weather-related decisions. The results of this study indicate social
cues may affect the aircrew decision-making process. Methods, such as flight risk assessment
tools and motivational structures employed in educational settings can be used to mitigate these
effects. Further research of these phenomena is recommended.
REFERENCES


Federal Aviation Administration (2008a). 121.613 Dispatch or flight release under IFR or over the top. In *Title 14, Chapter 1, Part 121—Operating requirements: Domestic, flag, and supplemental operations*, Retrieved December 30, 2008, from http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=c30dd92ab4efdfe4d1bd9185f435d8b6&tp=/ecfrbrowse/Title14/14cfr121_main_02.tpl.

Federal Aviation Administration (2008b). 135.78 Instrument approach procedures and IFR landing minimums. In *Title 14, Chapter 1, Part 135—Operating requirements*: 
Commuter and on-demand operations and rules governing persons on board such aircraft, Retrieved December 30, 2008, from http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=c30dd92ab4cfdfc4d1bd9185f435d8b6&tpl=/ccfrbrowse/Title14/14cfr13_5_main_02.tpl.


Appendix A: Weather Materials

CSC DUATS on the Web
Low Altitude Route Briefing

Low Altitude Route Weather Briefing Requested
CSC DUATS on the Web session ID: C/q2t/3yut5
Session Number: 00579
Transaction Number: 007707
13:06:10 (UTC)

FA Hazards and Flight Precautions

Current report not available

FA Synopsis and VFR Clouds / Weather

Miami area forecast amended, prepared at 1025z.
Synopsis and VFR clouds/weather
Synopsis valid until 0400z
Clouds / weather valid until 2200z.
North Carolina, South Carolina, Georgia, Florida and Coastal Waters
See AIRMET Sierra for IFR conditions and mountain obscuration.
    Thunderstorm(s) imply severe or greater turbulence, severe ice, low-level wind shear and
    IFR conditions. Non sea level heights denoted by above ground level or ceiling.
Synopsis
Stationary front southern Georgia coastal waters – northwestern Georgia – western
Tennessee. Warm front western Tennessee – east central Missouri. Occluded front east-
central Missouri – northwestern Illinois. High over eastern Oklahoma… Henderson
Florida
Panhandle … 1,000 feet broken, tops 4,000 feet. Visibility 3 statute miles in mist. 15z through
17z, becoming 2,000 feet broken, tops 7,000 feet, western half. 4,000 feet scattered, eastern
half. Occasional 3,000 feet broken, eastern half. 21z widely scattered rain showers western
half. VFR rain showers eastern half.
Florida peninsula… update
North … 1,000 feet broken, tops 3,000 feet. Visibility 3 statute miles in mist. 15z through 17z
becoming 3,000 feet broken, tops 5,000. 18z through 19z, becoming 4,000 feet scattered.
Outlook: VFR with rain showers.
Central … 1,000 feet broken, tops 3,000, northern half. 1,000 feet scattered, southern half.
Visibility 3 to 5 statute miles in mist. 14z through 15z, becoming 3,000 feet scattered.
Occasional 5,000 feet broken, tops 7,000 feet, northern half. 18z 3,500 feet scattered, 7,000
feet broken, tops 8,500. Outlook: VFR.
South … Sky clear. Visibility 10 to 15 statute miles. 14z 3,000 feet scattered. 17z 4,500 feet
scattered, 7,000 feet scattered. Outlook: VFR.
Keys … 2,500 feet scattered. 18z 2,500 scattered, 5,000 feet scattered. Outlook: VFR.
Gulf of Mexico coastal waters
North St Petersburg-Clearwater FL (PIE) … 3,000 feet scattered, broken cirrus. Until 15z
occasional visibility 1 to 3 statute miles in mist near Florida panhandle.

FA Turbulence

Current report not available

Severe Weather Warnings

Current report not available
SIGMETs

Current report not available

Convective SIGMET

Current report not available

Center Weather Advisory

Jacksonville Center (Hilland FL) [ZJX] Center Weather Advisory # 69
Prepared at 1035z
Valid through 1320z
From 20 miles west of Tallahassee FL [TLH]
To 30 miles northeast of Cross City FL [CTY]
To 25 miles north northeast of St Petersburg-Clearwater FL [PIE]
To 40 miles northwest of Crestview FL [CEW]
To 20 miles west of Tallahassee FL [TLH]
Widespread area with ceiling below 005 / visibility below 1/2 statute miles fog. Conditions expected to continue most areas through 13z...RAM

AIRMETs

Miami AIRMET amended, prepared at 1025z
AIRMET Sierra update 2 for IFR and mountain obscuration valid until 1500z
AIRMET – IFR
For Georgia, Florida and coastal waters ... update ...
From 50 miles south of Savannah GA [SAV]
To 30 miles south southwest of Orlando FL [MCO]
To 20 miles southwest of Sarasota/Bradenton FL [SRQ]
To 30 miles west of Cross City FL [CTY]
To 60 miles southwest of Tallahassee FL [TLH]
To 50 miles southwest of Crestview FL [CEW]
To 40 miles west of Crestview FL [CEW]
To 30 miles northwest of Tallahassee FL [TLH]
To From 50 miles south of Savannah GA [SAV]
Occasional ceiling below 1,000 feet / visibility below 3 statute miles precipitation / mist / fog. Conditions ending 14z to 15z central southern Florida peninsula.

Surface Observations

Cocoa Beach FL (Cape Canaveral AFS Skid Strip) [XMR]: no reports available

Titusville FL [KTTS] hourly observation at 1255 UTC
Wind 135° at 12 knots, visibility 7 miles, 4,000 feet scattered, temperature 25°C (77°F), dewpoint 17°C (63°F), altimeter 29.97, few smoke at the surface, sea level pressure 29.97” Hg (1014.9hPa).

Titusville (Space Coast Regional) [KTIX] hourly observation at 1255 UTC
Wind 120° at 11 knots, visibility 7 miles, 4,500 feet scattered, 24°C (74°F), dewpoint missing, altimeter 29.98

Daytona Beach FL [KDAB] hourly observation at 1253 UTC
Wind 120 at 9, visibility 6 miles, 3,200 feet scattered, 4,500 scattered, temperature 24°C (75°F), dewpoint 16°C (61°F), altimeter 29.92, automation with precipitation discriminator, sea level pressure 29.92 Hg (1014.9hPa)

Ormond Beach FL [KOMN] hourly observation at 1255 UTC
Motivational Orientation and Social Context

Wind 110 at 8 knots, visibility 6 miles, 3,000 feet scattered, 4,200 scattered, temperature 24°C (75°F), dewpoint 16°C (61°F), altimeter 29.92

Orlando FL (Orlando Sanford Int’l) [KSFB] hourly observation at 1253 UTC
Wind variable at 4 knots, visibility at 6 miles, 3,100 few, 3,800 scattered, 4,800 scattered, temperature 23°C (73°F), dewpoint 16°C (61°F), altimeter 29.96, automated station with precipitation discriminator, sea level pressure 29.97" Hg (1015.0 hPa), temperature 22.2°C (72.0°F), dewpoint 15.0°C (59.0°F).

Orlando FL [KMCQ] hourly observation at 1253 UTC
Wind variable at 4 knots, visibility at 8 miles, 3,500 few, 4,200 scattered, 4,800 scattered, temperature 22°C (72°F), dewpoint 16°C (61°F), altimeter 29.96, automated station with precipitation discriminator, sea level pressure 29.97" Hg (1015.0 hPa), temperature 22.2°C (72.0°F), dewpoint 15.0°C (59.0°F).

Orlando FL (Executive) [KORL] hourly observation at 1253 UTC
Wind variable at 5 knots, visibility at 6 miles, 3,300 scattered, 4,000 scattered, temperature 22°C (72°F), dewpoint 16°C (61°F), altimeter 29.98, automated station with precipitation discriminator, sea level pressure 29.99" Hg (1015.6 hPa), temperature 22.2°C (72.0°F), dewpoint 15.6°C (60.1°F).

St Augustine, FL [KSGJ] hourly observation at 1255 UTC
Wind 095 at 4 knots, visibility 5 miles, 2,200 feet broken, temperature 22°C (72°F), dewpoint 19°C (68°F), altimeter 29.97, automated station without precipitation discriminator.

Leesburg FL [KLEE] automated hourly observation at 1253 UTC
Wind variable at 3 knots, visibility 5 miles, 900 feet scattered, 1,500 feet broken, 3,500 feet broken, temperature 21°C (66°F), dewpoint 16°C (61°F), altimeter 29.92, automated station without precipitation discriminator.

Ocala FL (Ocala Intl-Jim Taylor Field) [KOCF] automated hourly observation at 1255 UTC
Wind variable, visibility 2 miles, 500 feet scattered, 700 feet broken, 1,500 overcast, temperature 19°C (68°F), dewpoint 17°C (63°F), altimeter 29.92, automated station without precipitation discriminator.

Gainesville FL (Gainesville Rgnl) [KGNV] automated hourly observation at 1255 UTC
Wind variable at 5, visibility 4 miles, 1,200 scattered, 2,500 scattered, 4,300 feet broken, temperature 21°C (66°F), dewpoint 14°C (57°F), altimeter 29.92, automated station without precipitation discriminator, less than 0.01 inch (water equivalent) of precipitation in the previous 3 hour period.

Cross City FL [KCTY] automated hourly observation at 1255 UTC
Wind variable at 3 knots, temperature 19°C (66°F), dewpoint 17°C (63°F), altimeter 29.92, present weather identifier sensor not operating, lightning detecting system not operating

Crystal River FL [KCGC]: no reports available

Brooksville FL (Hernando County) [KBKV] automated hourly observation at 1255 UTC
Wind variable, visibility 1/2 mile, fog, 400 feet scattered, 600 feet overcast, temperature 19°C (66°F), dewpoint 17°C (63°F), altimeter 29.92, automated station without precipitation discriminator, less than 0.03 inch (water equivalent) of precipitation in the previous 3 hour period, lightning detection system not operating, maintenance required.

Pilot Reports
Current report not available

Radar Summaries

Melbourne FL [MLB] radar weather report at 1235 UTC:
**Terminal Forecasts**

<table>
<thead>
<tr>
<th>Daytona Beach FL [KDAB] terminal forecast</th>
<th>Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind 110 at 9, visibility 6 miles, 4,500 scattered</td>
</tr>
<tr>
<td>1200 UTC to 1600 UTC</td>
<td>Wind 120 at 12, visibility greater than 6 miles, 6,000 scattered</td>
</tr>
<tr>
<td>1600 UTC to 2000 UTC</td>
<td>Wind 130 at 12, visibility greater than 6 miles, 8,000 scattered</td>
</tr>
<tr>
<td>2000 UTC to 0100 UTC</td>
<td>Wind 130 at 15, visibility greater than 6 miles, sky clear</td>
</tr>
<tr>
<td>0100 UTC to 1200 UTC</td>
<td>Wind 090 at 6, visibility 10, 2,500 few, 5,000 scattered</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orlando FL (Orlando Sanford Intn'!) [KSFB] terminal forecast</th>
<th>Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind variable at 4 knots, visibility at 5 miles, 3,100 few, 3,800 scattered, 4,800 scattered</td>
</tr>
<tr>
<td>1200 UTC to 1300 UTC</td>
<td>Wind variable at 5 knots, visibility 5 miles, 3,500 few, 4,500 scattered</td>
</tr>
<tr>
<td>1300 UTC to 1500 UTC</td>
<td>Wind variable at 5 knots, visibility 5 miles, 4,500 scattered</td>
</tr>
<tr>
<td>1500 UTC to 1800 UTC</td>
<td>Wind 120 at 8 knots, visibility greater than 6 miles, 5,000 scattered</td>
</tr>
<tr>
<td>1800 UTC to 2300 UTC</td>
<td>Wind 150 at 10 knots, visibility greater than 6 miles, sky clear</td>
</tr>
<tr>
<td>2300 UTC to 0100 UTC</td>
<td>Wind 150 at 8 knots, visibility greater than 6 miles, 3,500 scattered</td>
</tr>
<tr>
<td>0100 UTC to 1000 UTC</td>
<td>Wind 150 at 5 knots, visibility 10 miles, sky clear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orlando FL [KMCO] terminal forecast</th>
<th>Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind variable at 4 knots, visibility greater than 6 miles, 3,000 few, 4,200 scattered</td>
</tr>
<tr>
<td>1200 UTC to 1300 UTC</td>
<td>Wind variable at 5 knots, visibility greater than 6 miles, 3,500 few, 4,500 scattered</td>
</tr>
<tr>
<td>1300 UTC to 1500 UTC</td>
<td>Wind variable at 5 knots, visibility 6 miles, 4,500 scattered</td>
</tr>
<tr>
<td>1500 UTC to 1800 UTC</td>
<td>Wind 130 at 8 knots, visibility greater than 6 miles, 5,000 scattered</td>
</tr>
<tr>
<td>1800 UTC to 2300 UTC</td>
<td>Wind 150 at 12 knots, visibility greater than 6 miles, sky clear</td>
</tr>
<tr>
<td>2300 UTC to 0100 UTC</td>
<td>Wind 150 at 8 knots, visibility greater than 6 miles, 3,500 scattered</td>
</tr>
<tr>
<td>0100 UTC to 1000 UTC</td>
<td>Wind 150 at 5 knots, visibility greater than 6 miles, sky clear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orlando FL (Executive)[KORL] terminal forecast</th>
<th>Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind variable at 5 knots, visibility at 6 miles, 3,500 scattered, 6,000 scattered</td>
</tr>
</tbody>
</table>
Motivational Orientation and Social Context

Motivational Orientation and Social Context

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Weather Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1300 UTC to 1500 UTC</td>
<td>Wind variable at 5 knots, visibility 6 miles, 4,500 scattered</td>
</tr>
<tr>
<td>1500 UTC to 1800 UTC</td>
<td>Wind 150 at 8 knots, visibility greater than 6 miles, 5,000 scattered</td>
</tr>
<tr>
<td>1800 UTC to 2300 UTC</td>
<td>Wind 150 at 12 knots, visibility greater than 6 miles, sky clear</td>
</tr>
<tr>
<td>2300 UTC to 0100 UTC</td>
<td>Wind 150 at 8 knots, visibility greater than 6 miles, 3,500 scattered</td>
</tr>
<tr>
<td>0100 UTC to 1000 UTC</td>
<td>Wind 150 at 5 knots, visibility greater than 6 miles, sky clear</td>
</tr>
</tbody>
</table>

**Leesburg FL [KLEE] terminal forecast**
Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Weather Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind variable at 3 knots, visibility 5 miles, 900 feet scattered, 1,500 feet broken, 3,500 feet broken</td>
</tr>
<tr>
<td>1200 UTC to 1500 UTC</td>
<td>Wind 120 at 8, visibility greater than 6 miles, 1,500 feet scattered, 4,000 feet broken</td>
</tr>
<tr>
<td>1500 UTC to 2300 UTC</td>
<td>Wind 140 at 12, visibility greater than 6 miles, 4,500 scattered</td>
</tr>
<tr>
<td>2300 UTC to 0200 UTC</td>
<td>Wind 150 at 8, visibility greater than 6 miles, 2,500 scattered</td>
</tr>
<tr>
<td>0200 UTC to 1000 UTC</td>
<td>Wind 150 at 5, visibility greater than 6 miles, sky clear</td>
</tr>
</tbody>
</table>

**Gainesville FL [KGNV] terminal forecast**
Issued at 1125 UTC, valid from 1200 UTC today to 1200 UTC tomorrow

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Weather Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 UTC</td>
<td>Wind variable at 5, visibility 6 miles, 2,500 scattered, 4,300 feet broken</td>
</tr>
<tr>
<td>1200 UTC to 1800 UTC</td>
<td>Wind 150 at 9, visibility greater than 6 miles, 3,000 scattered, 4,500 scattered</td>
</tr>
<tr>
<td>1800 UTC to 2300 UTC</td>
<td>Wind 150 at 12, visibility greater than 6 miles, 4,000 scattered</td>
</tr>
<tr>
<td>2300 UTC to 0200 UTC</td>
<td>Wind 150 at 6, visibility greater than 6 miles, 3,000 scattered</td>
</tr>
<tr>
<td>0200 UTC to 1000 UTC</td>
<td>Wind variable at 3, visibility greater than 6 miles, 2,000 scattered</td>
</tr>
</tbody>
</table>

**FD Winds Aloft Forecast**

Winds aloft forecast based on observations taken at 0000 UTC. Forecast valid until 1200 UTC, for use from 0900 UTC to 1800 UTC. Temperatures are negative above 24,000 feet.

<table>
<thead>
<tr>
<th>FT</th>
<th>3000</th>
<th>6000</th>
<th>9000</th>
<th>12000</th>
<th>18000</th>
<th>24000</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLB</td>
<td>1112</td>
<td></td>
<td></td>
<td>1516+081621+041625+021630-09 1639-22 Melbourne FL [MLB]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAX</td>
<td>1312</td>
<td></td>
<td></td>
<td>1417+061621+041726-01 1733-12 1741-23 Jacksonville FL [JAX]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIE</td>
<td>9999</td>
<td></td>
<td></td>
<td>1509+081415+041422+021429-09 1435-22 St Petersburg-Clearwater FL [PIE]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTAMS**

**Daytona Beach FL [DAB]:** January NOTAM #9
Tower 381 (373 above ground level) 4.3 north-northeast lights OTS (ASR 1030823) until 0502041610

**Ormond Beach FL [OMN]:** November NOTAM #247 issued by St. Petersburg-Clearwater FL [PIE] Notice to airman file now OMN

**Ormond Beach FL [OMN]:** November NOTAM #5
Class D Surface area 1200 - 2359 daily

**Ormond Beach FL [OMN]:** November NOTAM #4
Tower commissioned 1200 – 2359 daily
Ormond Beach FL [OMN]: November NOTAM #3
Runway 17/35 runway lights out of service except low / medium intensity

Ormond Beach FL [OMN]: November NOTAM #1
Tower local (tower frequency) / pilot-controlled lighting / common traffic advisory frequency (CTAF0 119.075 / ground control 121.625 commissioned

Ocala FL (Ocala Intl-Jim Taylor Field) [OCF]: January NOTAM #11
Tower 384 (320 above ground level) 18 east lights out of service (ASR 1026090) until 0502011338)

Leesburg FL [LEE]: January NOTAM #1
Runway 3/21 closed

Ocala FL (Ocala Intl-Jim Taylor Field) [OCF]: January NOTAM #7
Runway 36 ILS LLZ unmonitored

Ocala FL (Ocala Intl-Jim Taylor Field) [OCF]: January NOTAM #6
Aerobatic area 3500 / below 3 nautical mile radius 12 nautical miles on the 115° radial of Ocala [OCF VOR] / FD04 1330 – 2300 daily until 0501212300

Gainesville FL (Gainsville Rgnl) [GNV]: December NOTAM #91
Aerodrome beacon out of service

Gainesville FL (Gainsville Rgnl) [GNV]: November NOTAM #148
Runway 29 runway visual range (touchdown) available instead of 11

Gainesville FL (Gainsville Rgnl) [GNV]: September NOTAM #143
Remote transmitter/receiver 269.325 instead of 257.75

Gainesville FL (Gainsville Rgnl) [GNV]: September NOTAM #75
Runway 6/24 open air carrier

Gainesville FL (Gainsville Rgnl) [GNV]: September NOTAM #20
Runway 11/29 ungrooved

FDC NOTAMS

! FDC 5/0344  GNV  PALATKA FL
PALATKA 1 MOA ACTIVE  M - F  0300 - 1100 UTC

! FDC 5/0343  GNV  PALATKA FL
R – 2910  ACTIVE  M - F  0300 - 1100 UTC

! FDC 5/0345  GNV  PALATKA FL
R – 2907 A / B  ACTIVE  M - F  0300 - 1100 UTC
Appendix B: Scenario Script

PROCEDURE

Welcome Participant.

Retrieve Demographic Questionnaire and provide Letter of Consent.

Ensure Participant understands and has signed Letter of Consent.

Experimenter signs Letter of Consent.

Participant is provided Test and Answer sheet.

If participant asks what the test measures, advise them it measures their problem solving style.

When participant has completed Test, escort to flight simulator.

Advise participant this is a ‘free-play’ period for them to familiarize themselves with the simulator.

Start Time: Stop Time:

Questions Asked:

Return to grade test; record Test scores on bottom left of test. The highest score determines the color code of materials envelope. Select first envelope of corresponding color and write ID number on outside.

When participant advises they are ready for flight planning, return to flight planning area.

Welcome participant to flight planning area; ask participant if there are any additional items they will need to complete flight plan.

Provide participant instructions and ‘current’ weather. Ask participant to remove instructions, complete flight plan and to advise when ready to begin the simulated flight.

"I can act as a flight service station or your passengers if you have any additional questions about the weather."

Questions Asked:

When flight planning is complete, retrieve smaller envelope from participant. Escort participant to simulator.

SIMULATOR TASK

Welcome participant back to flight simulator. Seat participant at Elite.

“The aircraft is currently located in the simulated run-up area of Runway 7L, Daytona Beach. The aircraft checklists are on the seat next to you. Please fly the segment from run-up to shut down, making all the normal radio calls using the call sign you are most familiar with. (You may omit the calls for taxiing.) Please identify the frequency you are requesting if it is not an assigned ATC frequency, such as the ATIS and your initial call-up. When you are ready, do a radio check on the headphones."

Verify advanced weather set at 3000 to 3500 3/8, Cumulus; 4500 to 5500 4/8, Cumulus; Winds 090/10; Visibility 10

Press record on camera. Verify camera and computer are recording.

When requested, provide ATIS: Time:
"Daytona Beach Information Echo. One three (xx) Coordinated Universal Time. Weather three thousand scattered, four thousand five hundred scattered, visibility 6, temperature 2–4, dew point 1-6, wind 1–2–0 at 1–2, altimeter two niner two. I–L–S Runway Seven Left in use, advise on initial contact you have Information Echo."

When requested, provide route clearance: Time: __________

"Cessna (xxx), Daytona Clearance Delivery, Cleared Crystal River Airport via radar vectors, direct Ocala, then as filed, climb and maintain 2000, expect higher five minutes after departure, departure frequency 125.72, squawk 5540"

When requested, provide departure clearance: Time: __________

"Cessna (xxx), Daytona Tower, Fly runway heading, upon passing 500 turn left heading 040, cleared for take-off Runway 7L"

Record Take-Off Time: _________________

When aircraft passes through 800 feet: "Cessna (xxx), contact departure, 125.72"

Pilot calls Daytona approach. Included Altitude: Yes No

Respond with: Time: __________

"Cessna (xxx), Daytona Approach, radar contact, (verify climbing through (alt)), turn left heading 270, proceed direct Ocala when able"

Change weather to: 2500 to 3500 3/8, Cumulus; 4000 to 5000 4/8, Cumulus; Winds 090/15; Visibility 10

7 minutes after take-off (or when queried): Time: __________

"Cessna (xxx), climb and maintain 5000, contact Jacksonville Approach, 118.6"

Pilot calls Jacksonville approach. Respond with: Time: __________

"Cessna (xxx), Jacksonville approach, (verify altitude) Altimeter 29.92"

(pause) Twin Cessna 9928 Fox, radar contact two miles south of Crystal River Airport, climb and maintain 2000, say intentions

(pause) Twin Cessna 28 Fox, fly heading 060, vectors for the approach."

50 miles from Ocala: Time: __________

Change weather to: 2000 to 3000 3/8, Cumulus; 4000 to 5500 4/8, Cumulus; Winds 090/18; Visibility 10

42 miles from Ocala: Time: __________

"Twin Cessna 28 Fox, turn left heading 320, vectors for the approach"

40 DME East of Ocala: Time: __________

"Twin Cessna 9928 Fox Trot, three miles east of Ocala VOR, turn left heading 250, maintain 2000 until established on the 225 radial outbound, cleared Crystal River VOR/DME Approach, frequency change your discretion"

Change weather to: 2000 to 3000 4/8, Cumulus; 4500 to 5500 4/8, Cumulus; Winds 090/18; Visibility 10

OCF ASOS: "Ocala International – Jim Taylor Field, Ocala Florida, Automated Weather, Wind variable, visibility 2, 700 scattered, 1,000 broken, 2,500 broken, altimeter 2992"

ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility one, 400 scattered, 500 broken, 600 overcast, temperature 18, dew point 17, altimeter 2992.

35 DME East of Ocala: Time: __________
Change weather to: 1500 to 3000 4/8, Cumulus; 4500 to 5500 4/8, Cumulus; Winds 090/18; Visibility 10

ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility one, 500 scattered, 600 overcast, temperature 18, dew point 17, altimeter 2992.

OCF ASOS: “Ocala International – Jim Taylor Field, Ocala Florida, Automated Weather, Wind variable, visibility 2, 600 scattered, 1,000 broken, 2,500 broken, altimeter 2992

30 DME East of Ocala: Time: __________

Change weather to: 1500 to 3000 5/8, Cumulus; 4000 to 5500 4/8, Cumulus; Winds 090/18; Visibility 5

ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility one, 400 scattered, 500 broken, 600 overcast, temperature 18, dew point 17, altimeter 2992.

OCF ASOS: “Ocala International – Jim Taylor Field, Ocala Florida, Automated Weather, Wind variable, visibility 2, 700 scattered, 1,000 broken, 2,500 broken, altimeter 2992

25 DME East of Ocala: Time: __________

“Twin Cessna 9928 Fox, radar contact two miles south of Crystal River, maintain 2000, say intentions (pause)

28 Fox, climb maintain two thousand two hundred, fly heading 080, vectors for the approach”

If queried:

AIRMET: “Miami Airmet Sierra Update 2 for IFR and mountain obscuration is still in effect, valid for another hour, From 50 miles south of Savannah GA [SAV] To 30 miles south southwest of Orlando FL [MCO] To 20 miles southwest of Sarasota/Bradenton FL [SRQ] To 30 miles west of Cross City FL [CTY] To 60 miles southwest of Tallahassee FL [TLH] to 50 miles southwest of Crestview FL [CEW] to 40 miles west of Crestview FL [CEW To 30 miles northwest of Tallahassee FL [TLH] To 50 miles south of Savannah GA [SAV]; occasional ceiling below 1,000 feet, visibility less than 3 statute miles in mist and fog.

CWA: “In addition, Jacksonville Center Weather Advisory 69 has been extended until 1030 am, from 20 miles west of Tallahassee [TLH] to 30 miles northeast of Cross City FL [CTY] to 25 miles north northeast of St. Petersburg – Clearwater FL [PIE] to 40 miles northwest of Crestview FL [CEW] to 20 miles west of Tallahassee FL [TLH], widespread area with ceiling below 500 feet, visibility below 1/2 statute miles in fog, conditions expected to continue through 1430z.

OCF: Ocala METAR, automated weather, Wind variable, visibility 2, 800 scattered, 1,200 broken, 2,500 broken, temperature 18, dewpoint 17 altimeter 2992


GNV: Gainsville Regional, Gainsville Florida, automated hourly observation, wind variable at 4, visibility 3, 1,000 scattered, 2,300 broken, temperature 19, dewpoint 17, altimeter 2992

CGC ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility one, 400 scattered, 600 overcast, temperature 18, dew point 18, altimeter 2992.

20 DME East of Ocala: Time: __________

Change weather to: 1500 to 3000 5/8, Cumulus; 3500 to 5500 4/8, Cumulus; Winds 090/18; Visibility 5

ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility 1, 300 scattered, 600 overcast, temperature 18, dew point 18, altimeter 2992.
OCF ASOS: "Ocala International – Jim Taylor Field, Ocala Florida, Automated Weather, Wind variable, visibility three, 600 scattered, 1,000 broken, 2,500 broken, altimeter 2992

15 DME East of Ocala: Time: ___________

“Twin Cessna 9928 Foxtrot, turn left heading 020, maintain two thousand two hundred until established on the localizer, cleared Ocala I-L-S Runway 36 Approach. (pause)”

“28 Fox, frequency change your discretion”

Change weather to: 1500 to 3000 5/8, Cumulus; 4000 to 5500 5/8, Cumulus; Winds 090/18; Visibility 5

ASOS: Crystal River Airport, Crystal River Florida, automated report, wind variable, visibility one, 300 scattered, 600 overcast, temperature 18, dew point 18, altimeter 2992.


10 DME East of Ocala: Time: ___________

“Cessna (xxx), 8 miles east of OCALA VOR, maintain at or above three thousand until OCALA VOR, Cleared Crystal River VOR/DME Approach”

Change weather to: 1500 to 3000 6/8, Cumulus; 3500 to 5500 5/8, Cumulus; Winds 090/18; Visibility 5

ASOS: Crystal River Airport, Crystal River Florida, automated weather, wind variable, visibility one, 400 scattered, 600 overcast, temperature 18, dew point 18, altimeter 2992.


5 DME East of Ocala: Time: ___________

Change weather to: 1500 to 3000 7/8, Cumulus; 3500 to 5000 5/8, Cumulus; Winds 090/18, Visibility 3

ASOS: Crystal River Airport, Crystal River Florida, automated report, wind variable, visibility one, 300 scattered, 600 overcast, temperature 18, dew point 18, altimeter 2992.


3 DME East of Ocala: Time: ___________

Prime as directed:

Divert: “We have your passengers on the landline, they say it’s still foggy at Crystal River and want to know if they should meet you somewhere else.”

Proceed: “We have your passengers on the landline, they want to know your ETA at Crystal River.”

None

Over Ocala: Time: ___________

Change weather to: 1000 to 3000 7/8, Cumulus; 3500 to 5000 6/8, Cumulus; Winds 090/18, Visibility 3

2 DME West of Ocala: Time: ___________

“Attention all aircraft, Amended AIRMET Sierra Update 3 in effect, Flight Watch 122.0”

If queried:

AIRMET: “Miami Airmet Sierra Update 3 for IFR and mountain obscuration is still in effect, valid for another hour, From 50 miles south of Savannah GA [SAV] To 30 miles south southwest of Orlando FL [MCO] To 20 miles southwest of Sarasota/Bradenton FL [SRQ] To 30
miles west of Cross City FL [CTY] To 60 miles southwest of Tallahassee FL [TLH] To 50 miles southwest of Crestview FL [CEW] To 40 miles west of Crestview FL [CEW] To 30 miles northwest of Tallahassee FL [TLH] To From 50 miles south of Savannah GA [SAV] occasional ceiling below 1,000 feet, visibility less than 3 statute miles in mist and fog.

CWA: “In addition, Jacksonville Center Weather Advisory 69 has been extended until 1030 am, from 20 miles west of Tallahassee [TLH] to 30 miles northeast of Cross City FL [CTY] to 25 miles north northeast of St. Petersburg – Clearwater FL [PIE] to 40 miles northwest of Crestview FL [CEW] to 20 miles west of Tallahassee FL [TLH], widespread area with ceiling below 500 feet, visibility below 1/2 statute miles in fog, conditions expected to continue through 1430z.

OCF: Ocala METAR, automated weather report, wind variable, visibility 2, 600 scattered, 800 broken, 1,200 overcast, tops estimated 3,000, temperature 18, dewpoint 17 altimeter 2992


GNV Gainsville Regional, Gainsville Florida, automated hourly observation, wind variable at 4, visibility 3 miles, 1,000 scattered, 2,300 broken, temperature 19, dewpoint 17, altimeter 2992

CGC: Crystal River Airport, Crystal River Florida, automated report, wind variable, visibility one, 400 scattered, 500 broken, 600 overcast, temperature 18, dewpoint 18, altimeter 2992.

PIREP: “We have a PIREP from a Cessna 340 that tried to get into Crystal River about twenty minutes ago... in that area, overcast below three thousand, broken three thousand to forty two hundred, sky clear above, with Crystal River airport below minimums, he actually tried twice and then diverted to Ocala, he reports Ocala VFR.

10 DME West of Ocala: Time: __________

“Cessna (xxx), change to advisory frequency your discretion.”

Change weather to: 1000 to 2500 7/8, Cumulus; 3500 to 5000 6/8, Cumulus; Winds 090/15; Visibility 2

ASOS: Crystal River Airport, Crystal River Florida, Weather Variable, visibility one, sky conditions 500 scattered, 600 overcast, temperature 18 dewpoint 18 altimeter 2992

Pilot calls CTAF. Altitude: Y N Location: Y N Time: __________

15 DME West of Ocala: Time: __________

Change weather to: 700 to 2000 8/8, Cumulus; 3500 to 5000 6/8, Cumulus; Winds 090/12; Visibility 2

ASOS: Crystal River Airport, Crystal River Florida, Weather Variable, visibility 1, sky conditions 400 scattered, 500 broken, 600 overcast, temperature 18 dewpoint 18 altimeter 2992

20 DME West of Ocala: Time: __________

Change Weather to: 700 to 2000 7/8, Cumulus; 3500 to 5000 6/8, Cumulus; Winds 090/10; Visibility 2

25 DME West of Ocala: Time: __________

Change Weather to: 700 to 2000 8/8, Cumulus; 3500 to 5000 6/8, Cumulus; Winds 090/5; Visibility 2

Upon missed approach:

Change Weather to: 700 to 2000 7/8, Cumulus; remove upper layer of clouds; Winds 090/5; Visibility 2
When called:

Cessna (xxx), radar contact two miles south of Crystal River Airport, verify climbing through (xx) for 2000, say intentions

If second approach to CRYSTAL RIVER or to DUNELLON:

“Cessna (xxx), fly heading 060, vectors for Ocala VOR, altimeter 2992.”

ASOS: Crystal River Airport, Crystal River Florida, Wind Variable, visibility one, sky conditions 200 scattered, 600 overcast, temperature 18 dewpoint 18 altimeter 2992

If divert to Ocala:

“Cessna (xxx), fly heading 070, vectors for ILS Runway 36 Ocala, climb and maintain two thousand two hundred, altimeter 2992.”


If divert to GAINESVILLE:

“Cessna (xxx), climb and maintain four thousand, when able proceed direct Ocala VOR, advise when ready to copy.”

“Cessna (xxx), you are cleared to Gainesville Regional via Ocala, DANTE intersection, then Gainesville. Maintain 4000, altimeter 2992.”

GAINESVILLE ATIS: “Gainesville Regional Airport, Information Echo. One (xxx) Coordinated Universal Time. Weather three thousand scattered, visibility 10, temperature 2–6, dew point 1-5, wind calm, altimeter two niner two. I-L-S Runway 28 in use, advise on initial contact you have Information Echo.”

22 DME from Ocala:

Change Weather to: 1000 to 2000 6/8, Cumulus; Winds 090/5; Visibility 2

18 DME West of Ocala:

Change Weather to: 1000 to 2000 5/8, Winds 090/5; Visibility 3

15 DME West of Ocala:

1000 to 2000 4/8, Cumulus; Winds 090/5; Visibility 3

10 DME West of Ocala:

1000 to 2000 3/8, Cumulus; Winds 090/5; Visibility 5

5 DME from Ocala:

1000 to 2000 2/8, Cumulus; Winds 090/5; Visibility 10

Approach Clearance:

“Cessna (xxx), (x) miles (direction) of (location),
turn (direction) heading (xxx),
maintain (altitude) until (IAF / established on the localizer),
cleared (airport) (approach).

Crystal River VOR/DME
Ocala Jim Taylor ILS Runway 36
Dunellon Marion County VOR/DME Runway 23
Gainesville Regional ILS Runway 28
OCF ASOS: "Ocala International – Jim Taylor Field, Ocala Florida, Automated Weather, Wind variable, visibility three, 700 scattered, 900 broken, 2,300 broken, altimeter 2992

ASOS: Crystal River Airport, Crystal River Florida, Wind Variable, visibility one, sky conditions 200 scattered, 600 overcast, temperature 18 dewpoint 18 altimeter 2992

Upon landing, stop videotape and computer log.

DEBREIFING

__________ Escort participant to flight planning area
__________ Provide participant with debriefing questionnaire and ask them to complete it.
__________ Once debriefing questionnaire has been completed, read participant debriefing form.
__________ Thank participant for participation. Encourage participant to send friends.
Appendix C: The General Causality Orientations Scale

The Scale (17-vignette version)

On these pages you will find a series of vignettes. Each one describes an incident and lists three ways of responding to it. Please read each vignette and then consider the responses in turn. Think of each response option in terms of how likely it is that you would respond in that way. We all respond in a variety of ways to situations, and probably each response is at least slightly likely for you. If it is very unlikely that you would respond in the way described in a given response, you would select numbers 1 or 2. If it is moderately likely, you would respond in the midrange of numbers; and if it is very likely that you would respond as described, you would select the 6 or 7. Please select one number for each of the three responses on the answer sheet for each vignette. The actual items begin on the next page.
1. You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:

a) What if I can't live up to the new responsibility?
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) Will I make more at this position?
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) I wonder if the new work will be interesting.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

2. You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think:

a) It's not what you know, but who you know.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) I'm probably not good enough for the job.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) Somehow they didn't see my qualifications as matching their needs.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

3. You are a plant supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:

a) Telling the three workers the situation and having them work with you on the schedule.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) Simply assigning times that each can break to avoid any problems.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) Find out from someone in authority what to do or do what was done in the past.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely
4. You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:

a) "I can't do anything right," and feel sad.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) "I wonder how it is I did so poorly," and feel disappointed.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) "That stupid test doesn't show anything," and feel angry.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

5. When you and your friend are making plans for Saturday evening, it is likely that you would:

a) Leave it up to your friend; he (she) probably wouldn’t want to do what you’d suggest.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) Each make suggestions and then decide together on something that you both feel like doing.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) Talk your friend into doing what you want to do.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

6. You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:

a) You'll try to fit in with whatever is happening in order to have a good time and not look bad.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

b) You'll find some people with whom you can relate.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

c) You'll probably feel somewhat isolated and unnoticed.
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely
7. **You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterized as:**

a) **Take charge:** that is, you would make most of the major decisions yourself.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) **Follow precedent:** you're not really up to the task so you'd do it the way it's been done before.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) **Seek participation:** get inputs from others who want to make them before you make the final plans.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. **Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you're likely to think:**

a) **You didn't really expect the job; you frequently get passed over.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) **The other person probably "did the right things" politically to get the job.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) **You would probably take a look at factors in your own performance that led you to be passed over.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. **You are embarking on a new career. The most important consideration is likely to be:**

a) **Whether you can do the work without getting in over your head.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) **How interested you are in that kind of work.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) **Whether there are good possibilities for advancement.**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unlikely</td>
<td>moderately likely</td>
<td>very likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. A woman who works for you has generally done an adequate job. However, for the past two weeks her work has not been up to par and she appears to be less actively interested in her work. Your reaction is likely to be:

a) Tell her that her work is below what is expected and that she should start working harder.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

b) Ask her about the problem and let her know you are available to help work it out.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

c) It's hard to know what to do to get her straightened out.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

11. Your company has promoted you to a position in a city far from your present location. As you think about the move you would probably:

a) Feel interested in the new challenge and a little nervous at the same time.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

b) Feel excited about the higher status and salary that is involved.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

b) Feel stressed and anxious about the upcoming changes.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

12. Within your circle of friends, the one with whom you choose to spend the most time is:

a) The one with whom you spend the most time exchanging ideas and feelings.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

b) The one who is the most popular of them.
1 2 3 4 5 6 7
very unlikely moderately likely very likely

b) The one who needs you the most as a friend.
1 2 3 4 5 6 7
very unlikely moderately likely very likely
13. **You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn’t seem involved in the work. You are likely to:**

   a) Talk it over with your daughter to understand further what the problem is.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   b) Scold her and hope she does better.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   c) Make sure she does the assignments, because she should be working harder.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

14. **Your friend has a habit that annoys you to the point of making you angry. It is likely that you would:**

   a) Point it out each time you notice it, that way maybe he/she will stop doing it.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   b) Try to ignore the habit because talking about it won’t do any good anyway.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   c) Try to understand why your partner does it and why it is so upsetting for you.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

15. **A close (same-sex) friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing." You might:**

   a) Share your observations with him/her and try to find out what is going on for him/her.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   b) Ignore it because there's not much you can do about it anyway.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely

   c) Tell him/her that you're willing to spend time together if and only if he/she makes more effort to control him/herself.
   
   1 2 3 4 5 6 7
   very unlikely moderately likely very likely
16. Your friend’s younger sister is a freshman in college. Your friend tells you that she has been doing badly and asks you what he (she) should do about it. You advise him (her) to:

a) Talk it over with her and try to see what is going on for her.

very unlikely moderately likely very likely

b) Not mention it; there’s nothing he (she) could do about it anyway.

very unlikely moderately likely very likely

c) Tell her it’s important for her to do well, so she should be working harder.

very unlikely moderately likely very likely

17. You feel that your friend is being inconsiderate. You would probably:

a) Find an opportunity to explain why it bothers you; he (she) may not even realize how much it is bothering you.

very unlikely moderately likely very likely

b) Say nothing; if your friend really cares about you he (she) would understand how you fell.

very unlikely moderately likely very likely

c) Demand that your friend start being more considerate; otherwise you’ll respond in kind.

very unlikely moderately likely very likely
Name or Code: 

Sex: M F (circle one) 

Date: 

GCOS Response Form - 17 Vignettes

1. a ______ b ______ c ______
   2. a ______ b ______ c ______
   3. a ______ b ______ c ______

4. a ______ b ______ c ______
   5. a ______ b ______ c ______
   6. a ______ b ______ c ______

7. a ______ b ______ c ______
   8. a ______ b ______ c ______
   9. a ______ b ______ c ______

10. a ______ b ______ c ______
    11. a ______ b ______ c ______
    12. a ______ b ______ c ______

13. a ______ b ______ c ______
    14. a ______ b ______ c ______
    15. a ______ b ______ c ______

16. a ______ b ______ c ______
    17. a ______ b ______ c ______
GCOS Response Form - 17 Vignettes

1. a I  
   b C  
   c A

2. a C  
   b I  
   c A

3. a A  
   b C  
   c I

4. a I  
   b A  
   c C

5. a I  
   b A  
   c C

6. a C  
   b A  
   c I

7. a C  
   b I  
   c A

8. a I  
   b C  
   c A

9. a I  
   b A  
   c C

10. a C  
    b A  
    c I

11. a A  
    b C  
    c I

12. a A  
    b C  
    c I

13. a A  
    b I  
    c C

14. a C  
    b I  
    c A

15. a A  
    b I  
    c C

16. a A  
    b I  
    c C

17. a A  
    b I  
    c C

KEY: A = Autonomy  
     C = Control  
     I = Impersonal
Appendix D: Participant Instructions

Control Group Instructions

Thank you again for agreeing to participate in this research. We would like to remind you that, as discussed in the letter of consent, these scenarios are designed to study how problem solving style interacts with the source of received weather information, not your skills as a pilot. We ask that as you fly the following simulator scenario you react to the conditions and inputs you encounter in the same manner as you would normally do during actual flight. A short debriefing form will available following the flight simulation to provide feedback regarding your experiences to the researchers.

You have agreed to fly an Angel Flight. Angel Flight is a non-profit organization that provides free long-distance medical transport for patients in need. This nationwide network of volunteers transports ambulatory patients and a companion seeking life-sustaining treatment far from home, provides on-call transport for transplant recipients, flies precious cargo such as organs, blood, tissue and medical supplies to waiting hospitals and patients, and participates in national disaster relief efforts. Your (simulated) participation includes you as one of over 5,000 pilots who generously donate your time and flight expenses to help patients in need.

The passengers you have agreed to transport are an eight-year old girl, Emily, and her mother. Emily requires transport to Atlanta for an experimental treatment for cancer. You and your aircraft are in Daytona Beach, FL. The closest airport to the patient is Crystal River (CGC), located on the west coast of Florida, north of Tampa. The mission requires you pick up Emily and her mother and transport them to Cobb County Airport (RYY). The time is now 7:55 am EST. Angel Flight requests you complete the flight to Atlanta by dark.

Though you will only be planning and ‘flying’ the first segment (to Crystal River), please remember this scenario as you negotiate the ‘flight’ portion of the session. For planning purposes, assume the weight and balance is within limits and you have 4 hours of fuel available. The researcher can act as a Flight Service representative during your flight planning, and will perform all radio (ATC, FSS, ATIS, etc.) services during the simulation. Your passengers can be reached (if needed) at (555) 543-6459. Please complete your IFR flight plan to Crystal River and inform the researcher when you are ready to move back to the simulator.
"Divert" Instructions

Note: Priming device has been highlighted with bold text.

Thank you again for agreeing to participate in this research. We would like to remind you that, as discussed in the letter of consent, these scenarios are designed to study how problem solving style interacts with the source of received weather information, not your skills as a pilot. We ask that as you fly the following simulator scenario you react to the conditions and inputs you encounter in the same manner as you would normally do during actual flight. A short debriefing form will available following the flight simulation to provide feedback regarding your experiences to the researchers.

You have agreed to fly an Angel Flight. Angel Flight is a non-profit organization that provides free long-distance medical transport for patients in need. This nationwide network of volunteers transports ambulatory patients and a companion seeking life-sustaining treatment far from home, provides on-call transport for transplant recipients, flies precious cargo such as organs, blood, tissue and medical supplies to waiting hospitals and patients, and participates in national disaster relief efforts. Your (simulated) participation includes you as one of over 5,000 pilots who generously donate your time and flight expenses to help patients in need.

Angel Flight Southeast takes great pride in its safety record; reasonable safety standards paired with qualified pilots have resulted in zero incidents or accidents during their 21 years of operations. Safety guidelines include patients must be ambulatory and medically stable, with night flights discouraged. Pilots are also encouraged to cancel (if prior) or modify (in the air) a proposed flight if they determine the medical condition of the passenger, the mechanical condition of the aircraft, pilot health or other factors would adversely affect the safety of flight.

The passengers you have agreed to transport are an eight-year old girl, Emily, and her mother. Emily requires transport to Atlanta for an experimental treatment for cancer. You and your aircraft are in Daytona Beach, FL. The closest airport to Emily and her mother is Crystal River (CGC), located on the west coast of Florida, north of Tampa. The mission requires you pick up Emily and her mother and transport them to Cobb County Airport (RYY). The time is now 7:55 am EST. Angel Flight requests you complete the flight to Atlanta by dark.

Though you will only be planning and ‘flying’ the first segment (to Crystal River), please remember this scenario as you negotiate the ‘flight’ portion of the session. For planning purposes, assume the weight and balance is within limits and you have 4 hours of fuel available. The researcher can act as a Flight Service representative during your flight planning, and will perform all radio (ATC, FSS, ATIS, etc.) services during the simulation. Your passengers can be reached (if needed) at (555) 543-6459. Please complete your IFR flight plan to Crystal River and inform the researcher when you are ready to move back to the simulator.
"Proceed" Instructions

Note: Priming device has been highlighted with **bold** text.

Thank you again for agreeing to participate in this research. We would like to remind you that, as discussed in the letter of consent, these scenarios are designed to study how problem solving style interacts with the source of received weather information, not your skills as a pilot. We ask that as you fly the following simulator scenario you react to the conditions and inputs you encounter in the same manner as you would normally do during actual flight. A short debriefing form will available following the flight simulation to provide feedback regarding your experiences to the researchers.

You have agreed to fly an Angel Flight. Angel Flight is a non-profit organization that provides free long-distance medical transport for patients in need. This nationwide network of volunteers transports ambulatory patients and a companion seeking life-sustaining treatment far from home, provides on-call transport for transplant recipients, flies precious cargo such as organs, blood, tissue and medical supplies to waiting hospitals and patients, and participates in national disaster relief efforts. Your (simulated) participation includes you as one of over 5,000 pilots who generously donate your time and flight expenses to help patients in need.

Treatments for aggressive life-threatening conditions such as cancer require equally aggressive treatments. Once diagnosed, patients are placed in highly structured programs designed to save the patient by overwhelming the cancer. Maximum benefit requires treatments be performed on time, with even slight deviations affecting the efficacy of treatment. One key to Angel Flight’s success has been the ability of volunteer pilots to provide reliable door-to-door transportation, making it possible for families to maintain hectic treatment schedules necessary for a positive outcome. Angel Flight Southeast’s system has proved so reliable the organization has expanded operations to include on-call, point-to-point transportation of transplant organs and recipients. You, as an experienced instrument rated pilot meet the criterion set to assist these patients.

The passengers you have agreed to transport are an eight-year old girl, Emily, and her mother. Emily requires transport to Atlanta for an experimental treatment for cancer. You and your aircraft are in Daytona Beach, FL. The closest airport to Emily and her mother is Crystal River (CGC), located on the west coast of Florida, north of Tampa. The mission requires you pick Emily and her mother and transport them to Cobb County Airport (RYY). The time is now 7:55 am EST. Angel Flight requests you complete the flight to Atlanta by dark.

Though you will only be planning and ‘flying’ the first segment (to Crystal River), please remember this scenario as you negotiate the ‘flight’ portion of the session. For planning purposes, assume the weight and balance is within limits and you have 4 hours of fuel available. The researcher can act as a Flight Service representative during your flight planning, and will perform all radio (ATC, FSS, ATIS, etc.) services during the simulation. Your passengers can be reached (if needed) at (555) 543-6459. Please complete your IFR flight plan to Crystal River and inform the researcher when you are ready to move back to the simulator.
Appendix E: Demographic Questionnaire

<table>
<thead>
<tr>
<th>Name</th>
<th>ID Number:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sex:</th>
<th>Age:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flight History</th>
<th>Last 12 Months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Flight Time:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PIC:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cross-Country:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total IFR:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IFR Time (Excluding Training):</th>
<th>Cross Country Time (Excluding Training):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratings Held:</th>
<th>Date Obtained:</th>
<th>Flight School(s) Attended:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F: Informed Consent

Informed Consent Form

Project Identification
This project is designed to test the effectiveness of weather presentation formats in the general aviation environment.

Purpose of Research
The purpose of this research is to test the interaction between problem solving style and the channel (written, visual or auditory) information is received during unusual weather events in a simulated flight environment. During this experiment, you will first be asked to provide demographic data and complete a pen-and-paper test. You will then be afforded time to familiarize yourself with the simulator before being presented with instructions and weather for the simulated flight segment. Remember as you proceed through the simulation that the purpose of this experiment is to test the effectiveness of the presentation, not your ability as a pilot. Please fly the simulated flight segment as close to your actual flying as possible. Following the flight segment you will be asked to provide feedback regarding the scenario to the researcher, along with additional flight experience information.

Risks and/or Discomforts
There are no known perceived risks to you or your property as a result of your participation in this experiment. Due to the mental stresses of simulated flight, some discomfort may occur during the segment. This discomfort is similar to that encountered during any simulated or Line-Oriented Flight Training segment. Some deception may be used during this experiment.

Confidentiality
Any identifying information presented to the researcher will be kept confidential. Reported results may be published as aggregate data; identifying characteristics of exceptional experiences will be limited to age, sex and appropriate descriptions of previous flight experience. All scoring materials will be returned to you at the end of this research project.

Consent to Videotape
I understand that, for scoring purposes only, my performance in the simulator will be videotaped. This videotape will be viewed only by raters hired by the researcher and project advisors as needed. I understand that this videotape will be sent to me following the completion of this study. Any returned or unclaimed videotapes will be destroyed by the experimenter. __________

Additional/Further Information
You may feel free to ask questions of the experimenter or assistant at any time prior to, during or after the experiment. You will be debriefed following the experiment. You may also request additional information or a copy of the completed study by contacting the researcher at Brunc681@erau.edu or in care of the Human Factors and Systems department.

Freedom to Withdraw
Your participation in this experiment is completely voluntary and you are free to withdraw at any time. Your relationships with ERAU staff, faculty and students will not be affected by your participation or self-removal from this study.

_________________________________  ___________________________________
Signature of Participant              Study Date

_________________________________  ___________________________________
Printed Name of Participant           Signature of Researcher
Appendix G: Post-Flight Questionnaire

ID: ____________

Thank you for participating in this experiment. Before you leave, please answer the following questions regarding your simulator experience:

Reference the forecast weather, when you left Daytona Beach what was your strategy to meet your passengers?

At any time during the flight did this plan change? Yes No

If Yes, when did it change and what strategies did you consider? (Please list all that came to mind, no matter how creative or 'outside the box')

What inputs influenced the decision(s) you made?

If faced with similar conditions, would you select this strategy again? Yes No

Why or why not?
Have you ever encountered a weather scenario similar to this in the past?

What type of flying do you currently participate in? (You may circle more than one)
Student  Instructor  SportEAA  Personal*  Other*
* Please describe:

What are your long-term flight aspirations? (You may circle more than one)
Airlines  Military  Corporate  Competition  Pleasure  Other:

Have you ever declared an emergency condition?
Urgency  In-Flight Emergency  None
If so, please describe:

Have you ever had an:
Deviation  Incident  Accident  None
If so, please describe:

On a scale from zero (never) to ten (always) how frequently do you use DUATS or other on-line flight planning programs?

Never  1  2  3  4  5  6  7  8  9  10  Always

Do you ever use at-home flight simulator products, such as MS Flight Simulator or VATSIM.net?

If Yes, how frequently and what do you estimate your "total time" with these products?
Appendix H: Participant Debriefing

Participant Debriefing

Thank you again for your participation in this experiment. Your participation will assist in furthering the understanding of aircrew decision-making. During this experiment, you were tested for your problem solving style then presented with weather information in visual or aural form during a simulated flight. The performance of all participants will be evaluated to determine whether problem solving style, information delivery channel or an interaction between the two can be used to predict pilot performance. Your problem solving style and a summary of the results of this study will be presented to you at the completion of this study. It may take up to six months to complete this study; please be patient. The form below is available for you to provide an address (or other contact information) you can be expected to be reached at (or through) at that time.

It is requested that you not discuss your experiences in this session until after the results are published.

Your participation has also qualified you for a drawing for cash prizes. You will be notified whether you have been awarded a prize once the study has been completed.

If you have any questions regarding your participation today, please feel free to ask them at this time. If further questions arise following your departure from this session, feel free to contact the researcher (Noelle) at Brune681@erau.edu, (386) 383-0953 or through the Human Factors and Systems department of Embry-Riddle Aeronautical University. Results of this study will be published and placed in the Hunt Library (Daytona Beach Campus) upon completion of this project.

Name: ____________________________________________

Address: _________________________________________

__________________________________________________

__________________________________________________

__________________________________________________

Phone: ____________________________________________

E-Mail: ____________________________________________