ABSTRACT

Title of Document: LEADERSHIP AND SAFETY CLIMATE IN HIGH-RISK MILITARY ORGANIZATIONS

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Preventable accidents and mishaps continue to degrade the readiness of U.S. military forces. In 2006, the National Safety Council reported an annual rate of over 30 accidental fatalities per 100,000 Department of Defense members and estimated that preventable injuries and illnesses cost the department approximately $21 billion per year. Reducing these occurrences was the policy mandate of the Secretary of Defense in 2003. He challenged the military service secretaries to reduce their mishap rates by 50 percent over a two-year period ending September 30, 2005. While each of the military services formulated its own compliance strategy, none of them met the reduction goal. In some cases, the mishap rate actually increased. The purpose of this dissertation is to evaluate the Department of the Navy's (DON) policy compliance strategy and to assess its shortcomings and areas for future improvements. The Navy focused their efforts on leadership-intervention best practices designed to elevate the safety climate in their high-risk units, primarily their aviation components. These units contribute almost 90 percent of the annual mishap cost due to preventable accidents. DON policy-makers theorized that certain leadership interventions would improve safety climate thereby reducing the likelihood that unit members would engage in unsafe behavior both on and off the job. This dissertation evaluates the validity of that general theory, and the appropriateness of the specific leadership interventions chosen, in two distinct data collection and analysis phases. In the first phase, statistical analysis is conducted on a safety-climate survey database maintained by the Naval Post-Graduate School containing 20,000 Navy and Marine Corps military survey respondents assigned to F/A-18 aircraft squadrons completed over the past 5 years. In Phase 2, Commander, Naval Air Forces Atlantic Fleet authorized climate research in four Navy F/A-18 squadrons located at Oceana Naval Air Station. Upon analysis, the intervention methods implemented in the Navy's mishap reduction strategy showed little correlation with safety climate improvement. Phase 2 analysis identified several organizational programs and specific leadership qualities that correlate with elevated safety climate and revealed a preliminary causal relationship between safety climate and safety performance.

LEADERSHIP AND SAFETY CLIMATE IN HIGH-RISK MILITARY ORGANIZATIONS

By

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Dedication

This dissertation is dedicated to the men and women of the United States Navy.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

The U.S. private sector workforce sustained almost 5,000 fatalities and 3,700,000 disabling injuries on-the-job in 2004 costing the economy an estimated $142.2 billion in higher prices for goods and services and higher taxes. Production time lost due to these on-the-job injuries totaled about 80,000,000 days, a 5 percent increase from 2003. According to the latest final data (2002), unintentional injuries (both on and off the job) continued to be the fifth leading cause of death, exceeded only by heart disease, cancer, stroke, and chronic lower respiratory diseases (National Safety Council, 2006). According to the National Council on Compensation Insurance's (NCCI) Detailed Claim Information (DCI) file, a stratified random sample of lost-time claims in 41 states, the average cost for all worker compensation claims combined in 2002–2003 was $17,787, up 12% from the 2001–2002 average of $15,865. Total incurred costs consist of medical and indemnity payments plus case reserves on open claims. Only injuries that result in medical payments with lost time are included. These numbers are often overshadowed by the sheer size of the U.S. workforce and the volume of domestic productivity and yet the social and financial impact of preventable accidents and injuries looms large.

According to the U.S. Department of Labor's Bureau of Labor Statistics, 6,455 government employees (federal, state and local) were fatally injured while at work between 1992 and 2001. During that period, the annual number fluctuated from a high of 780 in 1995 to a low of 566 in 1999. Local government workers, who accounted for half of the labor market, incurred the highest number (3,227) of deaths over the period. Federal employees, who accounted for 23 percent of the government workforce incurred 1,923 fatalities and faced the highest workplace fatality rate. The overall government fatality rate was 3.2 per 100,000 workers. The fatality rate in the private sector for the same period was 5.1 per 100,000 workers. Within government, the fatality rate was 4.1 for federal workers, 2.4 for state workers, and 3.2 for local government workers (U.S. Department of Labor, 2004).

The majority (1,253) of federal worker fatalities occurred in the areas of national security and international affairs. In addition, 146 members of the U.S. Postal Service and 105 workers in the environmental quality and housing sector suffered a fatal workplace injury over the period. Among the total number of local government fatalities, almost half (1,505) worked in justice, public order, and safety including 1,033 in police protection and 401 in fire protection. State government had the fewest workplace fatalities (1,224) within overall government. Among these fatalities, 343 worked in the justice, public order, and safety industry; 176 in the administration of economic programs; 162 in educational services; and 156 in highway and street construction (U.S. Department of Labor, 2004).

Despite the technical sophistication of the 21st century U.S. military, preventable accidents and mishaps impart similar social and economic costs. Every day, some member of the U.S. armed forces is injured or killed in a non-combat related mishap. A mishap could refer to an incident that occurs while the military member is off-duty such as a recreational boating accident or a private motor vehicle (PMV) accident (non-operational). Other mishaps might be incidents during on-duty events that are <u>not</u> the result of direct <u>combat</u> operations (operational). A mishap might be a collision at sea or an aircraft crash during a training evolution. These mishaps often involve personal injury or death and/or the damage or destruction of military equipment and infrastructure. As the nation's largest employer, the Department of Defense (DOD) faces enormous annual costs due to preventable accidents and mishaps involving both people and hardware. According to the National Safety Council (NSC), DOD had an accidental fatality rate of 30.3 per 100,000 people in fiscal year 1999; estimating that the annual cost of injury and illnesses for the department ranges conservatively from $10 billion to more than $21 billion (Greene, 2006; National Safety Council, 2006).

In 2001, the Department of Defense assembled an executive commission of government, military and labor representatives to evaluate DOD's safety and occupational health management systems. One of the panel's major findings was the lack of an effective department-wide management system and that "this deficiency has serious consequences for the department's mission because preventable injuries and illnesses absorb substantial human and financial resources that are needed for operational readiness" (Center for Naval Analyses, 2004).

Military personnel continue to hurt and kill themselves primarily due to improper decision-making and/or hazardous behavior, not due to faulty equipment or inadequate training (Neubauer, 2003). While preventable accidents can be considered statistically common in the private and public workplace, the potential for disaster increases exponentially when considering the world of high-risk technologies. "As our technology expands, as our wars multiply, and as we invade more and more of nature, we create systems — organizations, and the organization of organizations —

that increase the risk for the operators, passengers, innocent bystanders, and for future generations" (Perrow, 1984).

While the economic and social costs attributed to preventable accidents are well documented, intervention methods designed to improve safety performance in the workplace lack universality and consensus among planners, practitioners and researchers. Despite great strides in improving the training and equipment of the potentially most at-risk group of public servants (i.e. the military), much could be done to further understand how the environment of the workplace contributes to organizational safety and productivity. Of particular interest is to what extent and under what circumstances certain human resource management practices might influence individual and/or group behavior.

Study Background

Using the Department of the Navy (DON) as the organization of study, Tables 1.1 and 1.2 depict summaries of both operational and non-operational class A mishaps and fatalities between 2001 and 2005. A class A mishap is one that involves equipment damage costs that exceed $1 million, or involves a fatality or permanent disability. A class B mishap involves an injury that results in permanent partial disability, or hospitalization of five or more personnel, or the total cost of damage is $200,000 or more, but less than $1,000,000. A class C mishap involves an injury that results in one or more lost workdays, or the total cost of damage is greater than $10,000 but less than $100,000 (OPNAVINST 3750.6R, 2001). These mishaps are unplanned, non-combat related events and are considered "preventable" according to DOD policy (DOD Instruction 6055.7, 2000).

Table 1.1 Fiscal Years 2001- 05, DON Mishaps (Operational)

OPERATIONAL	Class A Mishaps	Navy Military Fatalities	Marine Military Fatalities	Federal Civilian Fatalities[1]	Other Fatalities[2]
Aviation	98	46	3	3	9
Afloat	45	15	4	0	11
Ashore	47	41	0	5	0
Operational Motor Vehicle	15	12	0	1	4
Total Operational	205	114	7	9	24

Source: http://www.safetycenter.navy.mil/statistics/navy/tables.htm
[1] Includes both Navy and non-Navy federal civilians.
[2] Includes civilian contractors, bystanders, etc.

Table 1.2 Fiscal Years 2001- 05, DON Mishaps (Non-operational)

NON-OPERATIONAL	Class A Mishaps	Navy Military Fatalities	Marine Military Fatalities
PMV[1]	341	329	2
Other Non-Operational	108	104	0
Total Non-Operational	449	433	2

Source: http://www.safetycenter.navy.mil/statistics/navy/tables.htm
[1] PMV: Privately Owned Motor Vehicle

While the financial costs attributed to these mishaps are significant, the human costs are alarming. For the Navy, the tables above reveal a non-operational accidental fatality rate four times that of the operational rate (433 versus 114) over the same five-year period. Within all branches of the military, the largest non-operational cause of accidental death has been historically due to privately-owned motor vehicle mishaps (cars, motorcycles, quads, etc.). Statistics show that 284 service members died in private motor vehicle crashes in fiscal year 2003. Though 82 of those deaths came from crashes involving motorcycles, many deaths were linked simply to impaired driving and the failure to wear safety belts. Yet, the military has made inroads since the 1980s, when as many as 700 uniformed and civilian personnel died every year in private automobile crashes. The Marines, for example, now enforce standardized safety belt regulations and teach driver-improvement classes to new recruits, while the Army seeks to identify soldiers who are most inclined to drink and drive, reaching out to them with educational materials and briefings.

Despite a consistently downward annual trend, the PMV fatal crash rate for the military services has remained above the national average. Though all types of people drink and drive, researchers say a common drunk driver is the younger man, aged 18 to 29, who takes risks and is a "sensation seeker" ─ exactly the kind of person pursued by military recruiters. According to the U.S. Department of Transportation (2007), automobile crashes are the leading cause of death nationwide for all people ages 18-34 years old. Moreover, the military employs large numbers of men aged 18 to 34, which is the age group most likely to be involved in alcohol-related crashes. Using the latest national data, the traffic crash fatality rate in 2004 for the U.S. was 14.6 deaths per 100,000 population compared to 19.5 deaths per 100,000 members for the Army; 19.0 for the Navy; 27.2 for the Marine Corps; and 16.1 for the Air Force (U.S. Department of Transportation, 2007).

Regarding operational mishaps, fiscal year 2003 was a particularly unsafe year for the Department of the Navy. For example, the class A flight mishap (FM) rate was the highest since fiscal year 1998 (26 class A mishaps) and the Marine Corps had the worst year on record for ground class A operational mishaps (34 class A mishaps). Tables 1.3 and 1.4 show the data for the most recent year on record (fiscal year 2005) for both operational and non-operational DON mishaps.

Table 1.3 Fiscal Year 2005, DON Mishaps (Operational)

OPERATIONAL	Class A Mishaps	Navy Military Fatalities	Marine Military Fatalities	Federal Civilian Fatalities[1]	Other Fatalities
Aviation	15	7	0	0	0
Afloat	12	6	0	0	0
Ashore	9	7	0	1	0
Operational Motor Vehicle	2	2	0	0	0
Total Operational	38	22	0	1	0

Source:http://www.safetycenter.navy.mil/statistics/navy/tables.htm
[1] Includes both Navy and non-Navy federal civilians.

Table 1.4 Fiscal Year 2005, DON Mishaps (Non-operational)

NON-OPERATIONAL	Class A Mishaps	Navy Military Fatalities	Marine Military Fatalities
PMV[1]	60	58	2
Other Non-Operational	22	21	0
Total Non-Operational	82	79	2

Source: http://www.safetycenter.navy.mil/statistics/navy/tables.htm
[1] PMV: Privately Owned Motor Vehicle

Considered by many to be the most hazardous and high-risk component of the naval service, the naval aviation flight mishap rate has markedly declined over the past 50 years. The FM rate just 20 years ago stood at nearly ten class A FM's per 100,000 flight-hours and now has dropped steadily to about two. Despite this downward trend in mishap rate, the cost per mishap has continued to climb. This can be attributed in large measure to the rising cost of aircraft, weapons and equipment. While the cost per mishap in fiscal year 1984 was about $6 million, it steady rose over the last two decades to about $31 million per mishap (Neubauer, 2003). Due to the nature of the tactical mission and operating environment, the F/A-18 aircraft Strike Fighter community is arguably the most high-risk aviation community within the DON. F/A-18's operate at high speed, low altitude, in all-weather, in close proximity to both aircraft and terrain, deliver high explosive ordnance, and have the highest landing speed aboard the aircraft carrier. The following table shows mishap data for the F/A-18 Hornet aircraft (Navy and Marine Corps) since its inception.

Table 1.5 Class A Flight Mishaps, F/A-18, Fiscal Years 1981-2004[1]

Fiscal Year	Annual Flight Hours	Class A Mishaps	Mishap rate[2]
FY 81	2,555	2	78.28
FY 82	8,458	0	0.0
FY 83	20,165	1	4.96
FY 84	44,736	2	4.47
FY 85	63,356	2	3.16
FY 86	99,019	2	2.02
FY 87	137,745	8	5.81
FY 88	138,360	6	4.34
FY 89	179,106	7	3.91
FY 90	207,760	7	3.37
FY 91	248,367	12	4.83
FY 92	247,047	13	5.26
FY 93	253,882	7	2.76
FY 94	259,249	5	1.93
FY 95	283,224	9	3.18
FY 96	282,499	10	3.54
FY 97	267,112	5	1.87
FY 98	273,479	9	3.29
FY 99	270,447	3	1.11
FY 00	249,187	9	3.61
FY 01	262,978	7	2.66
FY 02	305,189	6	1.97
FY 03	298,367	12	4.02
FY 04	274,181	14	5.11

[1] Source: http://www.safetycenter.navy.mil/aviation/aviationdata/aircraftinfo/f18/hornet%20_rates.doc
[2] Mishap rate is number of Class A mishaps per 100,000 flight hours

While the mishap rate for the F/A-18 aircraft community varies from year to year, the number of class A FM's, the percent of these due to human factors, or human error, has remained at a relative consistent rate of 80% (Neubauer, 2003). Much attention has been paid over the past few years to understanding human error in complex systems, including issues related to faulty cockpit design, poor judgment, and communication breakdowns. Relatively little attention has been paid to the impact of organizational influences (including leadership) on aircrew performance and safety, that is, what organizational factors might serve as antecedents to mishaps. Furthermore, even less attention has been paid to maintainers and maintenance error, despite their involvement in flight, flight related or ground mishaps.

While this doctoral research focuses specifically on the Department of the Navy, other military aviation components have experienced similar trends in preventable mishaps. According to Army statistics maintained to track their aviation units, data reveals fewer aviation related fatalities but a greater number of serious accidents in fiscal year 2006, making it one of the unsafest years in Army history. According to an Aerospace Daily computer analysis of fiscal year 2006 Army accident records, serious accidents (class A) led to 24 deaths, two below the three-year historical average of 26 and five below the fiscal year 2005 total of 29 fatalities. This positive trend is overshadowed by a significant rise in class B mishaps. Class B mishaps rose to 52 in fiscal year 2006, twelve higher than the fiscal 2005 total and 79 percent higher than the three-year historical average of 29. This is the largest Army mishap rate increase since records were collected starting in 1972. Class B mishaps, which have historically represented less than 1 percent of the service's total, accounted for about 25 percent of the mishap total in fiscal year 2006. Since 1972, class C mishaps have represented about 97 percent of the total. Class C mishaps accounted for only about half of the Army's total in fiscal year 2006 (Fabey, 2006).

DOD Mishap Reduction Policy

In a report submitted in 2002, the Congressional Research Service (CRS) concluded that the 50-year DOD trend of consistent preventable mishap reduction had finally stagnated and that the fiscal year 2002 mishap data showed some alarming numbers. That year, DOD mishaps resulted in more than 550 active duty fatalities, 308 were PMV accidents (1 military death every 16 hours). 82 personnel died in aviation accidents, 17 more than the 65 aviation flight-related deaths in fiscal year 2001. In 2002, there were over 1,474,000 military injury cases including 348,683 cases with duty limitations, 31,631 cases resulting in hospitalization or quarters, and 91,448 lost workdays (168 active duty military injuries every hour). Almost doubling from the previous year, the class A aviation accident rate for fiscal year 2002 was 1.95 mishaps per 100,000 flight hours resulting in hardware losses valued at almost $2 billion dollars (1 aircraft destroyed every 5.5 days). That year, 63 aircraft were destroyed compared to 46 destroyed aircraft in the previous year. The National Safety Council estimates the indirect costs of accidents (workers compensation, lost workdays, etc.) to be four times the direct costs (replacing/repairing hardware and infrastructure, etc.) (Angello, 2006).

On May 19, 2003, in an effort to address this rising accident rate among the armed forces, Secretary of Defense (SECDEF) Donald Rumsfeld issued a memorandum to all military service secretaries challenging them to reduce their mishap and accident rates by at least fifty percent over a two-year period (ending September 2005).

“*World-class organizations do not tolerate preventable accidents. Our accident rates have increased recently, and we need to turn this situation around. I challenge all of you to reduce the number of mishaps and accident rates by at least 50% in the next two years. These goals are achievable and will directly increase our operational readiness. We owe no less to the men and women who defend our nation*” (Rumsfeld, 2003).

Department of the Navy’s Policy Approach

From 2003 through 2005, the Department of the Navy committed considerable effort and resources to achieve SECDEF’s goal. Of primary focus was leadership’s role in energizing a more vibrant safety climate within Navy and Marine Corps units. The DON implemented a comprehensive plan to reduce mishaps by improving organizational safety attitudes through a variety of leadership interventions. In general, they were in broad areas such as reward and incentive programs, accountability processes and operational risk management. Substantial emphasis was placed on the presumption that certain leadership practices, such as implementing innovative award programs, would improve (elevate) safety climate. If safety climate improved, unit personnel would behave more prudently leading to a subsequent decline in preventable accidents and mishaps.

Following the release of the SECDEF policy memorandum, the DOD Safety Oversight Council (DSOC) was chartered in June 2003. Chaired by the Under Secretary of Defense for Personnel and Readiness (USD P&R), the DSOC was established to provide governance of DOD's accident reduction efforts (USD P&R, 2003). Developing initiatives to meet the SECDEF's mishap reduction goal was first on their agenda. At the core of these initiatives was a leadership "call to action".

On 14 Nov 2003, Secretary of the Navy Gordon R. England signed the charter for the Navy and Marine Corps Safety Council (NMCSC). This flag-level council (membership restricted to military rank of rear admiral, brigadier general or higher) was charged to oversee the implementation of the Naval Safety Strategic Plan and provide governance of current and future safety initiatives and improvements (Naval Safety Center, 2005).

On July 15, 2003, the Secretary of the Navy (SECNAV) issued an ALNAV "All Navy" message outlining a three-tiered strategy to meet SECDEF's safety tasking:

"*Commanders at all levels will:*

a. First, assume there may be a smarter way to do business and empower your best minds to develop and implement it. Ensure a sound approach using effective processes, best practices, and available technologies.

b. Second, ensure solid resources for safety. Safety programs are not discretionary. Fully funding them should be a priority. To move forward, it is also imperative that we resource promising safety initiatives and new system safety technologies.

c. Third, align support and infrastructure for safety. Leadership must be involved at all levels, ensuring senior supervision is present during high-risk evolutions and risk management is integrated into all endeavors, additionally, *leadership must ensure safety officers possess sufficient experience to assist the command, and they must have access to the commander on all safety issues. Commanders should consider the following essential to success: awards and recognition; accountability; partnerships and coalitions both internal and external to the command; and mechanisms to monitor progress"* (Secretary of the Navy, 2003).

In November 2003, after 3 months of little safety improvement, SECNAV issued another message further amplifying his safety policy:

"*My safety policy for the Department of the Navy is quite simple. Every command, every work center, every unit will have a safety culture built on three principles: leadership commitment, leadership courage and leadership integrity. Today's leaders for safety must exhibit a solid commitment to communicate safety policy and to personally abide by it. They must verbalize a belief in the value of safety and create an environment that encourages open, frank communication. They must have the courage to set and enforce tough and sometimes-unpopular standards, to allocate safety resources (the right people and sufficient funding), and to provide quality training to ensure their personnel learn correct safety practices. Today's leaders must have the integrity to hold themselves and their people accountable for violations of safety standards and to admit their own safety failures so others will do likewise. An effective leader must also openly praise and celebrate safety accomplishments.*

While the CNO, CMC and I are leading this mishap reduction effort for the Department of the Navy, we know that, in the end, success or failure depends on you. The CMC and CNO are establishing comprehensive mishap reduction plans to guide *the department in achieving the SECDEF 50 percent reduction goal by the end of FY05. These plans will require leadership and resources -- we must be committed to both. We will develop and track metrics to accurately measure our performance, and our level of success will be shared with you.*

I pledge to you my full support and commitment. Through our collective leadership efforts we will dramatically elevate the safety culture throughout the Navy and Marine Corps. It will take a decisive and targeted level of effort to achieve a fifty percent mishap reduction in two years, but if the effort saves your life or the life of a shipmate, fellow Marine or co-worker, there is no better time spent " (Secretary of the Navy, 2003).

In both of SECNAV's messages, he outlined several leadership interventions that should be important to and potentially constructive for, the commander focused on reducing preventable mishaps. Without offering specific implementation guidelines, SECNAV considered the following areas vital components of a leader's ability to shape the safety culture of his or her organization:

- Reward and incentive programs (safety specific)
- Open, frank communications
- Safety performance measurement/accountability
- Quality safety training
- Senior supervision
- Risk management application/training

The Aviation Committee, one of four committees of the NMCSC (afloat, aviation, ground tactical, and shore) emphasized some recent and near-term leadership initiatives that were considered key components of the mishap reduction strategy (NMCSC, 2005). For the Navy they include:

- Near Term - Achieving the Goal
    - Operational Risk Management (ORM) & Fundamentals Campaign – Navy & USMC Aviation. (ORM is a method used to manage/control risk consisting of five basic steps) (Naval Safety Center, 2007):
        - Identify hazards
        - Hazard assessment
        - Make risk decisions
        - Implement controls
        - Supervise
    - 100% ORM Fundamentals Trained
    - Community ORM Review Boards
    - ORM Assessment of Each Type/Model/Series (TMS) Community
    - Community ORM/Safetygrams
    - Mandatory Culture Workshops & Safety Surveys
- Leadership Initiatives
    - Mandatory Command Safety Assessment (CSA)/Maintenance Climate Assessment Survey (MCAS)
- Long Term - Sustaining Mishap Reduction
    - Institutionalizing ORM
    - Complete installation of Ground Proximity Warning System (GPWS)/Target Acquisition Weapons Software (TAWS)

- Military Flight Operations Quality Assurance (MFOQA)
- Data Mining Initiatives for Mishap Leading Indicators
- Consider Spatial Awareness Technologies
- Refocus Crew Resource Management

In addition to the leadership initiatives mentioned above, additional resources were committed to assist in the mishap reduction effort. In a statement before the Senate Defense Appropriations Committee on March 16, 2005, the Secretary of the Navy emphasized his aggressive pursuit to meet the Secretary of Defense's two-year goal to reduce preventable mishaps by 50 percent, from the fiscal year 2002 baseline. According to then Navy Secretary England, over $54.5 million, across the Future Years Defense Plan (FYDP) was added in the fiscal year 2006 budget for military flight operations quality assurance; a process to help refine the use of recorded flight data to reduce aircrew error and to achieve greater efficiencies in aircraft maintenance:

"The Department is pursuing Occupational Safety and Health Administration (OSHA) Voluntary Protection Program (VPP) status and has achieved significant reduction in lost workdays due to injuries at key installations. A professional safety community and safety intern program for our civilian personnel has also been established. The DON has embraced safety as a readiness multiplier. The Naval leadership team (Chief of Naval Operations (CNO), Commandant of the Marine Corps (CMC) and Secretary of the Navy) emphasized safety and mishap reduction as one of our published top ten 2005 objectives for the Department" (Secretary of the Navy, 2005)

Operational Guidance

It is common for defense policy to go through clarification and refinement as it filters its way down the chain of command to the operational unit level for implementation. In the case of the Navy's aviation mishap reduction policy, the Commander of Naval Air Forces (COMNAVAIRFOR) released a message on April 27, 2004 to all his aviation unit commanders with a subject line of: "*Leadership Intervention Best Practices*". This Fleet Response Plan (FRP) message (272254Z APR 04) was formulated from the processing of feedback solicited from aviation unit commanders in the field when asked to provide inputs on leadership-intervention best practices. COMNAVAIRFOR asked his subordinate commanders to provide their assessment of what best practices seemed to work for them as they considered their most successful efforts in mitigating the burgeoning mishap rate amongst their aviation units. The total number of Navy class A FM's had increased from 21 in fiscal year 2002 to 26 in fiscal year 2003 along with an annual mishap rate increase from 1.76 to 2.28 class A mishaps per 100,000 hours flown (Naval Safety Center, 2006). COMNAVAIRFOR's staff synthesized the inputs and provided guidance to the fleet (all Navy components) on what were collectively considered the most valuable and effective measures currently in use to reduce preventable injuries and mishaps. It is at this level of operational detail that this researcher will focus on evaluating the efficacy of the Navy's mishap reduction strategy.

COMNAVAIRFOR's operational guidance was organized into three overarching themes that emerged from the fleet input. It was his conclusion that these three themes reflected the root causes of the Navy's recent increase in mishaps and personal injuries. The themes he outlined were:

1. Complacency
2. Change and uncertainty
3. Personal behavior and taking care of Sailors

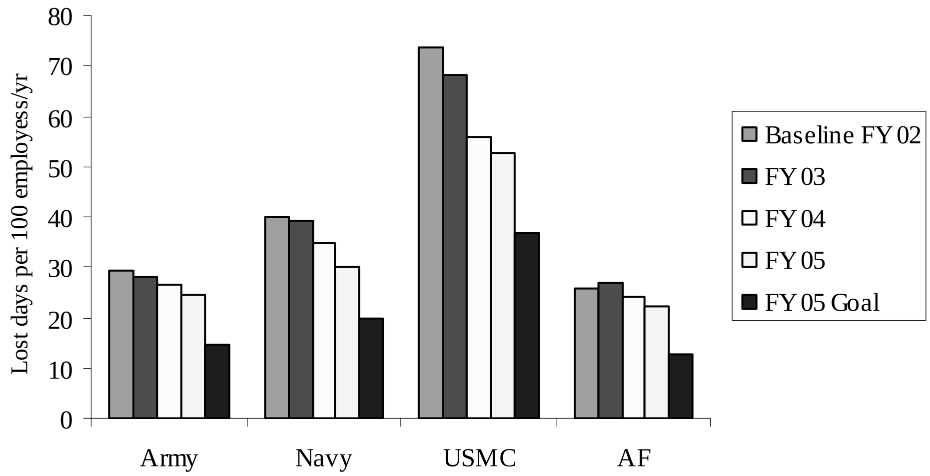
Each theme was followed with a series of leadership "best practices" intended for immediate unit implementation and designed to mitigate the behavior that was causing these negative safety trends. Evaluating this policy and implementation strategy is at the core of this doctoral research effort.

DOD Report Card

Based upon each service's mishap/incident data and the summary report provided by the Defense Safety Oversight Council in 2005, the mishap reduction policy mandate of the Secretary of the Defense was not met. Surveying a variety of metrics, there is conclusive evidence none of the uniformed services were able to meet the 50% reduction target by the end of fiscal year 2005. Safety data was collected from all 4 military services components covering a variety of categories including both civilian and military employees.

Figure 1.1 shows the summary data for civilian lost work days for each of the military components compared with the 50 percent reduction goal. On average, the Army, Navy, and Air Force reduced the civilian lost work day rate by about 15 percent over the three year implementation period while the Marine Corps reduced the rate by almost 30 percent. Despite a general downward trend for each service, the overall civilian lost day rates (measured as lost days/100 employees per year) never met the 2005 reduction goal.

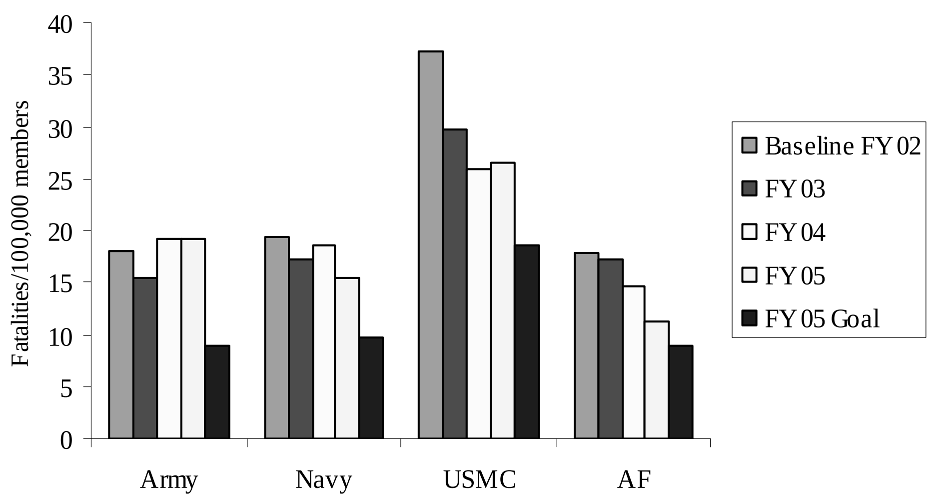
Figure 1.1 Overall Civilian Lost Day Rates (2002-2005)



Source: DMDC/DFAS pay records

Figure 1.2 shows the data for private motor vehicle fatality rates for all uniformed members of the military (measured in fatalities per 100,000 members).

Figure 1.2 Uniformed Member PMV Fatality Rates (2002-2005)

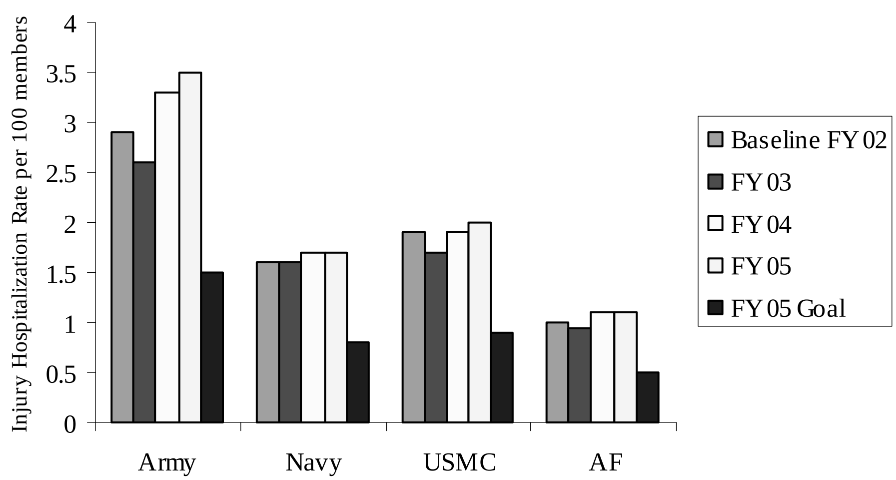


Source: DMDC/DFAS pay records

Army private motor vehicle accidents went up during the second and third year of the policy implementation period. Navy, Marine Corps and Air Force fatality rates trended down although all fell short of the policy target. The Air Force can be credited however, with an almost 40 percent reduction.

A third safety performance metric is the military injury case rate which tracks the number of injuries requiring hospitalization and quarters per 100 military members. Figure 1.3 summarizes this data.

Figure 1.3 Military Injury Case Rates (2002-2005)

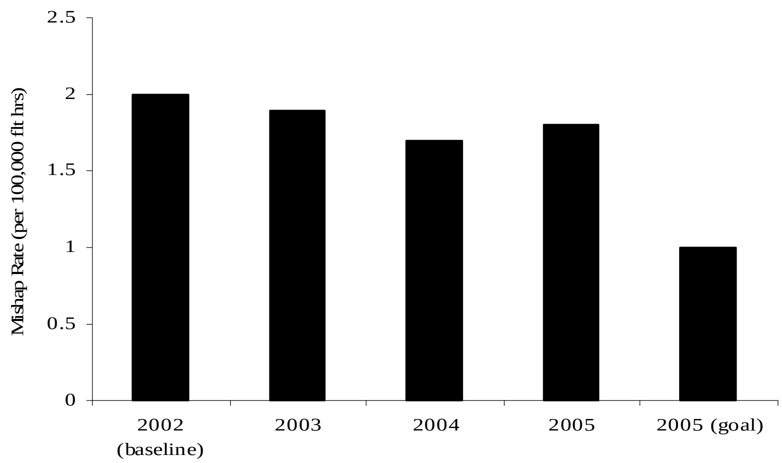


Source: Army Medical Surveillence Activity

All four branches had injury case rates that declined initially from the fiscal year 2002 baseline in fiscal year 2003 but increased above the baseline in the final two years of the policy implementation time frame.

Figure 1.4 depicts the overall class A flight mishap rate for DOD from fiscal year 2002 through fiscal year 2005.

Figure 1.4 DOD Class A Flight Mishap Rates (2002-2005)



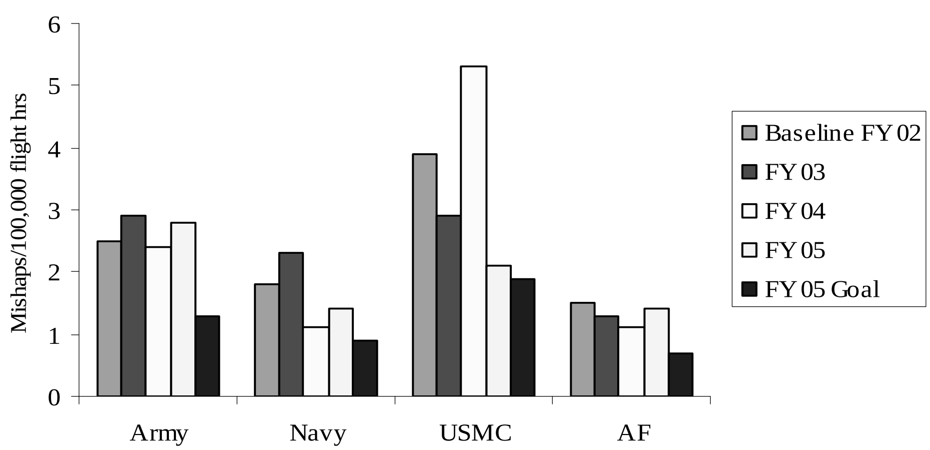
Source: Defense Safety Oversight Council (DSOC), 2006

The overall DOD class A flight mishap rate showed a modest decline from 2003 to 2004 but increased in 2005; falling well short of the 2005 50 percent reduction goal.

Naval Aviation Report Card

Figure 1.5 shows the class A aviation mishap rate data for each of the four uniformed services

Figure 1.5 Aviation Class A Flight Mishap Rates (2002-2005)



Source: Safety Centers

Each service had at least one annual class A flight mishap rate increase. The Army finished fiscal year 2005 with a rate higher than the fiscal year 2002 baseline while the Air Force finished fiscal year 2005 just slightly below the baseline (1.4 vs. 1.5). Specific Navy and Marine Corps numbers are outline in Table 1.6.

Table 1.6 USN/USMC Aviation Mishap Data, Fiscal Years 2002-2005

	FY02 (baseline)	FY03	FY04	FY05**	FY05 (goal)
Mishap rate* (Navy)	1.76	2.28	1.19	1.42	.88
Total mishaps	21	26	12	12	11
Mishap rate* (Marines)	3.89	2.91	5.18	2.36	1.94
Total mishaps	15	11	18	8	8

Source: http://www.safetycenter.navy.mil/statistics/aviation/statistics.htm
* Mishap rate based upon number of Class A mishaps per 100,000 flight hours.
** FY05 ended 30 Sep 2005.

For the Navy, the fiscal year 2005 rate of 1.42 (12 mishaps) was worse than the goal of .88 (11 mishaps). For the Marine Corps, the fiscal year rate of 2.36 (8 mishaps) was worse than the goal of 1.94 (8 mishaps). While the Marine Corps met their total mishap target (8) in fiscal year 2005, their rate was still above the goal because they flew fewer hours.

Research Problem

Since all four uniformed services failed to meet the mishap reduction policy mandate of the Secretary of Defense, this researcher concludes there is a legitimate public policy requirement to investigate where the failures occurred. To accomplish this investigation, several research challenges exist. Isolating the failure to a specific phase of the policy process is the first challenge in any research initiative. Was the policy realistic or achievable? Was the reduction target (50 %) equally achievable by all services given their unique tactical missions, operating environments, funding levels, resources, equipment, etc? Was there sufficient top-level guidance provided to the services in relation to implementation priorities, milestones, assessment metrics and inter-service coordination. Did each service design an intervention strategy focused on the same or combination of the same organizational component, i.e., people, training, infrastructure, funding, etc.? Did non-operational safety receive the same focus as operational safety? Were there environmental/contextual variables outside of the policy intervention that may have contributed to the preventable accident and mishap rate such as adjustments in recruiting standards, unusual weather, changes in the state of the economy, shifts in patriotism, etc? The research problem is vast and controlling for the myriad variables influencing the safety performance of an entire military component is impractical. Therefore, a reasonable analytical approach to this significant public policy failure must start with a more limited group, analyzing a specific policy cohort and evaluating the design, implementation and efficacy of their intervention strategy.

Research Question

In 2003, the Navy designed an intervention strategy to reduce preventable mishaps based upon leadership's ability to influence safety climate in Navy and Marine Corps units. The policy was based upon the presumption that leadership was the lever that could bring about improvements in how people perceive their safety environment; an improvement that would ultimately influence individual behavior and safety performance. Once this policy was announced, it became the task of subordinate organizations to put this high-level leadership strategy into operational terms and implement an effective mishap reduction initiative. By the end of the policy implementation period, the Navy failed to meet SECDEF's mishap reduction target (50 percent reduction in preventable accidents and mishaps by 2005).

This doctoral research endeavors to answer the first of many important questions generated by this policy failure. The foundation of the Navy's approach to mishap reduction was linked to the presumption that certain leadership best practices could positively elevate an organization's safety climate. The policy was designed to apply leadership practices to certain safety programs, thereby improving safety climate and consequently reducing preventable mishaps. Why did it not work? To unravel such a broad-reaching and consequential policy failure, this researcher starts with challenging the basic assumption under which the policy was designed. ***Do certain leadership best practices improve safety climate in high-risk military organizations?***

Until this question is answered, DOD might continue to waste manpower and infrastructure on ineffective or counterproductive attempts to reduce preventable mishaps. The consequences of such actions seem hopelessly dangerous and wasteful. Policy specific intervention strategies should be based upon empirical proof determined through scientific inquiry, not intuition, anecdote or tradition.

High Reliability Organizations

This research project focuses on a specific type of military organization (Naval Aviation) that manages a high level of risk to both personnel and infrastructure in the delivery of services. This type of organization is referred to as a "high-risk" or "high-reliability" organization. A High Reliability Organization (HRO) is an organization that operates in a hazardous environment, yet has a very low rate of accidents and incidents (Roberts, 1990). HRO's have less than their "fair share" of failures despite:

- Managing complex and demanding technologies
- Meeting peak requirements & time pressures
- Routinely handling significant risks & hazards
- Executing dynamic/intensely interactive tasks

Some common HRO's are commercial nuclear power companies, NASA (space shuttle operations), and the airline industry. HRO's in the military would be those units that perform high-risk tasks; having critical operation or maintenance procedures that have a high potential for performance shortfall and a corresponding adverse impact on overall system performance if personnel are not trained to perform the tasks to standard. These tasks are typically difficult to train because they are exceptionally complex and require a high degree of skill, have either a high frequency of inadequate performances, or any combination of the above (Joint Publication, DOD 1-02). The focus of this research will be specifically on F/A-18 strike-fighter squadrons of the Naval service; units that meet the aforementioned HRO criteria.

Personnel

Describing the people who typically serve in HRO's is well beyond the scope of this research. However, a brief description of the types of people who choose military service might be helpful in evaluating effective mishap prevention strategies and/or understanding the effectiveness of certain leadership best practices.

No single scholar has ever been able to paint a complete picture of the military conscript. Arguably the most famous study ever done on American enlisted men, *The*

American Soldier (1949), based on extensive interviews with the troops during World War II and the product of sophisticated analysis by a team of outstanding scholars, was promoted for its breakthrough in social scientific method and for its revelation about human behavior (Kohn, 1981). *The Professional Soldier: A Social and Political Portrait* (Janowitz, 1960) and *The American Enlisted Man* (Moskos, 1970) are seminal works that profiled Cold War military servants. Janowitz (1960) asserts that the life of the military professional produces a pattern of mental traits which are blunt, direct and uncompromising. *The Postmodern Military* (Moskos et al. 2000) evaluated the social determinants of military service in the postmodern period (after the Cold War) defined by a society whose aspects include:

- Lack of absolute values
- Relativism
- Ambiguity
- Permeability of institutions
- Erosion of national sovereignty

Today's postmodern military is more diverse than their Cold War counterparts regarding race/ethnicity, religion, gender and sexuality leading to greater opportunities for friction and fewer unifying factors. There is becoming less and less in common between leaders and led (Williams, 2004).

Regarding specific demographics of today's wartime recruits, there remains a continuous battle over the types and quality of personnel volunteering for service with many researchers claiming minorities and underprivileged are sharing an undue burden of sacrifice in the military. The continuous focus on military recruiting goals, personnel surges and the potential reinstitution of the draft raises the question of where the bar is, or where the bar should be, regarding the qualifications of potential enlistees. A report published by the Heritage Foundation in November 2005 analyzed military enlistees between 1999 and 2003 and could not substantiate any degradation in troop quality. In a report that updates these findings using data on U.S. recruits during 2004 and 2005 supports the previous finding that today's youths joining the military are more similar than dissimilar to the general population (Kane, 2006). The slight differences are that today's recruits:

- have a higher percentage of high school graduates
- have higher representation from Southern and rural areas
- come primarily from middle-class areas
- are underrepresented in poor areas
- have a proportional representation of racial groups

Relating these socio-economic demographics to mishap propensity among today's youthful military volunteers is debatable considering the previous research that suggests the modern military closely resembles the larger civilian population. Are there personality traits common to today's recruit that makes them more likely to engage in unsafe behavior (particularly non-operational)? Controlling for the confounding effects of age, experience, sex, and accident risk, Hansen (1988) concluded that the personality traits of extroversion, locus of control, impulsivity, aggression, social maladjustment, and some aspects of neurosis are related to the occurrence of accidents. Are these the types of traits that appeal to military recruiters?

The Army Recruiting Command defines *personal courage*, one of the Army's seven core values, as "the ability to face fear, danger or adversity (physical or moral). Personal courage has long been associated with our Army. With physical courage, it is a matter of enduring physical duress and at times risking personal safety" (Army Recruiting Command, 2007). Attributing some of these personality traits to today's military conscript might be fair considering contemporary recruiting strategies solicit potential candidates with a strong desire for adventure, opportunity, and those who seem attracted to the warrior ethos. While remaining inconclusive for the purposes of this dissertation, there does seem to be some correlation between the personality traits of today's military conscript, and the propensity to engage in risky or potentially unsafe behavior.

Unit of Analysis

The F/A-18 "Hornet" tactical aircraft squadrons of the U.S. Navy and U.S. Marine Corps are the smallest deployable aviation war fighting component of each service. Each squadron operates a variant of the F/A-18 "Hornet" aircraft and deploys as a component of a larger operational aviation group. The F/A-18 "Hornet" is a single and two-seat, twin engine, multi-mission fighter/attack aircraft that can operate from either aircraft carriers or land bases. The F/A-18 fills a variety of roles: air superiority, fighter escort, suppression of enemy air defenses, reconnaissance, forward air control, close and deep air support, and day and night strike missions. The F/A-18 Hornet replaced the F-4 Phantom II fighter and A-7 Corsair II light attack jet, and also replaced the A-6 Intruder as these aircraft were retired during the 1990s.

Following a successful run of more than 400 A and B models, the U.S. Navy began taking fleet deliveries of improved F/A-18C (single seat) and F/A-18D (dual seat) models in September 1987. These aircraft carry the Advanced Medium Range Air-to-Air Missile (AMRAAM) and the infrared imaging Maverick air-to-ground missile. Two years later, the C/D models came with improved night attack capabilities. The new components included a navigation forward looking infrared (NAVFLIR) pod, a raster head-up display, night vision goggles, special cockpit lighting compatible with the night vision devices, a digital color moving map and an independent multipurpose color display.

The multi-mission F/A-18E/F "Super Hornet" strike fighter is an upgrade of the combat-proven night strike F/A-18C/D. The Super Hornet provides the battle group commander with a platform that has range, endurance, and ordnance carriage capabilities comparable to the retired A-6. The F/A-18E/F aircraft are 4.2 feet longer than earlier Hornets, have a 25 percent larger wing area, and carry 33 percent more internal fuel which effectively increases mission range by 41 percent and endurance by 50 percent. The Super Hornet also incorporates two additional weapon stations, allowing for increased payload flexibility by mixing and matching air-to-air and/or air-to-ground ordnance. The aircraft can also carry the complete complement of "smart" weapons, including new joint weapons such as the Joint Direct Attack Munition (JDAM) and the Joint Stand-Off Weapon (JSOW).

The E/A-18G Airborne Electronic Attack (AEA) system was selected by the U. S. Navy to replace the EA-6B Prowler aircraft. A variant of the U.S. Navy F/A-18F two-crew strike fighter, the E/A-18G combines the F/A-18F strike fighter with the proven Improved Capability III (ICAP III) AEA avionics suite. Boeing and the U.S. Navy signed a five-year System Development and Demonstration (SDD) contract on December 29, 2003. The SDD contract runs from 2004 through early 2009 and encompasses all laboratory, ground and flight tests from component level testing through full-up E/A-18G weapons system performance flight testing. Boeing plans to fly the first production E/A-18G in October 2007, with Initial Operating Capability (IOC) for the E/A-18G expected in 2009 (Boeing, 2006).

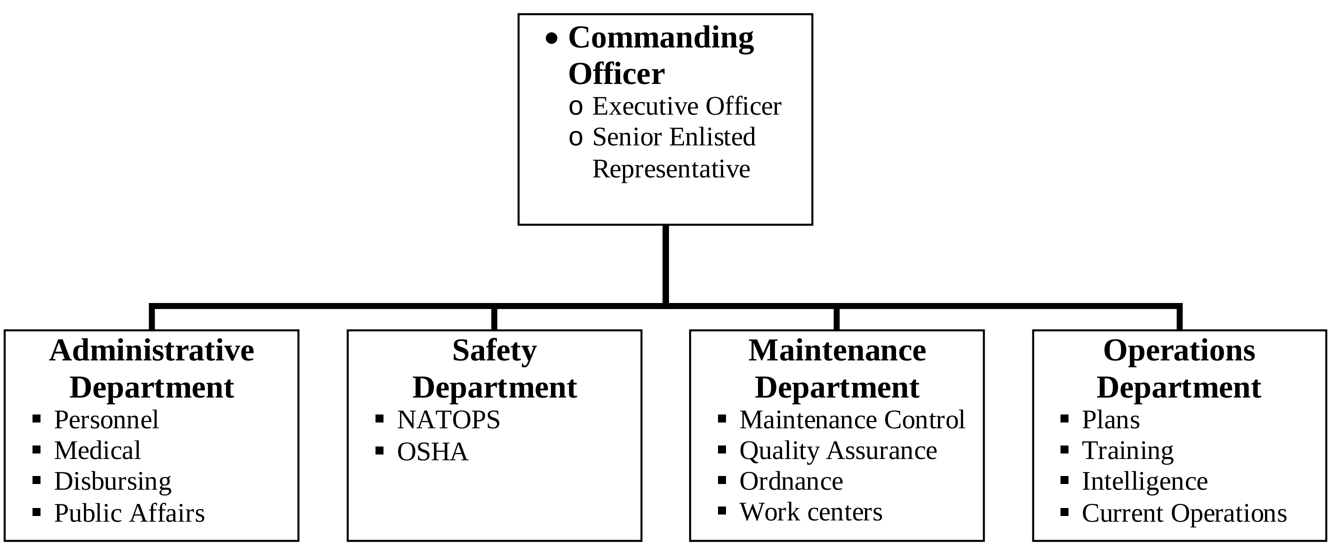
Navy F/A-18 squadrons deploy as part of a Carrier Airwing (CVW) embarked on an aircraft carrier (CV or CVN) and Marine squadrons deploy as part of a land-based Marine Air Group (MAG). A notional CVW is comprised of nine squadrons including four F/A-18 squadrons, one VAQ electronic attack squadron, one VAW airborne early warning squadron, one HS multi-mission helicopter squadron, one VS (fixed-wing) or HSL (rotary-wing) anti-submarine warfare squadron, and a C-2 personnel/cargo transportation detachment. Each of the ten CVW's currently in operation, operate with a slightly different aircraft and/or squadron mix based upon readiness factors and operational considerations (Tailhook, 2005).

Marine F/A-18 squadrons are assigned to Marine Air Groups (MAG's) and deploy in support of marine operations ashore. Each MAG is home-ported at a specific geographic location and their operational deployment schedules are driven primarily by world events as opposed to the Navy units which are tied to an aircraft carrier's deployment schedule. There are some Marine F/A-18 squadrons permanently assigned overseas as part of the Unit Deployment Plan (UDP). Recently, as a part of a formal integration plan between the Navy and Marine Corps, a schedule exists that has some marine squadrons deploying with Navy CVWs and some Navy squadrons in the UDP rotation.

The Marines structure their aviation commands a little differently than the Navy. In aircraft squadrons, the number of aircraft varies from 4 up to 24, depending on the type of squadron. A MAG typically has three or more squadrons and is usually all helicopters or all fixed-wing (MAG-36 in Okinawa has a KC-130 squadron attached). A Marine Air Wing (MAW) consists of three or more aviation groups. For example, 1st MAW has 1 fixed-wing MAG (MAG-12) and two 2 helicopter MAG's (MAG-36 and the Aviation Support Element, Kaneohe). 2nd & 3rd MAW each has 2 fixed-wing groups and 2 helicopter MAGs. 4th MAW (Reserves) has 4 mixed MAGs. Today, the U.S. Marines fly two types of fixed-wing tactical aircraft, the F/A-18 *Hornet* and the AV-8B *Harrier* (Mersky, 1997).

Figure 1.6 depicts the organizational chart of a notional F/A-18 squadron:

Figure 1.6 Organizational Chart, U.S. Navy F/A-18 Squadron



There is no set size (number of troops) assigned to any specific Marine element although there are some notional guidelines. The size of an element depends primarily upon the type of unit and mission. For example, an aviation squadron would have a different number of troops assigned than an infantry company because it has a different mission, different equipment, and therefore different requirements. In general, Navy and Marine Corps squadrons have approximately 280 personnel assigned including 40 officers and 240 enlisted personnel.

An F/A-18D/F squadron (the two-seat variant) will have slightly more personnel than the single-seat variant, F/A-18 C/E. Approximately 200 of the total 240 enlisted personnel serve in the maintenance department as maintenance technicians ranging from the most junior enlisted (E-1) to the Maintenance Master Chief (Navy) or Maintenance Master Gunnery Sergeant (Marine Corps), both of whom are typically E-9's (the most senior enlisted rank). The primary mission of the aviation squadron is to fly aircraft therefore the unit is organized to prepare and repair aircraft. Most officers are pilots or naval flight officers (80 percent) and most serve in either the maintenance or operations department. The non-flying officers are either administrative, intelligence or maintenance experts. Officers fill collateral billets in addition to their flying duties and these assignments are rotational and exist throughout the four departments.

The Commanding Officer (CO) and Executive Officer (XO) have the rank of either Commander (O-5) in the Navy or Lieutenant Colonel (O-5) in the Marine Corps. These officers are assigned to a squadron on average for three years serving initially as the XO for 15-18 months and then rotating into the CO billet for the remainder of their tour. Department Heads (DH) are either Navy Lieutenant Commanders (O-4) or Marine Majors (O-4) and are assigned to their billets, as is the case for all subordinate officers and enlisted personnel, by the CO. The tour length for officers is typically three years while the tour length for enlisted personnel varies from three to five years.

Both Navy and Marine F/A-18 squadrons are manned, trained and equipped to provide all the services necessary to launch, recover and repair their assigned aircraft. Most squadrons have 10-12 aircraft assigned although this number can vary based upon operational demands and aircraft modification schedules. Squadrons operate on a "tiered readiness" plan. This plan requires each unit to methodically increase their readiness status until they are tasked to fulfill an operational obligation like embarking on a carrier or deploying to a land-based site abroad. Therefore, a squadron's operational tempo varies in pace and intensity given the context of their training preparedness.

Managing safety (avoiding preventable accidents) under a "tiered readiness" construct can be quite challenging for squadron leadership for a variety of reasons:

- Manpower and equipment fluctuations (tiered readiness)
- Variations in operational intensity (war, turnaround, cold weather, etc.)
- Changes in organizational climate (new leadership, post-mishap)
- Schedule accelerations/delays/modifications (surges, extensions, etc.)

Assessing risk, and implementing organizational controls to mitigate such risk, is the challenges to all who have served in positions of authority in these high-risk organizations. Military aviation remains inherently risky regardless of operational context and it is often not until an accident occurs that organizational factors come under close scrutiny (i.e. mishap investigation). Reverse trends in historical safety rates also provide motivation for institutional action, as was such the case in 2003. Chapter 2 provides a theoretical overview of many of the institutional factors that might influence safety performance such as cultural context, human resource management practices, organizational climate and follower behavior; factors that will be evaluated in subsequent chapters.

Chapter 2: Theoretical Perspective

Overwhelming data suggests that the majority of fatalities, injuries and mishaps that occur in today's military are the result of poor decision-making (behavior) primarily due to complacency, inattention or negligence (Neubauer, 2006). The focus of an effective intervention (i.e. mishap reduction) strategy to mitigate hazardous behavior must consider the theories of recognized behavioral scientists and then operationalize and test the efficacy of such theories in modern organizations using applicable techniques. Readily acknowledging the field of organizational psychology is vast, the focus of this dissertation is to draw on scholarship that provides an understanding of what it takes for "leaders to have great effects on their followers" (Bass, 1985).

What do we know about the relationship between management strategies and organizational behavior that might lead to mutually-valued outcomes between leaders and followers? Of principal interest to this researcher are the concepts of leadership style, motivation and organizational climate and how they relate to follower behavior. It should be noted, this dissertation is primarily interested in the area of follower behavior that translates directly to organizational performance as measured by personal injury and mishap statistics, as opposed to other performance measures such as fiscal efficiency, operational output (quality) or personnel retention.

The following sections examine several leading theories on organizational behavior focusing specifically on the dimensions that might reveal tangible insights into how certain leadership interventions might favorably influence follower safety behavior.

In light of the mishap data presented in Chapter 1, influencing the behavior (safety performance) of military members has become a priority for DOD policy analysts and planners. Like most industrial managers, the military's determination to find effective ways to reduce or eliminate preventable mishaps is an essential ingredient to improving organizational productivity and service delivery. Safety performance in high-tech, high-risk military organizations might be viewed as a subset of the "*Cause-Effect equals Stimulus-Response*" theory of human behavior. In this theory, behavior is a direct function of rewards and punishments, or the expectation of them (McGregor, 1966). Although there are a great many variations on the theme, the prevailing theory of cause and effect is a simple stimulus-response theory. It has to do with what forms of reward and punishment (actual or promised) lead to what behavior. Safe behavior is essentially no different than productive or honest or hard-working behavior. If one behaves safely, one is rewarded for such performance.

This is not to suggest that all day-to-day decisions made by military members regarding personal conduct and behavior are based solely on this theory. Behavior is affected by many other considerations including an individual's intelligence, social and economic status, values, personality, and so on. Nevertheless, the primary causal relationship underlying attempts to control or induce change in behavior is almost universally conceived in simple stimulus-response terms, with rewards and punishments as the primary stimuli. It is not surprising that the majority of organizational factors designed to influence and improve safety performance in today's modern military are designed around these very factors.

First and foremost, is the timeless military management approach based upon close supervision and the strict enforcement of behavioral norms. Regimentation, the system of uniformity, strict discipline and rigid order captures the persona of historical and even modern military organizations. Rigid order, perceived as closely monitored and supervised behavior of unit personnel remains the hallmark of a world-class military machine, harkening imagery of Kim Jong Il's million strong army marching on display in Pyongyang or a ceremonial parade performed by the 8th and I barracks of the U.S. Marines. In these ideologically different, yet thoroughly military systems, compliant behavior is rewarded and indifferent or neglectful behavior is punished. The stimulus (rewards/punishments) produces the response (behavioral compliance).

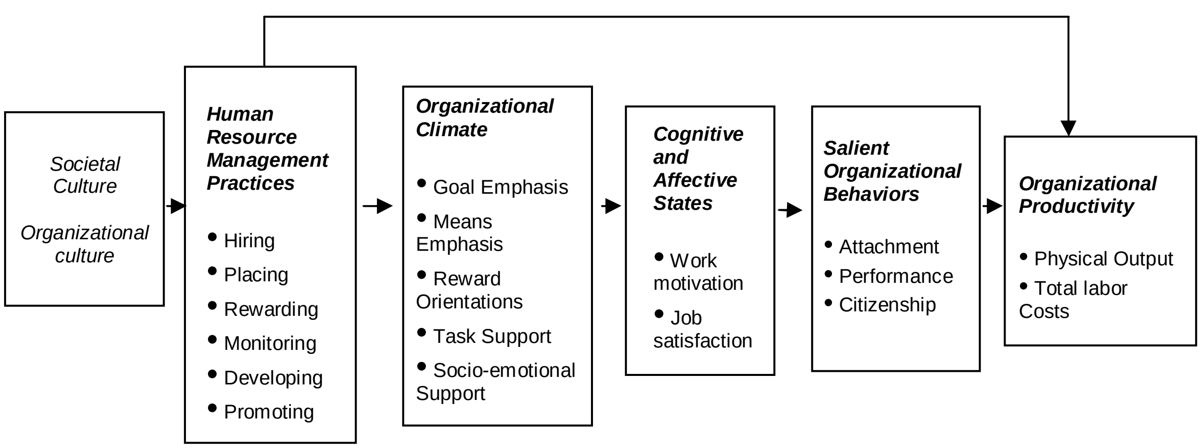
Despite attempts to control personal behavior through this simple cause and effect arrangement, military personnel continue to make decisions that lie outside the expectations of supervisors and managers. Other organizational factors must be influencing behavior besides the lure of rewards or the fear of reprisal. In view of continuing efforts to improve occupational safety in U.S. industries for example, some researchers have examined the construct of safety climate (shared perceptions of managerial safety policies, procedures and practices) and leadership focusing on how the association of these two organizational concepts might influence employee behavior (Zohar, 2002). Despite these modest efforts, little agreement exists over how these two factors relate or interact. Leadership qualities, particularly leader style remain context dependent while safety climate is typically self-reported and difficult to quantify. What remains undiscovered is a potential wealth of management insight into methods of influencing workers' shared perceptions and behaviors in ways that might improve workplace safety and organizational output. Large-scale industrial accidents, such as Three Mile Island and Chernobyl, raised public awareness regarding the social and economic costs of what were considered by many experts to be preventable mishaps and yet these calamities remain outside the realm of mainstream management research (Fahlbruch and Wilpert, 1999; Hofmann et al., 1995; Shannon et al., 1997).

Organizing Framework

This dissertation research endeavors to examine the relationship between certain leadership practices and safety climate. Schneider (1990) reviewed the organizational behavior, psychology and leadership scholarship and concluded that few studies exist that have documented changes in organizational climate that result from changes in human resource management practices.

An orienting framework for understanding the relationship between culture, climate, and productivity is depicted in the model in Figure 2.1:

Figure 2.1 Organizational Climate and Culture (Schneider, 1990)



Deferring a more in-depth discussion of climate and culture until Chapter 3, suffice it for now to consider culture as something an organization *has* (Smircich, 1983), a system of shared meanings, assumptions and underlying values (Schein, 1985). Schein further explains culture as a series of learned responses to situations that challenge an organization's survival or internal integration. Climate tends to be temporal and refers to shared perceptions about the way things are right now or the meaningful interpretations of a work environment by the people in it (Schneider, 1990). Culture and climate are similar concepts although climate has a referent such as "service" or "safety"; thus, organizations can have more than one climate. Schneider points out that climate can be understood as a manifestation of culture and that culture has a deeper, less consciously held set of meanings than climate.

Schneider's model distinguishes between societal culture and organizational culture. "Organizational leaders must be aware of the fact that there are many aspects of their social environment over which they have little or no control that nevertheless have a significant influence on their ability to achieve organizational goals" (United States Military Academy, 1988). While both organizational culture and climate can be influenced or changed, culture responds more slowly to organizational influences. Culture represents common understandings, habits and acceptable ways of doing business that characterize an organization, not unlike those associated with tribes, nationalities or ethnic groups. While most high-tech, modern organizations have rapidly changing environments (climates), it takes time, energy and a cause-effect mentality to bring about cultural change. "Change is always difficult. However, changes in culture can only be driven by the organization's leaders" (Bertels, 2003).

Cultural Context

Schneider's model posits that organizational productivity and member behavior are products of societal and organizational cultures and that the latter is nested within the domain of the former. It is important to point out that differences between the human resource management practices of similar organizations operating in different countries could potentially stem from cultural differences. For example, employee participatory policies such as work hours, work ethic, parenting priority and the value of leisure are just a few of the myriad cultural differences that may exist between a U.S. company and an international counterpart. An example might be the societal norms for female or youth employees in the textile industry in China compared to workers in a similar industry in Sweden or in the United States. Schneider's model suggests that while organizations might have their own organizational culture, they tend to mirror the broader environmental component and that variance in human resource management is more broadly attributed to societal rather than organizational cultural differences.

Human Resource Management Practices

Schneider's model indicates that what leaders do to increase organizational productivity is influenced by the culture within which their organization is embedded. Though not limited to those depicted in the model (hiring, placing, rewarding, monitoring, developing and promoting) these human resource practices in turn shape what workers perceive (climate) and influence decision-making across the gamut of employee behavior. Common human resource practices designed to increase production, for example, include fiscal incentives, leisure time, supervisory feedback, awards, participatory decision-making processes, organizational realignments and a host of reformed or reengineered programs and processes. The list of human resource practices is endless and the efficacy of certain choices to target specific organizational outputs (e.g. productivity, efficiency, unit cost, pollution, safety, etc.) provides adequate uncertainty to keep social scientists interested in this topic. Research on these practices leads some to conclude that much of the correlation is subject to varying degrees of influence based upon changes in operational context, work environment and personnel differences to name just a few (Guzzo, 1988).

Schneider's model offers an explanation for why certain human resource practices increase productivity through their influence on organizational climate. Perhaps the most common practice used to raise production is an increase in employee's pay. If workers receive an increase in pay, they tend to interpret their work environment (climate) differently. In this example, a worker gets a raise which in turns shapes a variety of perceptions about how he or she views the people he works for and the company that pays them. In most cases, an employee who receives a raise perceives their employers as being more appreciative and views the environment as one that values his or her contribution to the work process. Feeling valued, an employee may work harder, longer and perhaps with fewer mistakes or injuries because they have a different (theoretically more favorable) view about the world in which they work. This explanation seems theoretically plausible. What remains unresolved is the degree to which one can attribute an increase in productivity to a specific human resource practice or to the linearity of this influence over several employees and over different time frames.

Despite the intuitive nature of this cause and effect construct, few studies exist that have documented changes in climate that result from changes in human resource management practices. Climate as a behavior modifier is rarely used perhaps because it is difficult to model empirically or because most researchers are interested in the influence of human resource management practices on productivity, not climate (Schneider, 1990). Likert (1961) illuminated the difficulty of tracing the effects of causal variables like human resource management practices on end-result variables such as productivity without considering how intervening variables like climate might influence worker behavior. In addition to quantifying the anticipated influence of a specific management practice on productivity, there is the challenge of identifying how much behavioral variance can be attributed to an intervening variable such as climate. For example, a practice that makes organizational decision-making more participatory might positively shape the environment of a low-ranking employee (elevated self-worth, increased sense of empowerment), and yet such a practice might negatively affect the perceived environment (climate) of a long-term mid-level supervisor who views the policy as conciliatory or threatening. Not all human resource practices influence workers with the same magnitude or direction and many variables in this model are, and will remain, unaccounted for. The model merely suggests some organizational measures of production can be attributed to changes in climate influenced by certain human resource practices.

Organizational Climate

Organizational climate has different dimensions and many are in play simultaneously when leaders choose to implement a human resource practice designed to influence worker behavior. Schneider's model suggests climate is functional in nature and serves as a basis for employee interpretation and ultimately guides worker decision-making and behavior. Climate is the psychological process that mediates the relationship between the organizational policies, processes and procedures and employee attitudes and behavior (Indik, 1965). Therefore, climate is neither environment nor individual behavior; rather, it is a perceptual medium through which the effects of the environment on attitudes and behavior pass (Schneider, 1990). Schneider's model depicts five climate dimensions that apply across a variety of work environments.

1. **Goal emphasis**: the degree to which emphasis is placed on work standards and organizational output (goals). Goals affect an individual's expectation of organizational outcomes and outline the details necessary for positive self-evaluation. Simply, if one knows what it takes to be successful, then one can feel fulfilled when that level of performance is achieved. In addition, goals serve to create benchmarks for individuals developing capabilities and self-efficacy expectations (Bandura, 1986).
2. **Means emphasis**: the extent to which emphasis is placed on the proper techniques, processes and procedures needed for workers to get their jobs done. Complementing the self-efficacy contribution of goal emphasis means emphasis clarifies how a given level of performance may be achieved. Schneider (1990) points out that means emphasis, like the other climate dimensions may not always provide a positive organizational influence. For example, organizations that focus

on rules enforcement and strict procedural compliance may achieve efficiency at the expense of worker frustration or job dissatisfaction.

3. **Reward orientation**: the degree to which rewards are commensurate with merit and achievement.
4. **Task support**: the degree to which management provides workers with the necessary tools, resources, training and equipment to get the job done.
5. **Socio-emotional support**. The extent to which a worker feels like their best interests and personal welfare are valued by management.

Schneider (1990) notes that while the preceding dimensions may be common across a variety of work environments, their prominence and emphasis may vary. This explains the variation in emphasis among a variety of similar industries such as those focused on profit, productivity, image, safety or service. While the construct of climate is often measured as an individual perception (self-reported), there is ample evidence to conclude that climate is often widely shared in organizations for a variety of reasons. First, workers are commonly exposed to the same organizational stimuli (policies, processes and procedures) and second, most organizations recruit and retain similar people who respond to the organization's environment as evidenced by Schneider's Attraction-Selection-Attrition framework. Schneider (1987) asserted that "the people make the place" and that organizational culture, climate and practices are determined by the people in the organization, not "the nature of external environment, or organizational technology, or organizational structure".

Cognitive and Affective States

Schneider's model identifies two simple variables (work motivation and job satisfaction) as factors influencing worker decision-making and behavior. While a more detailed description of several cognitive theories advancing the concept of worker motivation is deferred to Chapter 3, suffice it for now to presume that workers will be more motivated to perform a certain activity if they perceive a high-valued outcome based upon their performance. Additionally, motivation is influenced by worker potential or self-efficacy; the ability to achieve what is assessed to be within an individual's potential.

In addition to various cognitive sources of motivation, followers simply behave based upon how they feel about their job, environment, leadership and cohorts. Job satisfaction is an affective state that influences worker performance, the extent to which remains inconclusively debated among behavioral scientists and industry experts. Several studies exist that predict a positive relationship between job satisfaction and worker absenteeism (Muchinsky, 1977), job satisfaction and employee turnover rate (Muchinsky & Tuttle, 1979), and job satisfaction and citizenship behavior (Organ, 1988). While Schneider highlights these two influences on employee behavior, this list should not be considered comprehensive or complete nor should the importance of these factors be overestimated. Technology is just one example of an organizational factor whose behavioral influence is a long way from being assessed or understood.

Organizational Behaviors

Safety performance, like other measures of organizational productivity (e.g. physical output, labor costs, etc.) is influenced by three broadly categorized organizational behaviors: attachment, performance, and citizenship-related behaviors. Attachment behaviors are those individual actions that reflect a desire or conversely, a disinterest in remaining a part of a specific organization. These behaviors would include actions designed to improve retainability such as volunteering for a difficult assignment or pursuing advanced education or work training to improve one's organizational stock. To the contrary, certain behaviors such as tardiness, absenteeism or quitting are attachment behaviors that can influence organizational productivity in unique and potentially significant ways.

Performance behaviors are broadly defined and include those actions that would be typically included in an employee's job description or on a performance appraisal. In many work environments, some performance behaviors directly relate to organizational output such as a pothole repairman while other employees might seemingly contribute less to the production equation such as a supply clerk or security guard. This behavior-production calculus varies from individual to individual and from production measure to production measure. In the previous example, a supply clerk may contribute more to production measured in terms of employee satisfaction than in physical output while a security guard's contribution to production measured in terms of physical security would far exceed their contribution to production measured by customer satisfaction or product quality.

High reliability organizations (HRO's) present a unique case if assessing safety performance as the focus of organizational productivity. The performance-productivity relationship, when it comes to the safety consequences of individual behavior, remains exceedingly high for every unit employee. There are no peripheral players when operating high-performance aircraft from ships at sea. Every unit member's job description includes a performance task that if executed improperly, could potentially lead to a catastrophic injury or accident. Unique to these types of military units is an organizational construct that requires all unit members to participate in most evolutions directly related to the maintenance, servicing, movement, arming, launch and recovery of jet aircraft. This is primarily due to embarked space limitations and the necessity to have all unit members fill a multitude of collateral duties. While few of the unit members actually fly the aircraft, every squadron member is equally capable of behavior that could cause a preventable accident or mishap due to their direct involvement in flight operations.

Finally, citizenship behaviors are those that are not typically included in a formal job description but those that contribute favorably to the productivity of an organization. As the name implies, these behaviors are positive or "pro-social" voluntary actions that contribute in some way to organizational performance. Katz (1964) suggests cooperating with others, protecting the organization from unexpected dangers, or suggesting organizational improvements are examples of these types of behaviors. These behaviors tend to be subtle and become more significant in the aggregate such as a continued pattern of assisting co-workers by providing spare supplies or offering work-related advice. Schneider (1990) suggests that citizenship behaviors serve to maintain the contributions of attachment and performance to productivity.

Productivity

The concern for organizational productivity runs deep in American society. Productivity is synonymous with growth, the accumulation of capital (wealth), and ultimately an organization's success or failure. While the causes, consequences, and measures of productivity are continually debated, the efficiency ratio of outputs to inputs remains central to its conceptual understanding (Guzzo, 1988). Inputs and outputs can be expressed in a variety of ways and no single formula exists to assess productivity for all types of organizations. Economists tend to study how all factor inputs are transformed into outputs while industrial-organizational (I/O) psychologists focus more on how select inputs relate to outputs. Additionally, the economist's unit of analysis tends to be nations, states or definable industries such as farmers, miners, etc. whereas a psychologist tends to focus on local productivity at the individual or work group level (Mahoney, 1988). Mahoney (1988) concludes that the psychological focus might be better described as a concern for performance, rather than productivity. Therefore, it seems important for policy-makers to define productivity as an efficiency concept and to acknowledge that there can be no single, ultimate measure of productivity (Campbell, 1988).

A major contribution of the psychology perspective is in the measurement of work performance and the recognition that individual output is but one component of productivity (Schneider, 1984). Categories of productivity measures common to research in I/O psychology are (1) output (including quantity, quality, and value), (2) withdrawal from work (chiefly through absenteeism and turnover), and (3) disruptions (such as accidents, strikes, and grievances) (Katzell et al, 1977). This categorization is consistent with the notion of productivity as a ratio of outputs to inputs (Campbell, 1988).

Factors such as those mentioned above are only partial measures of the overall productivity of an organization. Although only a few productivity factors might be assessed in any particular research effort, there exists a presumption that any favorable change in one or more of these factors will result in a discernable improvement in overall productivity. In a military unit for example, it seems logical to assume that an increase in retention or a reduction in workplace absenteeism would improve overall organizational productivity. While this association seems logical, it is extremely difficult to attribute empirical evidence to the contributory component of each factor. This research focuses specifically on preventable accidents and mishaps as the productivity factor of interest.

Organizational productivity is also influenced by individual behavior outside the walls of the traditional workplace. In the military context, non-operational injuries and accidents have a direct impact on operational readiness. As military members become more specialized, and as security requirements become more stringent, it becomes less and less likely an injured service member could be adequately replaced to meet unit deadlines and operational commitments. Non-operational accidents (primarily private motor vehicle mishaps) in the Navy account for four times as many fatalities as compared to accidents that occur during actual military operations (Tables 1.1 and 1.2). This workforce reduction has an enormous impact on organizational output and productivity and must be considered a principal motivation for any leadership intervention designed to reduce preventable mishaps.

Safety Performance

Along with technical malfunctions and faulty equipment, military accident investigators search for the individual or group behavior that may have caused or contributed to the mishap. These investigations strive to detail the organizational factors that may have contributed to unsafe behavior. In many cases involving complacency, dereliction of duty, or failure to follow approved procedures (pilot error), leadership often bears broad institutional blame in the resultant mishap report. When individual behavior or improper decision-making is considered a causal factor, investigators look to assess the correlation between leadership and safety climate. Following this type of mishap, it is not uncommon for investigators to conclude that leadership allowed a climate to exist (or develop) that facilitated, reinforced or condoned the unsafe act. When people are injured or equipment is destroyed, leadership often shares the blame with causal factors such as pilot error, maintenance malpractice and or complacency. Investigators focus on the operating environment at the time of the accident and look for organizational influences shaped by leadership that may have had a negative effect on safety climate. The leadership practice under scrutiny is often the predominant behavior in place at or near the time of the mishap. What was the operating environment like at or near the time of the mishap? This applies to organizational factors that might influence individual behavior both on and off the job.

Considering the above, several factors now point to an assessment of climate as the focus of this research and not culture. Climate tends to be the focus of most military mishap investigations. Climate implies the dominant social and organizational forces in play at the time of the mishap occurrence. Rarely do military accident investigators have the time or the training to analyze the complex historical, societal or organizational factors that may have influenced culture. In most investigative cases, the dimension under scrutiny (e.g. safety, service, profit, etc.) is presumed to be consistent with the broader societal/organizational culture and becomes the de facto focus of a mishap investigation (climate). Additionally, the focus of a mishap investigation typically starts with a review of the conduct of the organization's leader and works down the chain of command until culpability can be established for decision-making errors or if an unhealthy safety climate can be attributed to a flawed leadership practice. It is difficult to reconstruct the myriad of leadership influences (at all levels of the organization) in the aftermath of an accident. Often this reconstruction is subject to a variety of institutional flaws and biases.

Suffice it say, mishap investigators will interview enough people to corroborate a correlation between a certain leadership practice and the resultant degradation in the unit's safety climate. This downstream analysis does little to prove the influence leadership has on safety climate. Therefore, an important objective of this dissertation research will be to examine the relationship between leadership and safety climate in an effort to formulate intervention strategies that could be implemented before the preventable mishap occurs.

With the previous theoretical perspective in mind, this researcher is motivated to examine the relationship between certain leadership interventions (best practices), organizational climate, and safety performance, with a particular focus on members of a specific type of high-risk military unit. The research project reported on in this dissertation relies on a broad understanding of the leadership scholarship presented in Chapter 3 with a particular emphasis on theoretical leadership models, organizational behavior, and safety climate research.

Chapter 3: Literature Review

Accident Investigations

Accident investigations, particularly in catastrophes involving large-scale loss of life and substantial destruction of high value infrastructure and assets, often focus on leadership in determining causation. Following the loss of the space shuttle Columbia on her return to earth on February 1, 2003, the Columbia Accident Investigation Board (CAIB) spent six months investigating the cause of the mishap. In their first report issued on August 26, 2003, the CAIB concluded:

"Management decisions made during Columbia's final flight reflect missed opportunities, blocked or ineffective communications channels, flawed analysis, and ineffective leadership. Perhaps most striking is the fact that management — including Shuttle Program, Mission Management Team, Mission Evaluation Room, and Flight Director and Mission Control — displayed no interest in understanding a problem and its implications. In fact, their management techniques unknowingly imposed barriers that kept at bay both engineering concerns and dissenting views, and ultimately helped create "blind spots" that prevented them from seeing the danger the foam strike posed" (CAIB Vol.1, 2003).

The CAIB report concluded the physical cause of the mishap was due to a breach in the thermal protection system of the leading edge of the left wing cause by insulating foam impact damage incurred during lift-off. The organizational causes of the mishap were attributed to a variety of factors including the Space Shuttle program's history and culture, resource constraints, fluctuating priorities, schedule pressures and lack of an agreed national vision for human space flight. Cultural traits and organizational practices detrimental to safety were allowed to develop. Some included: reliance on past success as a substitute for sound engineering practices; organizational barriers that prevented effective communication of critical safety information and stifled professional differences of opinion; lack of integrated management across program elements; and the evolution of an informal chain of command and decision-making processes that operated outside the organization's rules. In the report's executive summary, members concluded:

"It is the Board's opinion that good leadership can direct a culture to adapt to new realities. NASA's culture must change and the Board intends the following recommendations to be steps toward effecting this change" (CAIB Vol.1, 2003).

While none of the report's Return-To-Flight (RFT) recommendations took on the linkage between leadership and safety climate, they did offer Opinion 10-12.1 regarding leadership training for NASA executives and managers:

"Managers at many levels in NASA, from GS-14 to Associate Administrator, have taken their positions without following a recommended standard of training and education to prepare them for roles of increased responsibility. While NASA has a number of in-house academic training and career development opportunities, the timing and strategy for management and leadership development differs across organizations. Unlike other sectors of the Federal Government and the military, NASA does not have a standard agency-wide career planning process to prepare its junior and mid-level managers for advanced roles. These programs range from academic fellowships to civil service education programs to billets in military-

sponsored programs, and will allow NASA to build a strong corps of potential leaders for future progression."

Opinion 10.12-1: *"NASA should implement an agency-wide strategy for leadership and management training that provides a more consistent and integrated approach to career development. This strategy should identify the management and leadership skills, abilities, and experiences required for each level of advancement. NASA should continue to expand its leadership development partnerships with the Department of Defense and other external organizations"* (CAIB Vol.1, 2003).

It is not surprising that the CAIB would recommend the military model of leadership training, considering the chairman, Hank Gehman is a retired four-star admiral and four of the remaining twelve members included three Air Force Generals and a Navy Admiral. Despite many sound and comprehensive change recommendations, the CAIB failed to explain what aspects of the military leadership model could have prevented, or might potentially prevent in the future, a similar occurrence. While many of the management shortfalls and remedies are addressed in the report, there is an over-supply of leadership criticism and an under-supply of leadership prescription.

Little research has been done examining the correlation between a particular leadership practice or intervention and its effect on safety climate; the very climate that allowed many of the organizational ailments to develop in pre-Columbia NASA. Yet in the business of operating highly complex and potentially dangerous systems, the military model of leadership is held in high regard. Following the accident at the Three Mile Island (TMI) Unit 2 nuclear plant near Harrisburg, Pennsylvania, on

March, 1979, the Kemeny Commission was appointed by President Carter to investigate the cause. Technical experts readily determined the physical cause of the accident included clogged condensate polisher lines, moisture in instrument air lines, false signals to the turbine, and emergency feed water pump valves set closed, instead of open.

Members of the commission battled unsuccessfully to determine an organizational cause. Many industry representatives of the commission argued that high-risk systems did not have to be operated any differently than low-risk systems. Harry C. McPherson, an influential Washington lawyer and reputed power broker in the Lyndon Johnson administration argued nuclear power plants should do no more than a General Motors plant; there is no difference. The commission could not reach consensus in determining if high-risk industries required a unique model of organizational management and leadership. In what many analysts consider a polite concession, Harry McPherson commented on how any difference might be handled: "There is a model of a nuclear system different from the one we have in our country, in our commercial power system. That's the naval reactor program, run with an iron fist, every decision made at the top, nobody budging down below, intense training, and intense discipline on the operators" (Perrow, 1984).

These two historical examples describe mishaps in highly technical and complex organizations. In both cases, the physical and organizational causes of the accidents were thoroughly investigated and their results were highly publicized. In both accidents, investigators recommended many changes including incorporating traditional military leadership models to correct ailments attributable to poor safety climate. Despite the effort that went into the Kemeny Commission and the CAIB, neither report explains why they conclude military leadership correlates positively with safety climate.

Leadership Accountability

As technology increasingly pushes the lethality and potential risk of operating complex military hardware, the success or failure of these units continues to be attributed to the leaders who are expected to manage a myriad of environmental and organizational forces. "In industrial, educational and in military settings and in social movements, leadership plays a critical, if not the most critical role, and as such, is an important subject for study and research" (Bass, 1990).

Leaders get the blame when bad things happen in the organizations they lead. This blame can be rightfully justified if a leader makes a poor decision or makes no decision at all and the unfortunate outcome can be linked to the leader's action or inaction. It remains crucial for governments, and the individuals who constitute them, to continue their search for innovative mechanisms for making government work better and to serve society better (Peters, 2001). At all levels, leaders in government are often blamed when the organization they lead fails to deliver the expected service or the level of service delivery is less than either published standards or the public's expectations. During and after Hurricane Katrina, many leaders (federal, state, and local) were highly criticized for providing inadequate leadership during a time of national emergency. When governmental services are inadequate or tardy, leadership often gets the blame. In cases such as government's failed response to a natural disaster, establishing the linkage between the cause (poor leadership) and the outcome (unnecessary fatalities, property loss, slow evacuations, etc.) becomes the investigative focus. These disasters get international attention because of the sheer cost to people and property. Table 3.1 reveals almost $100 billion in property losses alone due to Hurricane Katrina.

Table 3.1 Hurricane Katrina, Estimated Damage[1]

Category	Damage
Housing	$67 billion
Consumer durable goods	$7 billion
Business property	$20 billion
Government property	$3 billion
Total	$96 billion

[1]Frances Fragos Townsend, Assistant to the President for Homeland Security and Counterterrorism. *The Federal Response to Hurricane Katrina: Lessons Learned, Feb 2006.*

When the water from Katrina had finally receded and the federal investigation ran its course, the final report included specific leadership recommendations designed to prevent future occurrences of flawed federal, state and local responses to disaster victims. These recommendations included improved inter and intra-agency communications, diligent leadership oversight, and strict performance accountability.

During times of public crisis, leaders are often held brutally accountable when their actions fail to maintain the public trust. Heads should and do roll when public leaders fail those they are supposed to serve. Katrina served as a remarkable example of how emotional and serious assigning blame can be. Accountability in government should be insensitive to party, position or public sentiment. It is common for leadership to shoulder the blame when bad things happen during regular operations that involve high-risk. Many government agencies face enormous risk as they go about their routine. NASA, DEA and FEMA are just a few examples of federal agencies expected to conduct flawless operations in extremely dangerous circumstances.

Perhaps no agency is perceived as being any more high-risk than the armed forces. When bad things happen in the course of routine, yet high-risk military training, leaders must be held accountability for both their own actions and the actions of their subordinates. In addition to shouldering the blame for preventable injuries and mishaps, military leaders are expected to implement the organizational changes that will prevent future occurrences.

Distinguishing between Management and Leadership

Surveying the literature on leadership is daunting. It is interdisciplinary (reflected in literature, science, theology, philosophy, and medicine) and dates back to the oldest known literary texts and texts handed down by oral tradition. Little consensus has been reached on a definition of leadership that suits all areas of study in all occupational or professional contexts. Leadership studies cut across business administration, social and behavioral science, political, theological, and historical studies and the more contemporary, “new science” (Wheatley,1999). Defining military leadership is equally elusive. Complicating matters is the confusion over what management is and what leadership is. This distinction is important. It is not surprising that a variety of business management and public management scholars have effectively addressed this distinction.

Ronald A. Heifetz, Director of the Leadership Education Project at the John F. Kennedy School of Government, offers a practical distinction between management and leadership by focusing on output: technical work (management) versus adaptive work (leadership) (Heifetz, 2003). Technical work is employed in the types of situations where the problem can be identified and the solution can be readily implemented. Technical work is prominent within the military profession. Service members are trained to be knowledgeable of their technical profession and to be prepared to solve complex problems with precision and accuracy. Heifetz contrasts technical work with the more challenging circumstances where the problem, and quite possibly the solution, requires a certain level of learning on the part of the leader and the followers. This is what he calls adaptive work; the essence of leadership. It is in these types of situations that the center of responsibility for work shifts from the leader to the group; the learning process that can identify problems and formulate remedies must yield to the provisions of adaptive work.

Richard Danzig, the former Secretary of the Navy (appointed in 1998), has written broadly on the subjects of law, national security and military leadership, especially leadership during crises. A Yale law school graduate and Rhodes Scholar, the Secretary discovered the story of Sir Ernest Shackleton, the great Antarctic explorer, after reading Alfred Lansing's *Endurance*. The Secretary says he used the Endurance story to illustrate the kind of leadership he wanted to encourage in the Navy and Marine Corps. For him, the Shackleton model works on many levels: leadership in response to danger and adversity, working in extreme environments, surviving unforeseen challenges, flexibility in planning, and gaining and retaining the loyalty of those in your command. Trapped during an Antarctic expedition and through great danger and under tremendous pressure, Shackleton kept his crew together, maintained morale, and improved on his escape plans until he got everyone to safety. Mr. Danzig believes Shackleton had some flaws. "He is not the complete leader," he says, "but he is an exceptional example of a set of traits in a leader that we highly value. Warfare constantly requires adaptation and innovation, and he was extraordinary in that." (Morrell, 2001)

John W. Gardner, an author, activist, advisor to four presidents, and winner of the Presidential Medal of Freedom, wrote extensively on the subject of leadership. According to Gardner (1990), the word manager usually indicates that the individual holds a directive post in an organization, presiding over the process by which the organization functions. This includes allocating resources and making the best possible use of people. While suggesting that even the most visionary leader is often faced with common managerial tasks, he says leaders and leader/managers distinguish themselves from the general run of managers in at least six respects:

1. They think longer term—beyond the day's crisis.
2. They understand the unit they are heading in relation to a larger reality.
3. They reach and influence constituents beyond their jurisdictions and boundaries.
4. They put heavy emphasis on vision, values and motivation—understanding intuitively the non-rational and unconscious elements in leader-constituent interaction.
5. They have the political skill to cope with the conflicting requirements of multiple constituencies.
6. They think in terms of renewal. The leader seeks the revisions of process and structure required by the ever-changing reality (Gardner, 1990).

John P. Kotter, the Konosuke Matsushita Professor of Leadership at the Harvard Business School, is a prominent author and speaker on the subject of management and leadership. According to Kotter (1999), leadership is different from management, but not for the reasons most people think. Applied in a fundamentally business styled context, Kotter suggests management and leadership are two distinctive and complementary systems of action. Leadership complements management; it does not replace it. Management is about coping with complexity. Its practices and procedures are largely a response to one of the most significant developments of the 20th century; the emergence of large organizations. Without good management, complex organizations tend to become chaotic in ways that threaten their very existence.

Leadership, by contrast, is about coping with change. Kotter suggests the pace of technological change and the volatility of markets has made leadership so important in recent years. Major changes are more and more necessary to survive and compete effectively in this new environment. Kotter uses a simple military analogy to make his point, "coping with complexity and coping with change—shape the characteristic activities of management and leadership. A peacetime Army can usually survive with good administration and management up and down the hierarchy, coupled with good leadership concentrated at the very top. A wartime Army, however, needs competent leadership at all levels. No one yet has figured out how to manage people effectively into battle; they must be led."(Kotter, 1999)

Using the Kotter framework, the following figure identifies the types of activities associated with each system of action.

Table 3.2 Management and Leadership Activities, **(Kotter, 1999)**

Management (coping with complexity)	**Leadership** (coping with change)
Planning and budgeting	Constructive change
Setting targets and goals	Developing vision of future
Allocating resources	Strategies to achieve vision
Organizing and staffing	Aligning people
Control and problem solving	Motivating and inspiring

Applying business models to management and leadership training is extremely relevant in today's modern military. The Navy is altering its tradition-bound corporate culture to deal with modern issues. In order to modernize various strategies within the organization, the Navy established a new position, Executive Learning Officer (ELO), to initiate customized learning programs for senior naval leadership. For most of the Navy's history, high-ranking officers were selected according to how well they operated their particular weapon system, whether it was a surface ship, submarine or airplane, said retired Adm. Phil Quast, the first person to serve as the Navy's ELO. "That's all-important when you're operating submarines and airplanes, but when you get to the admiral level, only about 19 jobs out of the 230 actually involve the operational Navy," Quast said. "The rest are in a support function, and running the business that supports the acquisition, the training and all the other things associated with building a huge organization like the Navy. So we have to develop those skills at a senior level." The ELO provides FLAG/SES-level leaders, made up of between 500 and 600 admirals and their civilian counterparts, with a blended learning program. "It's business-savvy-type instruction," Quast said. "We try to take the business practices that are being utilized in the private sector." "The Chief of Naval Operations (CNO) has articulated a set of enduring corporate competencies required of all Navy senior leaders," Deputy ELO Jeffrey Munks said. "They include resource allocation, human capital management, change or transformation management, information technology management and leadership. What Admiral Quast has done is created a very rigorous and intensive residential learning experience for Navy senior leaders, called the executive business course (EBC) that builds on those five core competencies."(Summerfield, 2004)

Modern theory often complements traditional doctrine. *Command At Sea*, originally published in 1943, has become a required reference source for the naval community. Widely regarded as the most important guide for any officer taking over their first command, this book, written by the very officers who commanded a variety of naval vessels in World War II, makes the distinction between management and leadership quite clear. Leadership falls into six easily identifiable categories: personal characteristics, moral behavior, personal relations with seniors, personal relations with juniors, proper counseling and communications, and the responsibility to train. Management deals directly with the maintenance, upkeep, seaworthiness and combat readiness of the vessel under your charge (Stavridis & Mack, 1999).

Defining Leadership

Examining the distinction between management and leadership could continue indefinitely. This author is satisfied that although the two functions are complementary, they can be evaluated and assessed independently based upon an examination of an individual's organizational influence, role and the operating environment (context). Let us now move to the topic of defining leadership.

The early literature on leadership was dominated by attempts to define its essential characteristics. This exercise has generated much debate and difference in perspective. According to Bass (1997), leadership has been conceived as the focus of group processes, as a matter of personality, as a matter of inducing compliance, as the exercise of influence, as particular behaviors, as a form of persuasion, as a power relation, as an instrument to achieve goals, as an effect of interaction, as a differentiated role, as an initiation of structure, and as many combinations of these definitions.

Among the different definitions of leadership found in the literature are:

1. **Leadership as personality:** This literature focuses on discovering the leadership personality and examining what it is about the character, underlying motivations, and basic behavioral styles that make an individual a leader. Writers were drawn to the obviously exceptional, and at times extreme, personalities of particular leaders (Alexander the Great, Abraham Lincoln), and thus sought the explanation of leadership in the similarities among these personalities (Bogardus, 1928). This line of inquiry has not been supported by the results of empirical research.
2. **Leadership as an outcome of group process**: This line of research focuses on group dynamics and defines leadership as an outcome of this dynamic, rather than as a separable phenomenon in its own right (Cooley, 1902). Research has confirmed that group dynamics are an important determinant of leader behavior, but that leadership also has a separable effect on groups (Bass, 1981).
3. **Leadership as influence:** In contrast to the group dynamics perspective, other writers have defined leadership as the process of exerting individual influence on

followers' behaviors. This literature defines leadership as the power to persuade (Stogdill, 1950), both through the control over resources (rewards and punishments), and via the exercise of charisma and argument.

4. **Leadership as a pattern of activities and focus of attention and effort:** This research focuses on what leaders do when providing leadership. Kotter (1999), Laurie (2000), and Heifetz (1994) emphasize the set of responsibilities that leaders must meet and the type of focus and actions needed to accomplish them. Both Laurie and Heifetz emphasize leaders' important role in stepping outside the day-to-day crises to provide a broader perspective on the challenges and opportunities facing the organization to improve their effectiveness in setting the context, framing the problems, and mobilizing the staff to work on those problems. A significant subset of this literature identifies the creation, management, and, when necessary, transformation of organizational culture as the essential functions and key competency of leadership (Schein, 1999).

Paul Bartone (2003), Director of the Leader Development Research Center at the U.S. Military Academy, West Point, suggests military leadership is leadership in a military context. The previous discussion about management and leadership offers ample evidence that leadership is correlated directly to the context of the operational environment under which the construct of leadership is manifested. Leadership has as many definitions as people have opinions. There are almost as many definitions of leadership as there are persons who have attempted to define the concept (Stogdill, 1974).

Arriving at a definition of leadership that captures all social influences in all specialized roles is unnecessary. Broadly defined, leadership is both a social influence process as well as a particular, specialized role of the "leader" (Bartone, 2003). Understanding that leadership is the synthesis of personality, interpretation, influence, choice and action is satisfactory enough to move to a deeper examination of the leadership frameworks that help explain the leadership process.

Leadership Theories

There exists a multitude of theories and metaphors designed to explain the leadership process. The "endowment theory" or "great-man theory", although largely dismissed by contemporary scholars, explained leadership through the personality and characteristics of some of the world's most notable leaders. Leadership, seenas a quality of greatness, was manifested in a heroic persona (traits). The rise to power and influence was determined by physical qualities and personal talents and skills. Although traditionally considered to be value free, endowment theorists placed *extraordinary influence* as its highest principle (Heifetz, 1994).

Xenophon, the author of the famous book of adventure the *Anabasis* (or *The March Up Country*), tells his personal account of participating in the expedition led by *Cyros the Younger* against his older brother, the emperor *Artaxerxes* II of Persia, in 401 BC. Using primarily mercenaries left unemployed after the Peloponnesian War, *Cyros* fought and defeated *Artaxerxes* in the Battle of Cunaxa. *Cyros* was killed during the battle and the other Greek general, *Clearchos* of Sparta, was betrayed and executed after a peace conference. The mercenaries, known as the Ten Thousand, found themselves without leadership deep in hostile territory and elected *Xenophon* as one of their leaders. *Xenophon's* record of the entire expedition against the Persians and the journey home is one of the first written accounts of an analysis of the character traits of a leader. It is an example of a type of leadership analysis that has come to be known as "Great man" theory. In the *Anabasis*, *Xenophon* describes the character of the younger *Cyros*, saying, "Of all the Persians who lived after *Cyros* the Great, he was the most like a king and the most deserving of an empire" (Rouse, 1964). Chapter six describes the character traits of five defeated generals who were turned over to the enemy. The Greek general *Clearchos* is quoted as saying that "a soldier ought to be more frightened of his own commander than of the enemy." *Menon* is described as a man whose is motivated to acquire great riches while *Agias* the Arcadian and *Socrates* the Achaian are remembered for their courage and their consideration for friends (Rouse, 1964).

Leadership theorists, reacting to the weaknesses in the "endowment theory" of leadership argued that history was much more than the effects of these men on their times. "Situationalists" disputed a common set of objective traits and pursued an explanation that suggests leadership emerges from the unique circumstances faced by people with varying talents, personalities and styles. From the unique challenge of the times, emerge people with the talent, insight and depth to lead based upon the situation. According to Heifetz, the times produce the person and not the other way around. This behavioral theory explains why some people excel at certain tasks and fail at others. The value at the heart of the "situationalist" view is *preeminence* and is not radically different from the great-man theory. Both theories focus on the value of influence, a concept that fits nicely with the traditional methods of leadership training employed in classrooms filled with prospective military leaders.

"Contingency theory" is a modern approach that blends the great-man (trait) approach with the "situationalist" view. Rather than rejecting the legitimacy of these rather short-sighted explanations, there are situations that call for different personalities and different behaviors; in essence, a combination of the two traditional views. This notion expands the realm of action and calls for an appropriate style of leadership contingent on the particular situation. Great leaders can still emerge although it is not necessary in times of great challenge. There exists a variety of behaviors that can meet extraordinary challenges and the leadership quality that emerges is contingent on the scope and novelty of the task. This theory explains the utility in a variety of leadership styles that might be required to accomplish certain tasks. An *autocratic* approach might be more effective than a *democratic* or *consensus* approach in certain situations and visa versa. *Influence* and *control* remain the values at the heart of this theory. Heifetz (1999) acknowledges that influence is the common reference point for understanding leadership in a military context.

Contemporary leadership theories like the "attribution theory" look for a cause and effect relationship as a means to determine the proper leadership type (style). The cause of poor performance can be attributed to something internal to the follower (e.g. lack of ability or effort) or to external problems beyond the follower's control (e.g. lack of resources, information, or training). There are two stages to the attribution theory: (1) leader tries to determine the cause of performance inadequacy, (2) leader tries to select an appropriate response to fix the problem.

The “transactional theory” (Bass, 1985) describes leadership as a series of transactions between leaders and followers. This “transactional approach” is rooted in reciprocal arrangements between leaders and followers and describes a leader’s rise to authority based upon sustaining relationships. Transactional leadership provides a foundation of exchange of something of value between the leader and the follower as a means to generate action. A transactional leader gains influence and authority by justifying action and eliminating their followers cause for uncertainty. Bargaining and persuasion are the essence of authority. Although based on a “value-free” set of pseudo-economic principles, *influence* remains at the very center of the transactional model. Transactional leaders: focus more on stability than change, emphasize normal, work-related activities and foster motivation by appealing to followers’ self-interests. Styles of transactional leaders are:

1. **Contingent/reward**: leader contracts exchange of rewards for effort, promises rewards for good performance, recognizes accomplishments.
2. **Management by exception (active)**: leader watches and searches for deviations from rules and standards, takes corrective action.
3. **Management by exception (passive)**: leader intervenes only if standards are not met.

“Transformational leadership” arranges leaders and followers in a mutual process of raising one another to higher levels of morality and motivation (Burns, 1978). Considered the most important perspective on leadership in recent years (Bartone, 2003), transformational leaders raise the bar by appealing to higher ideals and values of followers. In doing so, they may model the values themselves and use charismatic methods to attract people to the values and to the leader. Some scholars consider transformational leadership to be a modern derivative of Max Weber's original discussions of charismatic leadership who described it as a form of social authority based on perceived exceptional and inspirational qualities of the leader, rather than to rational-legal authority or authority based on tradition (Weber, 1947). Transformational leadership occurs when leaders promote awareness and acceptance of the purposes and the mission of the group and then motivate employees to look beyond their own self-interest for the good of the group. Burns' (1978) view is that transformational leadership is more effective than transactional leadership, where the appeal is to more selfish concerns. An appeal to social values thus encourages people to collaborate, rather than working as individuals (and potentially competitively with one another). Burns also views transformational leadership as an ongoing process rather than the discrete exchanges of the transactional approach. Transformational leaders focus on a collective vision and seek to communicate it effectively to those being led. Proponents of transformational leadership claim it: increases the organization's productivity, generates higher commitment, increases follower trust in management, enhances employee satisfaction with both their job and the leader and reduces employee stress and increases well-being.

Transformational leadership advocates suggest superior leadership performance is seen when leaders broaden and elevate the interests of their subordinates, when they generate awareness and acceptance among the subordinates of the purposes and mission of the group, and when they move their followers to go beyond their own personal interests for the good of those they lead (Burns, 1978).

Transformational leaders motivate followers to do more than they may have expected or were told to do. These leaders elevate the awareness about the significance of organizational outputs and the ways of achieving them, and subsequently get followers to place the interests of the unit above their own. This motivation tends to raise the confidence of workers and expand their needs. The heightened level of motivation is linked to three empirically derived factors of transformational leadership (Bass, 1985; Avolio & Bass, 1988; Bass & Avolio, 1989; Hater & Bass, 1988).

1. **Charisma and Inspiration**. Transformational leaders have great power and influence over followers, inspire loyalty to the organization, command respect, and have an ability to see what is, and what is not important (Yammarino, Spangler & Bass, 1989). These qualities in their leader give followers a sense of mission and inspire an increased work ethic and commitment. People who serve transformational leaders tend to develop a close connection or feeling about their leader based upon trust in their abilities and confidence in their behavior, particularly organizational decision-making. Charismatic leaders excite, arouse, and inspire their subordinates (House, 1977).
2. **Individualized Consideration**. People who work for transformational leaders are inspired to work hard and are likely to be committed to their organization. Transformational leaders go beyond the importance of getting the job done and focus a significant amount of their effort in servicing a follower's need for self improvement and growth (both personal and professional). This is the transformational quality of this leadership style. Subordinates' needs and abilities

are transformed or elevated to higher levels. More specifically, this quality is viewed operationally as mentoring or coaching programs that focus on individual worker improvement including feedback and appraisal systems that provide performance feedback and follow-up. A critical factor in this dimension is a leader's ability to connect or link an individual's needs to the organization's mission making the two dimensions compatible and complementary (Bass, 1985).

3. **Intellectual Stimulation**. Transformational leaders retain the capacity to make followers feel like they are connected to the organization in more than just a physical, productivity oriented sense. Followers are challenged intellectually to engage workplace problems balancing professional knowledge with their own personal beliefs and values. This leadership quality motivates worker creativity, inspires individual awareness, and promotes a broader more effective approach to workplace problem-solving. This dimension is a potential source of organizational evolution, adaptation, and change (Bass, 1985).

Variation in Leadership Style

To this point, it has been satisfactory to describe leadership in a broad, theoretical sense focusing both on what leaders are, and what leaders do. Describing leadership in terms of personal qualities, process or group performance only deepens the curiosity for an understanding of what variables might influence the development or application of alternative leadership styles. While social and behavioral scientists have studied personality, cognitive ability and problem-solving ability as predictors of leadership style, even Bass (1998) admits that little is known about how leaders develop to be transformational, versus transactional (Bartone, 2003).

Research has been conducted on both cognitive and non-cognitive variables that might explain the difference between effective and ineffective leaders. Fiedler developed a model aimed at uncovering the contribution of two cognitive resources: intelligence and experience (Fiedler, 1986). Intelligence tends to improve leader performance in situations that are complex; the predominant style being very directive in nature. Conversely, intelligence wanes in relevance in highly stressful situations and a leader's performance is improved relative to their level of practical experience. The implications in a military context are keen. In related research, isolating problem-solving ability as a predictor of leadership performance has yielded modestly consequential results. The difficulty lies in task definition (simple versus complex) and is compounded by the interrelatedness of problem-solving with other cognitive and non-cognitive variables.

Practical intelligence or "tacit knowledge" is another cognitive variable that has recently received much interest by military researchers. On the job experiences provide opportunities for officers to not only apply the leadership doctrine they learned in the classroom, but also provides a context for acquiring new knowledge about leadership not well supported by doctrine or formal training. The tacit knowledge for military leadership project is aimed at understanding the role of operational assignments in the development of effective leaders. An example might be the tacit knowledge an individual gains in the process of solving practical problems. It represents the ability to learn from performing poorly-defined, context-specific practical tasks that do not necessarily have clear answers. Based upon a survey of over 1,500 army officers, an inventory of questions and problem scenarios was developed to measure tacit knowledge. Results showed that tacit knowledge for military leaders was a better predictor of leadership effectiveness (as measured by a variety of organizational assessments) than verbal ability, or rank. (Johnson, 2001)

Non-cognitive factors such as personality continue to emerge as a focal point in modern research on the subject of leadership studies. Conceptually, personality traits are generalized consistencies in styles of thinking, feeling and acting, and thus can be expected to affect many aspects of vocational behavior including leadership (Bartone, 2003). Acknowledging the influence of situational context and organizational arrangements in the formulation of a leader's strategy to succeed, one cannot dismiss the relevance of personality in determining how well these plans are formulated and pursued. One of the long-held goals of psychology has been to establish a model that can conveniently describe human personality with the intent of improving general understanding and research. One of the more prominent models in contemporary psychology is what is known as the five-factor model of personality. This theory incorporates five different variables into a conceptual model for describing personality. These five different factors are often referred to as the "Big 5": Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. The five-factor theory is among the newest models developed for the description of personality, and this model shows promise to be among the most practical and applicable models available in the field of personality psychology (Digman, 1990).

As it became evident to many psychologists that, mathematically, combinations of five factors were useful in describing personality, there was a need to clearly define what these factors were. As could be expected, there was some disagreement. One dissenter from the five-factor theorists was renowned psychologist H. J. Eysenck. Eysenck felt that due to overlaps in the five factors and their correlates, in fact a three-factor model was more appropriate and accurate. His theory is called the PEN model (which stand for psychoticism, extroversion, neuroticism) (Eysenck, 1998), or sometimes is even shortened to the two factor E-IN model (extroversion-introversion, neuroticism) (Eysenck, 1998). According to Eysenck, factor analysis has improved the situation but the problem of naming factors remains unresolved (Eysenck, 1998). Many psychologists support Eysenck's PEN model. However, of the major "factor-analytic models”, the Big Five dominates the landscape of current psychological research. Through extensive debating and experimenting, there is currently a general consensus in the realms of scholarly psychology as to the identity of the five factors, and their basic interpretations and values to analysis of personality.

Several longitudinal studies of the five-factor model have been conducted among military units yielding fairly consistent results. In a study conducted among cadets at West Point, conscientiousness and agreeableness were correlated with high leadership aptitude and performance (Bartone, Snook & Tremble, 2002). High conscientiousness and high openness along with low extraversion seemed to predict leader performance among Australian Army officers (McCormack &Mellor, 2002).

With the increase in interest on transformational leadership, the five-factor model has been expanded in an attempt to capture those elements of personality that might not be captured by the “big five”. Personality hardiness has been determined to be a significant predictor of leadership performance and has been the focus of a variety of studies using military subjects. Defined in a military context, hardiness (sometimes referred to as dispositional resilience) refers to a cognitive personality variable reflecting the typical way soldiers interpret potentially stressful events. Hardiness is thought to consist of three sets of cognitive styles – characteristic ways people interpret the world (Maddi, 1990). *Commitment* reflects ones' tendency to find meaning and purpose in potentially stressful events. *Control* refers to the tendency to believe that one is capable of managing the response to a stressful event. *Challenge* describes the tendency to see potentially threatening events as opportunities for personal growth. Thus, more hardy soldiers are thought to be more resilient to the potential demands of stressors because they tend to see meaning in their lives, tend to feel in control of events which might affect them, and prefer challenging environments over safety and security (Sinclair & Oliver, 2003).

In a study of West Point cadets, hardiness was the most consistent predictor of military grades (formal grades assigned to each cadet at the end of every semester). Analysis of the same cohort revealed that although hardiness is not significantly correlated with transformational leadership, the facet of commitment is moderately correlated with transformational leadership style (Bartone, 2003). Developing subordinate commitment is a fundamental tenet of transformational leaders and these results seem to substantiate the tendency of transformational leaders to develop subordinates who can make sense of highly stressful situations. This notion of "sense-making" is rooted in how followers interpret and ultimately strengthen their commitment to an organization or unit.

Another interesting variable in assessing the difference in leadership style and performance is gender. The most recent class (Class of 2008) to enter the service academies included 20.1% (250) women at Annapolis and 16.2% (198) women at West Point. (USNA/USMA, 2004) While Bass (1998) concluded that women tend to be more transformational in their leadership style when compared to men, Bartone, Snook & Tremble (2002) determined that women cadets at West Point scored higher in agreeableness and hardiness than their male counterparts. These results would suggest that female cadets would tend to be more transformational in their leadership style than their male counterparts because of increased agreeableness, and also be capable of more effectively moderating the stress of military service because of their increased hardiness.

Much has been accomplished in the field of leadership studies. While psychologists and sociologists have assessed many of the personal variables that might influence leadership style development and leader performance, much research still remains. Although personality, experience and gender remain at the heart of contemporary military research, many situational factors or conditions have yet to be considered as possible direct or interacting effects on leader development and leader performance. Assessing the impact of contextual variables under the cognizance of military planners and policy makers and their influence on leader development is of keen interest to this author. Examples might include promotion, awards and/or personal evaluation policies, or technology, infrastructure and/or equipment differences.

Models of Leadership

Explaining organizational behavior is at the heart of leadership modeling efforts. The majority of these efforts consider easily measurable, first-order explanations for personnel stimulation and motivation to work. Research has focused primarily on short-term, readily observable leader-follower arrangements and failed to assess the influence of some of the qualities and characteristics of today's most charismatic leaders (McCall, 1977). Typical research focuses on antecedent conditions, such as work environment, leader personality, power arrangements and information flow, along with leader decision style versus the orientation of leader-follower relations. Organizational outputs measurements typically include member job satisfaction and unit productivity or effectiveness. These measures tend to explain only a small percentage of the variance attributable to leadership and its effect on organizational performance. In this doctoral research, identifying some of the unexplained variance in leader-follower relations and safety performance begins with an overview of the major theories of leadership.

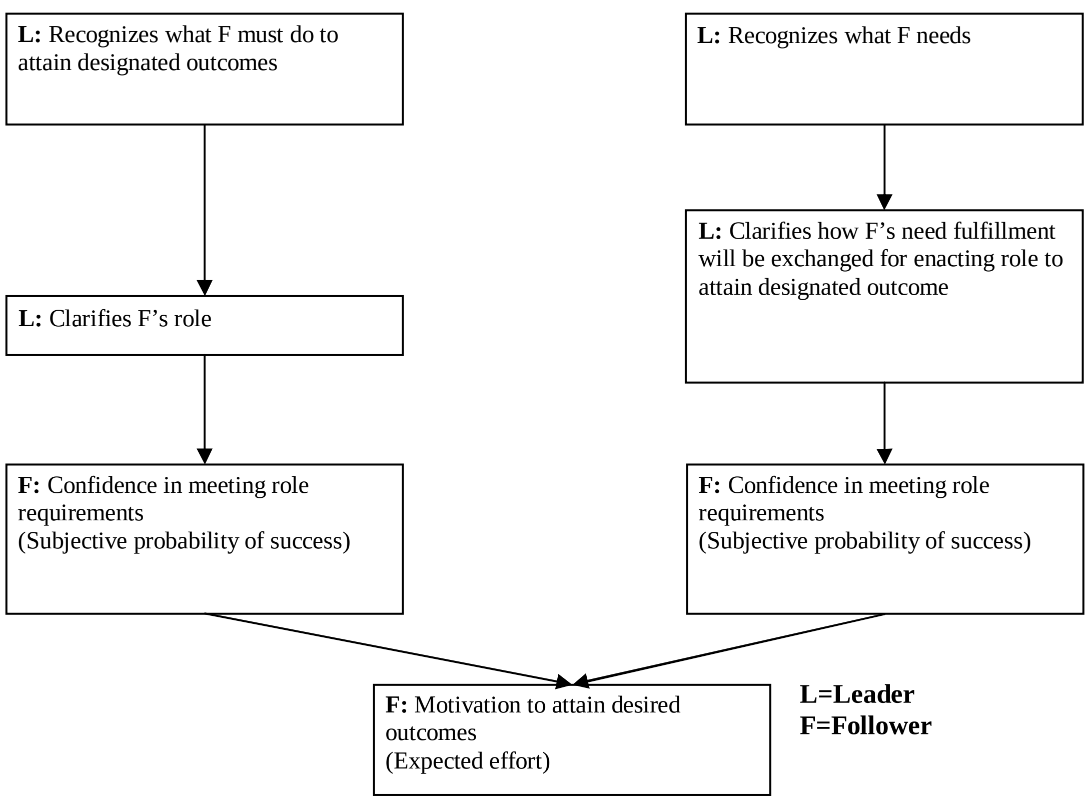
Transactional Leadership Model

The principal behavior of the transactional leader is to motivate follower behavior through a series of exchange relationships facilitated by trading awards and incentives for services rendered. A broader concern for the individual actualization of subordinates is overshadowed by an immediate interest in unit objectives and short term goals. According to Bass (1985), the transactional leader can be described in his relations with subordinates as follows:

- Recognizes and supports worker desires if it is merited by worker performance.
- Exchanges rewards and promises of reward for individual effort.
- Responds to worker immediate self-interest if compatible with getting work done.

Figure 3.1 displays the simplified transactional leader and follower relationship detailing how the follower's needs and roles are managed by the leader and how ultimately the follower is motivated to achieve the leader's expected outcomes when these two interests are in balance.

Figure 3.1 Transactional Leadership and Follower Effort (Bass, 1985)



The transactional model shows how expected effort and performance is influenced by a leader's assessment of worker' role and worker's need fulfillment.

Two important leader functions are being performed simultaneously. One, the leader recognizes and clarifies the role the follower must play in order to achieve the outcomes desired by the leader. Second, the leader assures the follower their needs will be satisfied in exchange for satisfactory effort and performance.

According to Zaleznik (1983), transactional leaders are just “managers” by another name. Broadly speaking, managers focus on the process, not the substance of issues and tend to assume their followers maintain a steady state of motivation to implement their plans. Zaleznik uses such adjectives as “manipulative”, “inscrutable”, and “detached” to describe the behavior of transactional leaders in his manager construct. The manager, like the transactional leader seeks an exchange relationship with followers to meet both their current material and emotional needs in return for specified services rendered.

Transformational Leadership Model

In the transactional model, workers’ needs are assessed by the leader as those rewards or incentives the worker expects to receive for an agreed upon level of effort or performance. Workers’ needs are specifically tied to the exchange relationship between work and reward, the quid pro quo of expected payoff for level of effort. In the transformational model, the leader’s focus on needs is broadened based upon Maslow’s (1954) hierarchy of needs.

Maslow (1954) created a simplified hierarchy of individual needs and used the symbol of a five-layered pyramid to add visual salience to the concept of basic needs forming a person’s base with sequential layers of needs resting above. The basic concept is that the higher needs in this hierarchy only come into focus once all the needs, that are lower down in the pyramid, are mainly or entirely satisfied. This does not mean the needs are independent. Each level can overlap the prior with many needs being mutually dependent of each other.

At the bottom are the biological necessities a person needs to live such as air, water, and food. Higher needs lose priority if these basic needs are not met. The second level reveals an individual's need for safety and security; safety from threats to personal well-being such as violence, crime or illness and the security of pay, resources, and protection from unemployment. After physiological and safety needs are fulfilled, the third layer of human needs is social. This involves emotionally-based relationships in general, such as friendship, personal intimacy and family. Humans generally need to feel belonging and acceptance, whether it comes from a large social group (clubs, office culture, professional organizations, and sports teams) or small social connections (family members, intimate partners, mentors, close colleagues, confidants). They need to love and be loved (sexually and non-sexually) by others.

According to Maslow, all humans have a need to be respected, to have self-respect, and to respect others. People need something like a profession or hobby to keep them busy and make them feel socially relevant. A lack of this esteem can cause a person to feel defeated or depressed while an overabundance can make a person seem self-righteous or arrogant. There are two levels to esteem needs. The lower level relates to elements like fame, respect, and glory while the higher level (self-actualization) is contingent to concepts like confidence, competence, and achievement. Maslow (1949) describes self-actualization as "the intrinsic growth of what is already in the organism, or more accurately, of what the organism is." He describes self-actualizing people as those who:

- Embrace the facts and realities of the world, rather than denying or avoiding them.
- Are spontaneous in their ideas and actions.
- Are creative.
- Are interested in solving problems; this often includes the problems of others. Solving these problems is often a key focus in their lives.
- Feel close to other people, and generally appreciate life.
- Have a system of morality that is fully internalized and independent of external authority.
- Judge others without prejudice, in a way that can be termed objective.
- In short, self-actualization is reaching one's fullest potential.

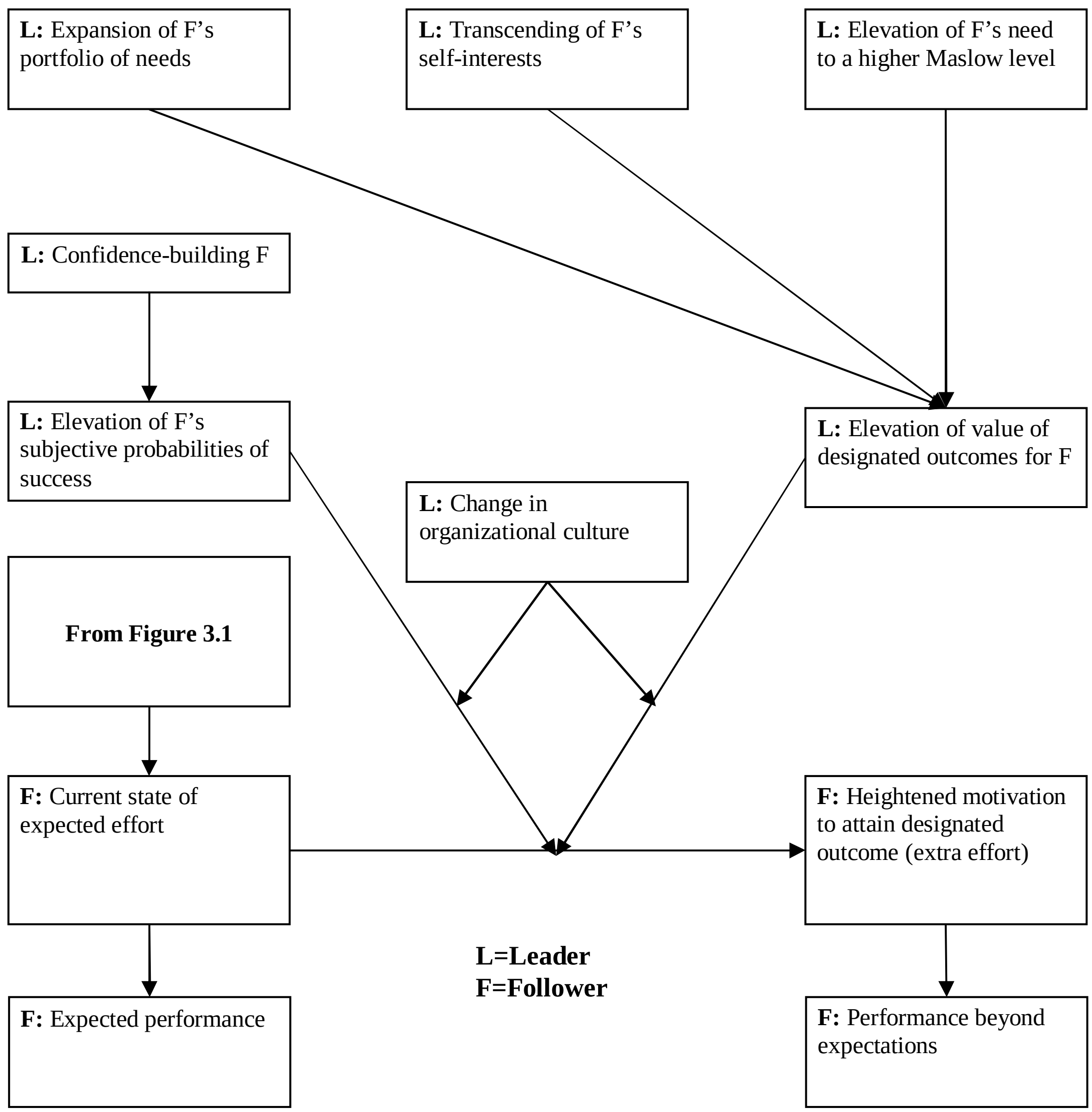
Burns (1978) considered Maslow's construct to be fundamental to understanding the transformational process and core to motivating followers to recognize the need for sacrifice and extra effort.

The model in Figure 3.2 starts with an original follower effort expectation based upon their original confidence in reaching a desired or designated performance outcome. The transformational leader elevates followers' efforts by raising their confidence and by increasing the value of the possible outcomes. The first tier of the model shows how this can be done by:

- Expanding the follower's needs

- Transcending the follower's self interests (placing the group above the individual)
- Elevating/altering or widening the follower's level of needs on Maslow's scale

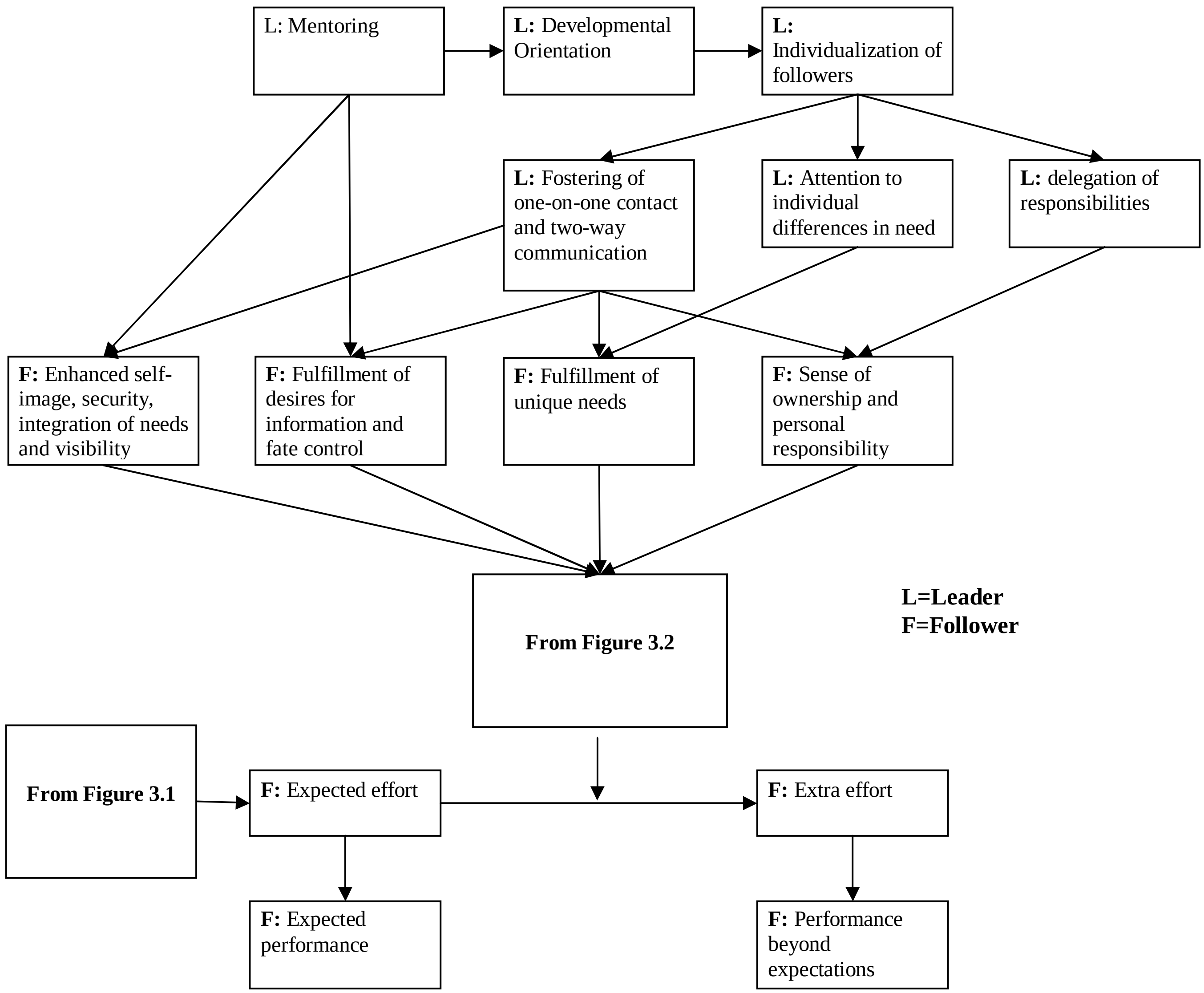
Figure 3.2 Transformational Leadership and Extra Follower Effort (Bass, 1985)



This model suggests that the work of a transformational leader is to tap into an existing pool of motivation that lies latent within the formal workforce. Many unmotivated workers will continue to comply with their current state of expected effort and perform at the level outlined in the transactional model without a leader providing some release mechanism or trigger. The transformational leader elevates worker confidence by believing they are capable of achieving higher levels of success and by elevating the value of worker effort. A worker is more likely to successfully accomplish a valuable organizational task if he believes he has an increased probability of success and if he feels his effort will help contribute to, or satisfy a higher personal need. These two leader influences help change organizational culture; the basic philosophy and core values that shape an organization's shared interpretation of events, maintains the organization's boundaries, and provides members with a sense of community, loyalty and commitment (Siehl & Martin, 1982).

Figure 3.3 adds a layer of individual consideration to the transformational model depicted in Figure 3.2. Mentoring increases worker confidence and fosters organizational loyalty. Individuation means one to one contact in a way that is honest, sincere and perpetuates the transfer of accurate communications. This leader action enhances a follower's self-image and organizational empowerment.

Figure 3.3 Individualized Consideration by Leader and Follower Effort (Bass, 1985)



Organizational Risk

To understand safety climate in high-risk military organizations, one must start with a broader understanding of organizational risk and the uncertainty posed by known and unknown hazards. Most safety programs focus on hazard identification and hazard elimination. Organizational hazards are often unique to the operating environment but most typically fit within the following categories (Bahr, 1997):

- Collision
- Contamination
- Corrosion
- Electrical
- Explosive
- Fire
- Human factors
- Physiological factors
- Loss of capability
- Mechanical
- Pressure
- Radiation

Not all hazards apply to all industries and production processes, with the exception of human factors. Irrespective of their mission or purpose, the human factor remains an inherent element of all organizations. The most well-intentioned human often stands between believing and achieving the "zero" accident goal. Humans are the reason most accidents still occur. James Reason (1990) asserts:

- Fallibility is part of the human condition
- We cannot change the human condition
- We "can" change the conditions under which people work.

People are fallible because we have certain limitations and physiological frailties. We can suffer from fatigue, complacency, poor judgment, spatial disorientation, optical illusions, panic, distractions, depression and a whole host of other symptoms that make us susceptible to accident-prone behavior. A leadership intervention designed to improve safety performance must start with the fundamental knowledge that humans are at the intersection of behavior that causes and/or prevents accidents.

Organizations are made up of fallible individuals. One person can adversely effect an organization by accepting improper risk. We coexist with risk individually and corporately, requiring our careful concern. An important element of risk management is to accept risks at the appropriate level of management to ensure only risks that are acceptable to the corporate body are allowed. Organizationally, there are three major levels of risk acceptance (Alston, 2003):

- Strategic level
- Operational level
- Individual level

Strategic decisions are made by senior leaders and affect the corporate mission, types of products, methods of production, and promote safety policy, structure, culture and climate. These types of decisions are mindful that success or failure still rests with the actions of individuals. The U.S. Navy and Marine Corps have often been credited with a "can-do' attitude. Strategic decision makers must consider this phenomenon when pushing the operational forces to the maximum. Individuals may say yes to commitments that might be beyond an acceptable risk when viewed from a strategic level. The strategic component must promote a safety policy that empowers both the operational and individual levels of risk managers and risk takers to know that they can back away from unnecessary risks without being viewed or labeled as weak.

The operational level of risk acceptance is unique to the organization based upon supervisory structure but can be generalized to fit a very basic design. A director of operations operationally manages risk that can cause the loss of life, jeopardize operations or cause potential damage to equipment and/or infrastructure. In a DON tactical strike-fighter squadron, this person would be the squadron Commanding Officer or detachment Officer in Charge (OIC). Mid-managers like squadron department heads render risk acceptance or avoidance decisions at a lower operational level focusing more on their specific area of expertise and in areas under their supervisory control. Line supervisors such as divisional Chief Petty Officers (CPOs) or Leading Petty Officers (LPOs) are rarely required to accept unnecessary risk. Standard Operating Procedures (SOP) and established technical procedures and/or checklists control their sphere of decision-making. The individual makes risk decisions that effect their daily operation but should not compromise their well-being for the sake of the operational mission.

In the high-risk business of launching jet aircraft from an aircraft carrier, operational effectiveness remains the summation of individuals making decisions regarding risk at a consistently high rate. Organizational leaders must consider this individual component of risk acceptance very seriously because all it takes is one individual's poor decision to cause the most catastrophic and tragic of accidents to occur. Individuals need detailed training on their responsibilities regarding risk and safety. Sailors and Marines should know how to protect themselves during their daily routine and how to preserve their personal well-being while accomplishing this routine. They must know how to make risk decisions that avoid placing people and equipment in danger. Decision-making training should pay off when the unexpected situation or risk arises.

If individuals make up an organization and ultimately make all of the risk acceptance decisions, then leaders (both operational and strategic) must understand that some people are more likely to accept risks than others are. Risk taking is not inherently bad; in fact, some risk taking is required for organizational success. Tactical aviation squadrons require risk tolerance to accomplish their mission. Nevertheless, how well do leaders understand the variation in individual propensity to take risks? Perceptions that may influence risk acceptance vary from one person to another. Slovic et al (1979) determined there are certain factors that affect how people perceive risk (Bahr, 1997).

- Is the risk voluntary or involuntary? People more readily accept risks they chose. If a risk is forced upon them, people often oppose the risk, even if the risk is low.
- Are the consequences catastrophic? Perceived or real, catastrophic consequences raise the concern for risk.
- Are the consequences dreaded or common? Dreaded consequences raise risk perceptions. Common consequences are more readily accepted. Nuclear contamination from a mishap (dreaded/uncommon) versus a chemical mishap (more common).

- Are the consequences certain death or uncertain? Certain death is less tolerated as opposed to uncertain death. An example would be risk associated with driving on a steep cliff versus an icy road.
- Are the consequences immediate or delayed? The chronological nearness of the risk affects capacity to tolerate. (Risk delay in smoking)
- Are the risks technically controllable? Does an individual feel they can personally control the risk? (Hang gliding versus bungee jumping)
- Is the risk new or old? Traditional risks are more easily accepted.

Organizations such as the military need risk takers. They need prudent risk takers who do so at the appropriate time to optimize mission effectiveness, and who avoid unnecessary risks. While much accepted risk comes from individuals, risks also come from other sources. Organizations are faced with risks across the spectrum of activity, and must consider all avenues of risk. Environmental risks and organizational risks that include structure, behavior, culture and climate can present risks to an organization (Ginley, 2002).

Elements that exist outside of the boundaries of an organization that might influence production are considered environmental factors. These factors might include the economy, government, suppliers, customers, geography, and weather to name just a few. When environmental factors change, they can put pressure on an organization to adjust. Adjustment can bring complacency, distraction, worry, concern, and unrest, all factors that can influence human behavior and decision-making in varying and potentially dangerous ways. Naval aviation commands operate in highly dynamic environments providing an abundance of potential risky environmental factors.

Like environmental factors, internal factors present risk that must be effectively managed. These include command or corporate philosophies, organizational culture, safety policies and work ethic. All can contribute favorably to a healthy attitude towards risk management. The organizational structure can harbor hidden risks based on poor policies and weakly written guidance. Some organizations like the U.S. Navy are quite complex with components organized by mission, country, region, division, and many other variables. Communications become intangible hazards when people in complex organizations do not receive hazard information or safety guidance.

Organizational processes must allow effective communication and a well-organized safety training program for new personnel, annual refresher training, and safety training for supervisors. Organizational leaders should clearly define roles, responsibilities and accountabilities for all members. Formal rules in the form of written policies, regulations, procedures and guidelines shape the organization's structure. A clear safety structure will positively affect safety behavior (Alston, 2003). To manage risks, safety must be embedded in the key dimensions (Nelson and Quick, 2000) of the organizational structure.

- **Formalization:** Official rules, regulations and procedures.
- **Centralization:** Degree to which safety decisions are made at the top of the organization.

- **Specialization:** Safety occupations should be narrowly defined and require unique expertise/training.
- **Standardization:** The degree to which safety is accomplished in a routine fashion.
- **Complexity:** How safety interfaces with different types of activities within the organization.
- **Hierarchy of Authority:** Vertical safety chain across levels of management.

Organizational behavior defines the stability of the corporation, unit, entity or squadron and can be the source of risk. Nelson and Quick (2000) define the organizational behavior as the study of the individual behavior and group dynamics in organization settings. Organizations are comprised of individuals who must work together to achieve the mission. Factors that internally influence an organizations behavior are:

- Personal needs of members
- Personal goals
- Goal congruence for the organization and its members
- Organizational incentives
- Cooperation
- Conflict

A myriad of other associate factors also apply, but risk to an organization depends on the health of the above list. If individual needs are not met, risks surface from distraction, depression, complacency and lack of dedication. Divergent goals lead to disunity. When organizations lack incentives, people lose focus and loyalty.

If cooperation is lacking, resentment may cause internal pressures that pose risk. Conflicts present distrust, disloyalty, unhappiness; factors that distract people from their assigned tasks and influence behavior. Organizational behavior is a product of the organization's general health, and a by-product of its culture and climate.

Safety Culture and Climate

Organizational culture is a pattern of basic assumptions that are considered valid and that are taught to new members as the way to perceive, think and feel in the organization (Nelson and Quick, 2000). Cultural strengths and restraints help to keep the culture stable. Cultural strengths are habits of thought and behavior that have served and will continue to serve the organization, if not threatened by change. Cultural restraints are deeply held assumptions that condition and restrain thinking about the future. People are content with the present. The overall culture depends on the levels of cooperation, individual development, and group commitment to organizational goals. Organizational risks that affect safe operations can rise from poor function, ambiguous policy, disjointed processes, undefined roles, unclear responsibilities and inconsistent accountabilities. These risks affect the overall safety culture of the organization.

The term "safety culture" gained recognition following the International Atomic Energy Agency's (IAEA) initial report on the Chernobyl nuclear accident in 1986. Most of the definitions developed for safety culture have been derived from the more general notion of organizational culture as used throughout the social and management sciences, and given prominence by organizational theorists such as Rohner (1984) and Schein (1985) in the early 1980s (Cox and Flin, 1998). One of the most widely used definitions of safety culture was proposed by the Human Factors Working Group of the Advisory Committee on Safety in Nuclear Installations (ACSNI) (HSC 1993: 23):

"*The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management.*"

Wiegman, et al. (2002) proposed a global definition of safety culture:

"*Safety culture is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values.*"

Colonel Greg Alston (2003), USAF (retired), a 28-year fighter pilot in the U.S. Air Force and former Deputy Chief of Safety in the Pentagon, synthesized the myriad of safety culture definitions into a working set of commonalities:

- Safety culture is a concept defined at the group level or higher, which refers to the shared values among all of the group or organization's members.
- Safety culture is concerned with formal safety issues in an organization, and closely related to, but not restricted to, the management and supervisory systems.

- Safety culture emphasizes the contribution from everyone at every level of an organization.
- Safety culture influences members' behavior at work.
- Safety culture is usually reflected in the contingency between reward systems and safety performance.
- Safety culture is reflected in an organization's willingness to develop and learn from errors, incidents and accidents.
- Safety culture is relatively enduring, stable and resistant to change.

According to Alston (2003), there are five global indicators that help measure safety culture within an organization:

- Organizational commitment
- Management involvement
- Employee empowerment
- Reward systems
- Reporting systems

The level of depth that these components are engrained into an organization reveals the overall culture of safety. Leadership clearly contributes to the depth. Organizational well-being depends on strong, healthy organizational and safety cultures. While these cultures are enduring, an organization is also affected by the temporal impacts of the organizational safety climate.

Organizational climate differs from culture in its lack of permanence and stability. The safety climate in particular is a "snapshot" of employees' perceptions of the current operating environment or prevailing conditions which impact upon safety (Mearns et al. 2000). Based upon common themes in various definitions of safety climate, Wiegmann, et al. (2002) derived the following definition of safety climate:

"Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on features of the current environment or prevailing conditions."

Safety professionals and organizational leaders cannot overlook the importance of safety climate within their organizations. The safety climate can fluctuate with real-time influences, such as new leadership, organizational changes, and environmental impacts. Safety managers must be vigilant for climate changes realizing the constant fluctuation. They must become experts on measuring and assessing the influence of these organizational influences and be prepared to advise leadership on appropriate intervention techniques. Through diligence and effort, the climate can be controlled with incentives, training and participative processes.

Behavioral Influence and Analysis

Leadership interventions are designed to place key influences on employee attitudes through a variety of motivational factors such as peer influence, pressure from informal groups, whether the job is meaningful or important, and how much recognition is given for good performance. These insights come from the thinking of Frederick Herzberg, Chris Argyris, Rensis Likert and other influential management theorists (Petersen, 1980).

Conflict Theory

Argyris's theory provides safety mangers with insights into why people commit errors. Argyris takes human nature as a starting point and analyzes the process of growing up and maturing. Mature adults must adjust to the grown-up world of subordination and control. As children, these adults were comfortable viewing older persons as controllers because they lacked certain self-awareness. As adults, most people view themselves as equals in most relationships because of their evolved self-awareness. This creates tension for many in formal organizations. According to Argyris, all organizations are structured under certain principles:

- They have a chain of command: creates senior-subordinate relationships
- The span of control is small: creates dependency, restricts freedom
- There is a unity of command: only one boss
- Characterized by specialization: small simple task, leads to lack of interest

These principles cause "management pyramiding" and cause many workers to become dependent on their supervisor or minor-boss and consider themselves very unequal. Argyris says that these principles of management are in conflict with the needs of individuals. He suggests this conflict can cause people to become apathetic, complacent, lack motivation, form informal groups, or quit. It can cause accidents because of inattention, disregard of safety rules and poor attitudes toward the company. Most managers react to this phenomenon by adding more rules, layering bureaucracy, exercising more control, or applying more pressure.

To remedy this cycle of conflict, Argyris proposed, "leveling" an organization which means to distribute decision-making more evenly and/or to involve people more in the decision-making process. His emphasis was on the extent to which people's perception of the problem were sought, their ideas on alternative solutions were cultivated, and their thoughts on implementing decisions which were already made were solicited (Argyris, 1957).

Motivation-Hygiene Theory

Herzberg called certain factors that influence behavior "hygiene factors" and other factors "motivation factors". Hygiene factors can be improved to increase a worker's job satisfaction although this might not necessarily increase the worker's motivation. Motivation factors have to do with the job itself while the hygiene factors are peripheral to the job (Herzberg, 1966).

The following factors determine the worker's level of **satisfaction**:

- Money
- Status
- Relationship with boss
- Company policies
- Work rules
- Working conditions

The following factors determine the worker's level of **motivation**:

- Sense of achievement
- Recognition
- Job satisfaction
- Possibility of promotion
- Responsibility

- Chance for growth

Leadership interventions targeting a worker's level of **satisfaction** will never motivate people to be truly excited about their job and will probably lead to boredom and complacency.

Likert's Theory

Likert's studies investigated the effect of the supervisor-employee relationship on productivity. Among Likert's findings relevant to leadership and safety climate are (Likert, 1961):

- The tighter the supervisor's control over the employee, the lower the productivity.
- The more the supervisor watches and supervises the worker, the lower the productivity.
- The more punitive the supervisor is when the employee makes a mistake, the lower the productivity.

Do any of the three previous behavioral theories square in the face of the contemporary work ethos and/or the culture of a high-risk industrial organization like a commercial nuclear power plant, NASA, or the military? Isn't a typical military unit subject to management pyramiding; the very organizational structure Argyris suggests causes worker apathy? Aren't the preponderance of military incentives targeting pay and promotion, the "hygiene factors" Herzberg concludes will fail to motivate followers and ultimately lead to boredom and complacency. Can a military leader's need to control (and be accountable) be reconciled with a follower's desire to exercise a certain level of autonomy? Likert's theory suggests that less control over employees equates to more production. An important part of this doctoral research will be to investigate how these theories of behavior should weigh in the formulation of safety policies and leadership intervention strategies designed to reduce preventable mishaps.

Antecedent-Behavior-Consequence (ABC) Analysis

An essential tool of safety management is discovering and addressing the cause of accidents. In heavy industry (and the Navy is no exception), it is well known that 80-95% of accidents are caused by unsafe behavior (Krause et al, 1990). All leadership interventions that improve industrial safety performance are effective in large measure because they influence employee behavior. Ironically, most organizations have behavioral influences that indirectly favor unsafe behavior. These influences are such things as short fused schedule changes, increased productivity targets, or extended work hours. Behavioral analysis can help an organization to assess the factors that are really driving its safety efforts. In terms of ABC analysis, an antecedent is an event which triggers an objectively observable behavior. For example, a ringing doorbell (antecedent) triggers a (behavior) answering the door to see (consequence) who is at the door. Managers tend to identify the antecedent as the most powerful stimulus to behavior, in this case, answering the door. However, in his pioneering work in behavioral science, B.F. Skinner showed that consequences are more powerful determinants of behavior than are antecedents. ABC Analysis involves the following principles (Krause et al, 1990):

- Both antecedents and consequences control behavior
- But they do so very differently

- Consequences control behavior powerfully and directly, and
- Antecedents control behavior indirectly, primarily to predict consequences.

Many well intended safety programs fail because they rely too much on antecedents—things that come before behavior—safety rules, procedures, meetings, etc. In most cases, these antecedents have no powerful consequences backing them up. Some consequences are stronger than others are and some consequences push a worker towards a certain behavior and other consequences push a worker away from a certain behavior. Three features determine which consequences are stronger than others:

- **Timing:** A consequence that follows soon after a behavior controls behavior more effectively than a consequence that occurs later.
- **Consistency:** A consequence that is certain to follow a behavior controls behavior more powerfully than an uncertain or unpredictable consequence.
- **Significance:** A positive consequence controls behavior more powerfully than a negative consequence.

Safety Climate Research

Organizational climate describes an area of research rather than a specific organizational measure (Zohar, 1980). Broadly defined, organizational climate can refer to either specific properties of organizations such as size, shape and complexity or employees' shared perceptions about certain dimensions of the work environment (James & Jones, 1974). It is within this broad construct that specific climate measures such as Litwin and Stringer's (1968) motivation climate, Taylor's (1972) creativity climate, or Schneider's (1990) service climate have emerged for field research. The common reference being that workers tend to share similar perceptions regarding the specific environmental aspect and that these perceptions guide or influence employee behavior. Workers respond to cues in the environment by behaving according to an expected set of outcome contingencies (Dieterly & Schneider, 1974; Litwin & Stringer, 1968).

Attempting to refine the organizational climate concept and in an effort to develop a general, theory-based approach to organizational safety factors, Zohar (2000) tested a group-level model of safety climate derived from the organizational model. Based upon a study of 534 production workers, divided into 53 work groups in a metal-processing plant an anonymous safety climate questionnaire was administered and analyzed. Safety climate perceptions provided significant prediction of sub-unit injury records over the 5-month period after climate measurement. Also, the effect of overload on personal injury was significantly reduced in subunits with a high safety action supervisor. These results suggest that safety climate perceptions can develop at the subunit level of organizations in parallel to their development at the organizational level.

A particular type of organizational climate is a climate for safety. In what is considered by many to be the first journal article on the subject, Zohar (1980) attempts to: define the dimensions of safety climate and to assess the concept's relevance in understanding occupational behavior when operationalized and validated. He designed a questionnaire based upon the organizational characteristics extracted from a review of the literature on industrialized companies and organizational safety practices. Upon analysis, the dimensions that distinguished low-rate from high-rate accident companies included:

- Top management was personally involved in safety on a routine basis
- The rank and status of safety officers
- Open communication links and frequent contacts between workers and management
- Frequent safety inspections by appropriate personnel
- Stable work force with less turnover and older workers
- Successful companies had distinctive ways of promoting safety using guidance and counseling, rather than enforcement and admonition

Based upon his research of 20 factories (over 500 workers in one of four industries: metal fabrication, food processing, chemical industry and textile industry), Zohar concluded: (a) safety climate can be regarded as a characteristic of industrial organizations, (b) safety climate is related to the general safety levels in these organizations, and (c) production workers have a unified set of cognitions regarding the safety aspects of their organization. The two climate dimensions most influential in determining safety climate level is the perceived relevance of safety to job behavior and the perceived management attitude toward safety. Zohar was unable to correlate safety climate scores with standard safety measures such as accident-frequency rate and accident-severity rate due to a lack of reliability of these measures (reports were used for worker's compensation purposes and considered biased).

Zohar's work verifies Schneider's (1975) theory that workers' perceptions regarding climate dimensions and behavior-outcome expectations can guide employee behavior. A worker's cognition regarding safety is largely related to how they perceive their manager's attitude toward safety and the organization's production process. Zohar suggests that a genuine change in management's attitudes and an increased commitment are needed to improve the safety climate in an organization. Reward campaigns, contests or improved safety regulations are impotent organizational initiatives without first securing a renewed safety commitment from management.

While organizational climate research primarily focuses on the individual, the predictive benefit of unit analysis relies on the aggregation of individual climate assessment scores to provide explanatory power. Climates based upon perceptual agreement are termed collective climates and do not necessarily overlap formal organizational units, divisions or work groups (aggregate climates). Presumed in previous research, Joyce & Slocum (1984) set out to establish a consistent basis for the aggregation of individual climate perceptions. The usefulness of an aggregate climate concept could potentially yield an understanding of how individuals understand and ultimately respond to environments (James, 1982).

Several challenges face the researcher. There has been a notable lack of agreement regarding criteria to assess the validity of aggregated climate data with the following most commonly used: (1) discrimination, or demonstrable differences between mean perceptions between climates; (2) predictable relationships to organizational or individual criteria; and (3) internal consistency, or agreement in perceptions within aggregate climate (Joyce & Slocum, 1984). Beyond the lack of consensus regarding methodological criteria, most hypothesis testing presumes homogeneity of psychological climate perceptions for many social groups and then does means comparison to test differences. The validity of this procedure relies on the researcher's ability to hypothesize where agreement on climate perceptions are most likely within an organization (James, 1982).

In a study where all three methodological criteria were met, Jones and James (1979) evaluated the aggregate climate scores of divisional personnel onboard 20 Navy warships operating at sea. In total, 233 divisions were evaluated and their climate scores met all methodological criteria, which cannot be said of the same analysis conducted by ship or ship department. Among those Navy divisions, their study concluded patterns of climate dimensions were systematically and predictably related to job satisfaction and job performance. Joyce and Slocum (1974) tested these findings by surveying employees within three plants operated by a heavy duty truck manufacturer. Their tests verified that membership in climates, formed on the basis of similarities in perceptions (collective climates), were significantly related to measures of individuals' job performances and job satisfactions.

Research conducted to assess the source of climate perceptions can be categorized as either the structural or selection-attraction-attrition approach (Schneider & Reicher, 1983). As the name implies, the structural approach proposes that it is the organization's structure that influences climate perceptions such as size and span of control. While acknowledging individuals can shape climate perceptions, their focus is on structural factors and how these factors can influence climate as they change from setting to setting. The selection-attraction-attrition approach explains the source of climate perceptions as the bi-directional exchange between worker and work seeking a person-organization match. The match is constantly improved through attrition (termination or transfer) and the congruence of similar perceptions and meanings are expressed as climates due to the decrease of individual differences. The Joyce & Slocum (1984) study provides support for both the structural and selection-attraction-attrition argument.

Industrial researchers have focused significant attention on evaluating certain organizational factors as antecedents to accidents or the accident sequence. Wright (1986) investigated the causes of several fatalities involving oil workers on off-shore facilities in the North Sea. Several themes emerged from his review including the development of informal work methods to handle situations where there were no formal procedures; a strong pressure to complete the work as quickly as possible; and defective communications regarding safety-related issues.

After a thorough review of over 100 accidents involving merchant marine traffic in the 1980's Wagenaar and Groeneweg (1987) determined two organizational factors had significant relevance in determining the mishap's cause. Human decision-making was flawed in the presence of high situational stress meaning more information processing errors occurred under these conditions. Additionally, they determined that social pressure influenced job performance more than formalized rules. Communication channels and safety culture are two of several factors that influence how a worker perceives the technical and social systems within an organization; factors that are important influences on safety performance (Hofmann & Stetzer, 1996).

In their research on factors influencing unsafe behaviors and accidents, Hofmann and Stetzer (1996) hypothesized three group-level factors (group process, safety climate, and intentions to approach other team members engaged in unsafe acts) and one individual-level factor (perceptions of role overload) influenced the frequency of reported unsafe activities. Collecting data from 222 people on 21 teams in a Mid-western chemical processing plant, both the individual and group-level variables were significantly associated with unsafe behavior. Role overload, defined as the degree to which role performance was affected by inadequate time, training and resources, was significantly associated with unsafe behavior. Perceptions of group processes (e.g., performance monitoring, freedom to question others) were found to influence the frequency of unsafe behaviors within teams. Perceptions of safety climate were also significantly associated with unsafe worker behavior. Teams that perceived and reported higher safety climate assessment had higher safety performance measures.

Safety climate survey data from 18 companies with 2,680 respondents were used to evaluate a model associating safety climate with self-reported injuries (Ho, 2005). The association of four climate dimensions: (1) management commitment, (2) return-to-work policies, (3) post-injury administration and (4) safety training were tested against 3 objective injury rate measures and the results confirmed safety climate's association with self-reported injury. This association disappeared when the analysis controlled for industry hazard differences. In a study of 66 U.S. Air Force squadrons consisting of 7,029 survey respondents, Capps (2000) determined organizational climate has a predictive capability with job satisfaction and performance perceptions at the three levels studied (i.e. individual, unit and cross-level). Climate perceptions failed to correlate with any objective measure of operational unit performance with the exception of flying schedule effectiveness (higher climate perceptions led to higher sortie completion rates).

Leadership, as an organizational factor, has been studied as a potential determinant of safety climate and thus, an antecedent to individual behavior and safety performance. Hofmann and Morgeson (1999) studied the relationship between group leaders and their superiors theorizing the quality of this relationship predicted injury statistics in the respective workgroups highlighting the mediating effect of safety communications (in their study it was the frequency of raising safety concerns with a supervisor). This study along with Zohar's (2000) research suggests a leadership-climate-injury mediation model. When a person's performance has direct safety implications, the leader's concern for an employee's well-being (leadership style), has direct bearing on the group's safety climate perceptions (climate) and ultimately the group's behavior (injury mediation) (Zohar, 2002). Leaders express or operationalize their concern for an employee's safety through their supervisory practices. This climate perception for safety implies there are certain aspects of a supervisor's behavior that infer the leader's priority for safety and the importance of performing one's task in a safe manner. These perceptions inform workers of the consequences of working safely. Zohar (2002) concluded, based upon role theory (Katz and Kahn, 1978), social learning (Bandura, 1986), and expected utility constructs (Lawler, 1971), there should be a positive relationship between safety-climate level and behavior.

In a study of 411 production workers in a metal processing plant divided into 42 work groups, safety climate and leadership questionnaires were administered during work hours. Safety data was collected at the infirmary for a period of six months following the initial data collection phase. The study's intent was to examine the two complimentary models (transformational vs. transactional) of the leadership-safety relationship. Theoretically, the relationship between the two is that of augmentation. Transformational leadership predicted injury rate while transactional leadership provided indirect, conditional prediction. Leadership effects were moderated by assigned safety priorities (1-5 scale) and mediated by safety climate variables (preventive action, reactive action and prioritization). The results suggest that transformational and transactional leadership provide complimentary modes of (mediated and moderated) influence on safety behavior of group members (Zohar, 2002).

Alarcon (2005) examined the relationship between law enforcement officers' ratings of their leaders' leadership style and their ratings of job satisfaction. 373 officers of the Bexar County Sheriff's office in San Antonio, Texas were surveyed using standard instruments to assess supervisor's leadership style and the respondent's level of job satisfaction. Multiple regression analysis and analysis of variance revealed transformational leadership had statistically significant results on overall job satisfaction and all facets of satisfaction except for present pay. The results were consistent between two separate groups of employees including both detention officers and law enforcement officers.

Lindell and Brandt (2000) studied whether climate quality (average climate ratings) and climate consensus (the variance of climate ratings) are related to organizational antecedents and outcomes. Data from over 1,000 members in 180 organizations (Local Emergency Planning Committees) were collected and analyzed revealing that while climate quality and consensus both had significant correlations with organizational antecedents and outcomes, climate quality was more strongly related. The results were stronger for internal structural antecedents and individual outcomes than for external contextual antecedents and organizational outcomes.

Implications for Organizational Interventions

Considering the growing body of research examining antecedents to unsafe behavior and accidents, scholars have turned to interpreting these results offering valuable insight into possible organizational interventions aimed at mitigating these undesirable events. Safety interventions designed to reduce accidents and/or injuries focus on individual-level factors such as: training, goal setting, feedback, and/or incentives (Sulzer-Azaroff, Harris, McCann, 1994). Hofmann and Setzer (1996), suggest the disproportionate emphasis on individual-level interventions reflects an assumption that safety problems exist at the individual level. Investigators searching for clues to a mishap often stop after they find what they have been looking for (Rasmussen, 1990). One cannot dismiss the contribution of individual behavior to accidents; however it is important to consider the contextual influence on behavior uniquely attributable to the organization (House, Rousseau, & Thomas-Hunt, 1995).

Hofmann and Stetzer (1996) suggest safety practitioners engage in more systematic organizational diagnosis using several approaches to determine potential causes. In addition to individual level factors (micro), they recommend a focus on broader organizational factors (macro) such as communication, coordination and safety climate contributing to a cross-level (meso) assessment of organizational safety performance. It is through this effort that leaders will ultimately be able to identify all the relevant organizational variables influencing safety performance in their particular organizations.

In a recent study conducted by the Center for Naval Analyses (CNA), they concluded that in order for the Navy to create and foster a culture of safety, they needed to increase elements of management and leadership similar to many corporate industry safety models (Dolfini-Reed & Streicher, 2004). These interventions include commitment, accountability, defining roles and responsibilities, defining policies and objectives, planning and self-assessment, and annual evaluations. It is only until these factors are known that applicable and appropriate interventions, which address both micro and macro factors such as group processes, safety climate and socio-technical relationships, can be developed (Hofmann & Setzer, 1996).

Attribution error plays a significant role in identifying the underlying cause of work-related accidents. The tendency to blame an individual rather than determine the full nature of an accident has clear implications for the implementation of change interventions and for organizations trying to learn from negative events (Reason, 1994). The preponderance of attribution in serious military accidents remains solely on the shoulders of the individual. In fiscal years 1994 and 1995, human error, as a contributing factor, ranged from a high of 76 percent in Army mishaps to approximately 71 percent in Air force mishaps. The Naval Safety Center showed that human error was a causal factor in 80 percent of Navy and Marine Corps Class A flight mishaps for fiscal years 1990 through 1994 (GAO, 1996).

According to a research study conducted by Hofman & Stetzer (1998), fundamental attribution error is the tendency of investigators to overestimate the influence of personal factors and underestimate the influence of situational factors while the defensive attribution bias influences workers who are situationally or personally similar to accident victims to attribute mishap cause to external factors. In their study, it was hypothesized that safety climate would influence a worker's causal attribution about an accident. In negative safety climates (those defined by management's tendency to respond to accidents in a blaming and punitive manner), mishap observers would tend to attribute cause to external factors. Conversely, external attributions made by mishap observers in a positive safety climate would be less and cause would more likely be attributed to an individual if indeed this was the case. Surveying 2,566 workers from the outdoor division of a large utility company, the main effects of safety climate and safety communication on accident attributions were analyzed. The results indicated that supervisors tended to make more internal attributions about worker accidents than workers, and that safety communication significantly moderated the relationship between informational cues and causal attributions. In general, large organizational factors such as safety climate and safety communications can influence the interpretation of information obtained in investigations intended to explain the causes of negative events such as industrial mishap (Hofmann & Setzer, 1998).

Understanding the influence of these organizational factors has important implications for organizational learning, the interpretation of negative events, and the subsequent development of effective interventions. Managers in high risk organizations must carefully balance the requirement for process output in dangerous conditions with the natural tendency for frontline production workers to underestimate the occurrence likelihood of a rare, but catastrophic event. Using simple cost-benefit analysis, workers might tend to unsafe behavior because the expected short term utility (speed and efficiency) outweighs the cost of slower pace, extra effort or personal discomfort. When managers assign higher value to short-term results, the tendency to choose unsafe behavior among action alternatives is reinforced (Herrnstein, Lowenstein, Prelec & Vaughan, 1993).

Zohar, (2002) developed a leadership-based intervention model designed to modify supervisory monitoring and rewarding of workers' safety performance. The theory was to provide workers with safety related information when there was a priority conflict with competing goals such as speed or schedule. Using group leadership or supervision as the relevant construct, two primary attributes of effective supervision were exploited: performance-based monitoring and timely communication of consequences (Komaki, 1998). The intervention entailed the evaluation of supervisors who monitored work in progress, particularly through work sampling and direct observation, as opposed to conventional intervention methods dependent on external observers and other appointed officials to provide feedback and deliver incentives.

The participants in the study included 381 line workers and 36 supervisors in a regional maintenance center specializing in repair and upgrading of heavy-duty equipment. 36 work groups were formed where half served as the experimental group and the other half served as the control group. Safety data was collected during the 8-week intervention period during which feedback was given weekly to supervisors and their immediate superiors. The cumulative frequency of reported episodes between supervisors and their subordinates in which safety was the criterion for supervisory approval or disapproval was collected. At the core of the intervention was the concept that modifying facet-specific supervisory practices (as opposed to facet-free supervision which monitors *all facets* of subordinate's performance) will induce concomitant change among workers. Results indicate that supervisory safety practices (increased frequency of safety-oriented interaction with subordinates) changed over a short period from a baseline of 9 percent to almost 58 percent. This increase resulted in a significant decrease in the micro-accident rate and a parallel increase in safety related practices and safety climate assessment (Zohar, 2002). In general, intermittent safety related interviews used to communicate high safety priority information and provide worker feedback seemed to turn safety priority into a tangible performance goal.

Summary

The relevant leadership literature and applied safety climate research suggests the relationship between what leaders do, and how followers behave, is far from being thoroughly understood. To most people, the importance of leadership is apparent no matter what the context. Van Wart (2003) suggests that "in any organization, *effective* leadership provides higher-quality and more efficient goods and services; it provides a sense of cohesiveness, personal development, and higher levels of satisfaction among those conducting the work; and it provides an overarching sense of direction and vision, an alignment with the environment, a healthy mechanism for innovation and creativity, and a resource for invigorating the organizational culture." It seems fair to conclude that organizations have ample opportunity to influence their member's decision-making and behavior although it is not completely clear what leadership interventions cause what performance.

Furthermore, public-sector leaders are expected to intervene when specific organizational outputs such as quality, service or safety are not being held to a set standard. Regarding an organization's commitment to reducing preventable mishaps among employees both on and off the job, it appears there is only a modest amount of research that corroborates the efficacy of specific leadership best-practices. While most of the research has been conducted with the private-sector workforce, there is some analytical evidence that: individual safety climate perceptions can be aggregated; safety climate assessment positively correlates with safety performance; leadership style predicts injury outcomes; and safety climate quality correlates with organizational antecedents and outcomes. Determining if specific leadership best-practices will elevate safety climate amongst a high-risk military aviation cohort, and assessing if this climate change causes improved safety performance, will be evaluated in the remainder of this dissertation.

Based upon this literature review regarding leadership theories, models of leadership, behavioral analysis and safety climate research, Chapter 4 will present several testable hypotheses regarding the relationship between leadership interventions, safety climate, and follower behavior.

Chapter 4: Hypotheses

As emphasized in Chapter 1, Navy planners responding to SECDEF's direction to initiate a mishap reduction strategy placed high priority on the presumption that certain leadership best practices would elevate safety climate in high-risk military organizations. Their inclination was that the proper leadership interventions would elevate organizational safety climate in a way that would get people to "do the right thing" both on and off the job reducing preventable mishaps and personal injuries.

This research effort is focused in two phases using two uniquely different sets of data. The first phase is a secondary analysis of safety climate survey data collected by the Naval Post-Graduate School at Monterey California between 2001 and 2005. The data was obtained for every Navy and Marine Corps Strike-Fighter squadron that participated in the survey process over that five-year period. These Command Safety Climate Assessment Surveys (CSCAS) were designed specifically for command level use and consist of two separate survey instruments. The Command Safety Assessment (CSA) survey is designed specifically for the officer/aviator cohort and assesses an organization's operational practices from a safety perspective. The Maintenance Climate Assessment Survey (MCAS) is designed for the enlisted cohort and assesses an organization's safety practices from a maintenance perspective. In Phase 1, statistical modeling is conducted assessing the relationship between certain leadership interventions and a respondent's safety climate assessment.

Phase 1 allowed the researcher to evaluate secondary data collected when the mishap reduction initiative was created in 2003. Theoretically, this data would have been available to policy makers at the time the mishap reduction strategy was implemented. Phase 1 hypotheses are limited in scope because they were shaped by an existing database that was generated from a survey instrument, not specifically designed to evaluate the research question presented in Chapter 1. However, it is constructive to ascertain whether there was enough empirical evidence resident in the CSA/MCAS survey repository to inform policy makers regarding the potential efficacy of their mishap reduction strategy. Phase 1 evaluates correlations between certain personal demographics and responses to individual assessments of safety climate. Additionally, Phase 1 examines the potential relationships between certain organizational practices and safety climate although it is impossible to determine causality given the limitations of the data.

For Phase 2 analysis, this researcher designed two safety climate survey instruments designed for military unit data collection. The officer survey and enlisted survey are both 86 question surveys formatted in seven sections: demographic data, safety climate, safety program, squadron programs, leadership style, and program assessment. The surveys vary only slightly regarding content and wording appropriate to the respective cohorts. The survey instrument was administered to four separate strike fighter squadrons at NAS Oceana, Virginia from August 6-12, 2006.

Phase 2 was designed to allow the researcher to evaluate specific relationships between a variety of organizational predictor variables and safety climate. Of primary interest to this researcher are those leadership best practices outlined in the Navy's mishap reduction plan and those potential interventions not specifically highlighted as recommended "best practices". Additionally, the Phase 2 survey instrument was designed so that a causality relationship between safety climate and safety performance as measured by individual and cohort injury rates and unit mishap rates could be assessed.   Finally, Phase 2 allowed the researcher to conduct individual and group interviews focused on evaluating the preferences and particularities of leadership practices in four Navy Strike Fighter squadrons.

Operational versus Non-operational Context

Chapter 1 emphasized the significance of non-operational activities, attributing the preponderance of preventable mishaps involving U.S. service members to PMV accidents. Equally significant is the researcher's challenge in collecting accurate injury, accident, and mishap data to be used as a statistical benchmark for organizational safety performance analysis; particularly safety data regarding individuals outside of work. The non-operational component of Phase 1 analysis is nonexistent and the Phase 2 component is superficial given these limitations. The Phase 2 survey instrument is designed primarily to assess leadership, organizational climate, and safety performance in the operational context although the questionnaire does attempt to collect some non-operational safety data.

The decision to focus on the operational environment was intentional due to several factors. First, the researcher was restricted by Navy authority to limit the survey instrument to a specific time limit (20 minutes) for a respondent to complete the questionnaire. This limitation was imposed to minimize the impact on unit routine since the data collection occurred during work hours. The survey design would have exceeded this restriction if a thorough question bank was included that queried non-operational activities. Second, there is a propensity for military respondents to inaccurately report on leisure activities due to a strong privacy bias, regardless of the most persuasive anonymity contract. Controlling for this bias, given the limited size of the study group, would be problematic. This non-operational drawback does not diminish the relevance of the study; rather it represents a research limitation and presents an acknowledged opportunity for future study.

Listed below are six research questions evaluated in Phase 1 and Phase 2 analysis. Each question is followed by a series of testable hypotheses developed based upon theory and a review of the applicable literature.

Phase 1

1) What demographics determine differences in how Navy and Marine Corps strike fighter squadron members assess the safety climate of their organization?
   a) Individual safety climate assessment for both officers and maintenance personnel varies with rank, authority, and experience.
      i) Senior officers, senior maintenance personnel, and persons in positions of authority have a higher assessment of organizational safety climate. This peer group is closely tied to formulating and implementing leadership practices evoking a positively skewed (elevated) safety climate assessment bias.
      ii) Increased flight experience correlates directly with a higher assessment of command safety climate. Aviators with more experience equate their longevity (e.g. safety record, flight qualifications, operational accomplishments) with confidence (trust) in organizational policies and procedures.

iii) Mid-grade Petty officers (E-4 to E-5) will have a lower climate assessment compared to junior and senior enlisted categories. This peer group negatively judges differences (inconsistencies) between leadership intentions and work level policy outcomes.

b) Individual safety climate assessment for maintenance personnel varies by organizational work center and workday shift.

   i) Maintenance personnel assigned to the Maintenance Control (MC) and Quality Assurance (QA) work centers have a higher climate assessment than the production work centers. MC and QA are supervisory organizations and are more inclined to favor current policies and procedures compared to their production counterparts.

   ii) Day check personnel will have a higher climate assessment than night check (and/or mid check) personnel. Less monitoring and supervisory involvement occurs during these evening work shifts.

c) Variation in respondent climate assessment will occur based upon command/unit location and command type.

   i) Training organizations like the Fleet Replacement Squadron (FRS) and organizations serving the Commander Naval Air Training Command (CNATRA) will have a lower assessment of squadron climate than their operational counterparts will. Training squadrons have more oversight and tend to be less operationally focused.

   ii) Squadrons assigned overseas will have a lower assessment of climate than their embarked or ashore based counterparts. Units stationed overseas tend to view their support structure as inferior to their CONUS based counterparts.

2) Using CSA/MCAS survey data, are there organizational variables (leadership best practices) that correlate with an individual's assessment of unit safety climate?

   a) Individuals who favorably view the efficacy of certain leadership best practices will also give a higher rating to their organization's safety climate.

      i) Leadership practices that facilitate or encourage open communication regarding operational schedule, organizational mission, safety concerns, personnel management policies, and daily job performance will predict higher levels of individual safety climate assessment.

      ii) Leadership practices that express concern for subordinate development and individual welfare (transformational) will predict higher levels of individual safety climate assessment than those leadership practices based primarily on exchange relationships (transactional) or laissez faire (autonomy) relationships.

      iii) This close interaction with supervisors (transformational arrangement) predicts a subordinate will tend not to abandon a commitment to safety even when the focus on safety yields to higher operational priorities.

3) What effect did the Secretary of the Navy's leadership best practices initiative have on improving safety climate in high-risk naval aviation units?

   a) Best practices designed to emphasize goals and/or means, orient effective rewards, support individuals in their tasks or provide socio-emotional support to unit's members will elevate safety climate (motivation).

i) The following practices outlined in COMNAVAIRFOR's Fleet Response Plan (FRP) will improve safety climate in affected units:

(1) Emphasize big picture

(2) Develop culture of mission first, safety always

(3) Expand human factors councils

(4) A clear and relevant vision

(5) Life skills program

(6) Mentor program

(7) Leadership wake-up call. Real intervention with real Sailors

ii) The following practices outlined in COMNAVAIRFOR's Fleet Response Plan (FRP) will fail to improve safety climate in affected units (hygiene):

(1) Purge culture of complacency, take ownership of issue

(2) Institute program focused on basic flying skills

(3) Emphasize mastering basics

(4) Complacency war council

(5) Intensity ashore equals intensity afloat

(6) Avoid repeat performances

(7) Safety and ORM messages constant, renewed visibility

Phase 2

4) Are there certain leadership best practices commonly considered outside the scope of the organizational safety program that improve an individual's assessment of unit safety climate?
   a) Improved personal and professional development programs will predict higher levels of safety climate assessment to include:
      i) Appraisal programs
      ii) Awards/incentive programs
      iii) Mentoring/counseling programs
      iv) Family advocacy/individual advocacy programs
5) Does a supervisor's leadership style correlate with an individual's or group's assessment of organizational safety climate? Does safety priority influence this assessment?
   a) Respondents who report their leader or supervisor as transformational will report a higher level of safety climate assessment than those respondents who report their supervisor as transactional (all else being equal).
   b) Respondents who report their leader or supervisor as laissez-faire will report a lower level of safety climate assessment than those respondents who report their supervisor as either transformational or transactional (all else being equal).
   c) As safety priority increases (e.g. work-ups, certifications, combat operations), safety climate assessment will increase for transformational leaders and remain unchanged for transactional and laissez-faire leaders.

6) Does an individual's safety climate assessment mediate behavior-dependent injury and accidents?
   a) Higher levels of safety climate assessment will predict lower injury and accident rates.

Question 1 is evaluated by conducting a secondary analysis of the CSA and MCAS data sets. Using a variety of analytical techniques such as t-tests, f-tests, chi-squared and analysis of variance (ANOVA), different demographic variables are evaluated for independence with safety climate. Question 2 again uses the CSA/MCAS data. Logistical regression is conducted on these secondary data sets to assess the correlation between the dependent variable, safety climate, and a variety of predictor variables derived from survey responses. These independent variables represent a variety of organizational policies, programs and procedures determined to reasonably represent the policy interventions outlined in the Navy's mishap reduction strategy. Question 3 relies on logistic regression techniques conducted on a parsed data set representing the pre and post-policy cohorts. Several regression methods are used to compare cohorts searching for indicators of policy influence (elevated safety climate) across the spectrum of organizational predictor variables such as leadership and communications.

Phase 2 data provides a significant number of demographic variables that will be subject to the same analytical techniques described above. Question 4 will be evaluated using means comparison and multi-variable regression techniques designed to model organizational predictors of elevated safety climate. Question 5 will be evaluated using question 4 techniques however the predictor variables are participant's assessment of their supervisor's leadership style, leadership behavior and safety priority. Question 6 uses logistic regression techniques to model performance assessment responses as predictors of safety climate assessment. Throughout Phase 2 analysis, individual and group interviews will be used to validate empirical findings.

Chapter 5: Data, Methods and Procedures

This research study investigates the relationship between leadership interventions and their influence on the safety climate in high-risk military organizations, specifically U.S. Navy and Marine Corps Strike Fighter squadrons (VFA/VMFA). This research is framed around a specific 2003 DOD policy to reduce preventable mishaps and is conducted in two distinct data collection and analysis phases. The first phase is a secondary analysis of squadron survey data collected by the Naval Post-Graduate School at Monterey California between 2001 and 2005. The second phase involves the primary analysis of data obtained by the researcher through the use of a study specific survey instrument and through interviews conducted with voluntary study participants in August 2006. This research design is modeled after previous research on organizational climate-behavior relationships, leadership-based intervention models and safety climate perceptions (Zohar, 2000).

Research Roadmap (Theory to Practice)

This research plan is designed to evaluate a practical policy problem using the theoretical model of organizational climate outlined in Chapter 2. Schneider's (1990) model suggests a linear organizational system that predicts that certain human resource management practices will produce a specific organizational climate within which workers (followers) will develop predictable cognitive and affective states. These workers' attitudes correlate directly with their behavior within the organization and can be measured individually or in aggregate as a function of a specific productivity metric (e.g. efficiency, output, safety, etc.). Using the framework of Schneider's model, the methodology described throughout the remainder of this chapter is designed to empirically test and evaluate this study's research question with a specific focus on the components of human attitudes and behavior that have safety implications.

Recognizing the complexity of analyzing human systems, Schneider's model allows for a simplified application of quantitative techniques to analyze data obtained from research participants. Data will be obtained in five parts of the framework including human resource management practices, organizational climate, cognitive and affective states, salient organizational behaviors, and organizational productivity. Using a variety of analytical methods, the framework will serve as a guide for evaluating the relationships between these components. In general, the methods are designed to evaluate the relationship between certain leadership best practices (human resource practices), organizational climate (individual perceptions) and safety attitudes and behavior.

Data Analysis

The author has retained working files of all research data in order to replicate the results of quantitative methods. Using descriptive and multivariate statistical analysis, the remainder of this dissertation will focus on answering the research question proposed in Chapter 1. This chapter will outline the data used in each phase of the research and provide descriptive statistics for several independent and dependent factors. These factors include not only demographic data on survey respondents but also a variety of organizational factors that describe command functionality (e.g. policies, programs and procedures) and leader/follower relationships. Since the data were collected and analyzed in two distinct phases, this chapter will describe each phase separately including a descriptive introduction to the data. A variety of quantitative methods will be used for empirical analysis in subsequent chapters including cross tabulations, means comparison, analysis of variance (ANOVA), factor analysis and logistic regression. Because the size of each data set varies and the number of variables included for evaluation is vast, the potential of committing a Type 1 error cannot be eliminated. The chance of rejecting the null hypothesis when it is not false exists and must be managed throughout the analysis phase. Because of this potential, this researcher will not rely on the results of one particular method to develop conclusions but will rely on the broader interpretation of mixed methods to determine potential correlation and causality.

Chapter 6 will examine the relationship between traditional safety program interventions and safety climate in Navy and Marine Corps Strike Fighter squadrons evaluating the phase 1 research questions and hypotheses outlined in Chapter 4. This analysis phase will evaluate relationships between certain unit demographics and their correlation with an individual's assessment of safety climate. Specific safety program interventions like the ones outlined in the DON's mishap reduction strategy will be modeled along with a pre versus post-policy implementation assessment. While none of the data used in Phase 1 is longitudinal (repeated sampling of respondents over time), the surveys used were collected over a five-year period that brackets the date of SECDEF's mishap reduction policy mandate. This technique presumes consistent survey responses during the five-year sample period.

Utilizing Phase 2 data, Chapter 7 examines the efficacy of certain leadership interventions to improve safety climate outside the traditional confines of a formal unit safety program. These interventions target organizational factors such as award, performance, appraisal, and individual development and mentoring programs. Of additional research interest is the influence of certain leadership styles on command safety climate. Finally, this chapter evaluates the influence of safety climate on an individual's safety performance focusing specifically on whether on this factor causes a reduction in behavior dependent accidents and injuries. Phase 2 is augmented with a sizable number of personal interviews which may substantiate or contradict some of the empirical findings.

Data Analysis Software

Statistical analysis for both Phase 1 and Phase 2 was conducted using STATA 8.2, a full-featured statistical program for Windows provided by the University of Maryland, School of Public Policy (MSPP). This program was utilized on computers in the Ph.D. lab at MSPP, Nimitz library at the United States Naval Academy and my private residence.

The Command Safety Climate Assessment Survey (CSCAS) process

The Command Safety Climate Assessment Survey (CSCAS) process used in Phase 1 analysis was designed to provide squadron-level Commanding Officers (COs) with a means by which to survey their aircrew and maintenance personnel with regard to safety issues, and receive real-time feedback on their attitudes and perceptions. A key goal of this survey method is to identify and correct latent organizational conditions that may lead to increased mishap potential. Following survey administration, COs receive statistical feedback concerning key issues regarding command climate, safety culture, resource availability, workload, estimated success of certain safety intervention programs, and other factors relating to safely managing military aircraft operations. The CSCAS process helps squadron COs identify safety concerns (hazards) and highlight areas where they might best focus their efforts (hazard assessment). COs, Aviation Safety Officers, and those selectively afforded access, are then in a position to use this information to develop strategies (risk decisions) and then implement those strategies (controls) to better their organization's performance.

CSA/MCAS Survey Background

In 1996, a Human Factors Quality Management Board (HFQMB) was established by the Navy to analyze and recommend improvements to processes, programs, and systems that affect human performance with the purpose of reducing the naval aviation mishap rate. One outgrowth of the HFQMB was the development of two organizational climate assessment surveys by the School of Aviation Safety, Naval Postgraduate School Monterey, CA: the Command Safety Assessment (CSA) survey which assesses an organization's operational practices from a safety perspective, and the Maintenance Climate Assessment Survey (MCAS) which assesses an organization's maintenance practices from a safety perspective. The QMB was chartered to analyze and recommend improvements to anything involving high-risk flying with the purpose of reducing the aviation mishap rate. The QMB's ultimate goal was to prevent mishaps and enhance readiness. The QMB is composed of representatives from each Type Commander, the Naval Safety Center, the Naval Postgraduate School, operational commands, and aviation safety and human factors specialists. Led by a Flag Officer, the QMB meets biweekly during scheduled video teleconferences. Initially, the QMB defined several potential intervention areas including leadership, policy, organizational effectiveness, training and qualifications, standard operating procedures, aircraft systems, safety information management, human factors evaluation, mishap investigation, and operational risk management. Later, as the focus expanded to include maintenance operations, an aviation maintenance working group was added.

Following the formation of the HFQMB and under sponsorship of the Secretary of the Navy's Office of Safety and Survivability, a study of organizational factors in flight mishaps was undertaken. The Command Safety Assessment Study began by focusing on the chain of events leading to a mishap. The study was particularly interested in assessing command influence throughout the reconstruction of the event. Examining many cases, they concluded much was available and much could have been done to prevent the mishap from occurring.

While cultural factors are difficult to define in terms amenable to observation and measurement, a Model of Organizational Safety Effectiveness (MOSE) was developed by Professors Ciavarelli and Figlock that incorporated some organizational climate and cultural aspects that may underlie Naval Aviation values and norms. Their model presumes that command leaders set the tone for a healthy (positive) command climate and reinforce their safety culture. Differences in safety climate and culture among commands may be a root source of certain unsafe attitudes and behaviors (Naval Safety Center, 2006).

The MOSE model identifies five major areas that impact the effectiveness of Naval Aviation activities:

- **Process Auditing**: A system of ongoing checks to identify hazards and correct safety problems
- **Reward System:** The expected social rewards and disciplinary actions used to reinforce safe behavior, and correct unsafe behavior
- **Quality Control:** The policies and procedures for promoting high quality work performance
- **Risk Management**: A systematic process used to identify hazards and control operational risk
- **Command and Control:** The organization's overall safety climate, leadership effectiveness, and the policies and procedures used in the management of flight operations and safety

The MOSE served as the basis for the initial Command Safety Assessment Survey (CSA). The 57-item survey was administered by mail to 69 naval squadrons and a total of 67 units (97%) participated and a total of 1254 surveys were collected. This sample was randomly selected from a sample frame that represented a proportional cross-section of both Navy and Marine aviation units from different types of communities. The sample of respondents included only designated Naval Aviators and Naval Flight Officers. Data were analyzed for all categories of the MOSE model and all survey items. Findings show that ratings for most items, particularly those items related to command climate, qualification standards, safety training, and leadership issues, were favorable. Key findings show a general concern about operational tempo, workload, staffing, and resource availability (Naval Safety Center, 2006).

The initial survey served as a starting point for the development of an internet-based application for Fleet-wide use. A revised survey based on statistical validation and ease of use was developed as well as guidelines for Navy-wide administration. A web-based CSA survey is now available to all aviation squadrons and is a required resource for all unit commanders.

Currently, the CSA data collected is being analyzed by Dr Figlock (under contract by the Naval Safety Center) using multivariate techniques and his analysis is being published as issue papers (www.safetyclimatesurveys.org). These issue papers provide insights into the causal and associative relationships that impinge on safety in aviation organizations and also enable taking the next step in survey development, namely calibrating the survey to produce more helpful data.

The Command Safety Assessment Study initially focused on aircrew. Using the CSA survey and theoretical MOSE framework, a prototype maintenance-oriented survey was developed comprised of 15 demographic items (e.g., community, experience, etc.) and 67 maintenance-related items (MRIs). The MRIs were selected from a candidate battery of over 200 items by maintenance and safety subject matter experts. Items not fitting the original MOSE categories were placed into a sixth one: Communication/ Functional Relationship. This category considers such items as organizational communications, the influence of quality control, and the pressure placed on workers to complete their assigned tasks.

The maintenance prototype and a revised Maintenance Safety Assessment survey served to validate the stability of the questionnaire using cluster and factor analysis. A subsequent study of demographic variable bias found they do not impact responses, but showed they are useful in understanding sample composition and response patterns. A final study conducted by NPS determined the MCAS survey adequately assesses a technician's perception of safety climate and that there is a positive correlation between the human errors in squadron mishaps and their corresponding survey results.

The initial MCAS served as a starting point for the development of an internet-based application for Navy-wide use. A revised survey based on statistical validation and ease of use was developed as well as guidelines for administration. Like the CSA instrument, a web-based MCAS version is now available to all Navy and Marine Corps aviation units and the data is being evaluated by qualified analysts.

Data and Phase 1 Sample

Phase 1 conducts secondary data analysis of survey data collected from Navy and Marine Corps Strike Fighter squadrons between November, 2000 and August 2005. Research was done in compliance with the following Department of the Navy policies regarding the CSCAS system:

- **Individual Survey Respondent Anonymity**: An individual must be free to respond without fear of reprisal, whether the fear is real or perceived.
- **Organizational Confidentiality:** The identity of the organization is kept confidential to avoid the perception that the results could be used as a unit safety report card.
- **Ability to Conduct Unfettered Research/Analysis of Data**: Access to data on an "as needed" basis to safety researchers in the academic environment allows the

Navy and Marine Corps the ability to address strategic issues regarding safety climate and culture.

This researcher obtained permission from Professor Figlock (then the data base manager) at NPGS to use four CSCAS data sets in compliance with the policies outlined above. These data sets were electronically transmitted as four separate Excel files. Each file contains the cumulative responses to CSCAS samples taken over a five-year period from officers and enlisted maintenance personnel in U.S. Navy and U.S. Marine Corps Strike Fighter squadrons. The CSA officer sample responded to a two-part 72-question survey instrument (Appendix A) and the MCAS officer/enlisted sample responded to a similar 54-question survey (Appendix B). While data linking the survey respondent to a particular unit were not available, the date the survey was completed was determinable. Table 5.1 summarizes the data obtained in the four spreadsheets received from NPGS.

Table 5.1 Phase 1 Data Sets

Data Set	Service	Officer/Enlisted	# of respondents
1 (CSA)	U.S. Navy	Officer	1,783
2 (MCAS)	U.S. Navy	Officer/Enlisted	14,242
3 (CSA)	U.S. Marine Corps	Officer	1,160
4 (MCAS)	U.S. Marine Corps	Officer/Enlisted	7,134

Survey data collected between November 2000 and August 2005.

Part 1 of the CSA survey asked respondents to answer 10 demographic information questions with survey options (data choices) outlined in Table 5.2.

Table 5.2 Demographic Data Choices for CSA Respondents

Demographic variables	USN	USMC
Rank	Junior Officer (O-1 to O-3) Senior Officer (O-4 to O-6)	Junior Officer (O-1 to O-3) Senior Officer (O-4 to O-6)
Designation	Pilot NFO	Pilot NFO
Current Model	C-130 EA-6 F-14 FA-18	AH-1 EA-6 F-5 F-18
Total flight hours	*Numerical response*	*Numerical response*
Total hours in model	*Numerical response*	*Numerical response*
Department Head?	Yes No	Yes No
Status	Regular Active Reserve Drilling Reserve	Regular Active Reserve Drilling Reserve
Service	USN USMC Other	USN USMC Other
Parent Command	CNAL CNAP CNARF CNATRA NAVAIR Other	1MAW 2MAW 3MAW 4MAW Other
Unit's location	Ashore Afloat FRS Overseas	Ashore Afloat FRS Overseas

Survey data collected between November 2000 and August 2005.

Similarly, Part 1 of the MCAS survey asked respondents to answer 10 demographic information questions with choices outlined in Table 5.3.

Table 5.3 Demographic Data Choices for MCAS Respondents

Demographic variables	USN	USMC
Rank	E-1 to E-3	E-1 to E-3
	E-4 to E-5	E-4 to E-5
	E-6 to E-7	E-6 to E-7
	E-8 to E-9	E-8 to E-9
	O-1 to O-3	O-1 to O-3
	O-4 to O-6	O-4 to O-6
	WO-1 to CWO-5	WO-1 to CWO-5
Total Years Aviation Maintenance Experience	*Numerical response*	*Numerical response*
Work center	Airframes	Airframes
	Avionics	Avionics
	Flight Line	Flight Line
	Maintenance Control	Maintenance Control
	Ordnance	Ordnance
	Other	Other
	Power Plants	Power Plants
	QA	QA
	Survival	Survival
Primary Shift	Day	Day
	Night	Night
Current model aircraft	A-4	A-4
	AV-8	AH-1
	C-12	AV-8
	C-2	C-130
	C-20	E-2
	C-26	F-14
	C-9	FA-18
	E-6	H-1
	F-14	H-53
	FA-18	T-34
	H-2/H-3	V-22
	S-3	
	T-34	
	V-22	
Status	Regular	Regular
	Active Reserve	Active Reserve
	Drilling Reserve	Drilling Reserve

Service	USN USMC Other	USN USMC Other
Parent Command	CNAL CNAP CNARF CNATRA NAVAIR Other	1MAW 2MAW 3MAW 4MAW Other
Unit's location	Ashore Afloat FRS Overseas	Ashore Afloat FRS Overseas

Survey data collected between November 2000 and August 2005.

Part II of the CSA and MCAS surveys asked participants to respond to statements regarding their organizations by selecting an appropriate agreement statement gradated on a seven-factor Likert scale (strongly disagree, disagree, neutral, agree, strongly agree, not applicable, or don't know). The CSA survey had 61 such questions with two final free response questions. The MCAS survey had 43 survey statements with two final free response questions.

Part II of both the CSA and MCAS surveys present statements about a variety of organizational features associated with safety programs, processes and procedures. The survey statements are aligned with the categories of the MOSE model discussed in the previous section. Survey participants completed the questionnaire on-line (within unit spaces) and were given adequate privacy and time to complete the instrument. Due to the anonymity policy, associating respondents with particular units is indeterminable therefore cumulative assessments of individual squadrons is beyond the scope of Phase 1 analysis. Demographic information collected in Part I is very limited. The survey instrument focuses specifically on the major elements of each command's aviation safety and maintenance program.

Variables

Principal component analysis (PCA) and factor analysis (FA) provides a sophisticated method for simplifying large survey instruments into a manageable number of underlying elements by combining many correlated variables. The challenge for the researcher is to accurately ascertain these dimensions and model them in a fashion such that different options produce similar or convergent results. Maximum-likelihood factoring (MLF), a technique that provides formal hypothesis tests to help determine the appropriate number of factors was also employed. There is always the possibility that arbitrary or inaccurate assumptions might lead to analytical flaws in data analysis when using PCA or FA techniques. To protect against this danger, this researcher chose to: a) verify the principal components in the CSCAS surveys using PCA and MLF techniques, and b) conduct multivariate analysis using both principal components and selected dummy variables created from specific survey statements.

Independent Variables (Phase 1)

The MOSE model organizes the CSA and MCAS surveys into five principal components or factors (Naval Safety Center, 2006). Table 5.4 displays the principal factors and shows which survey questions (identified by question number) contribute to each principal component in the respective questionnaire.

Table 5.4 Principal Factors, CSA/MCAS Survey Instrument

MOSE Principal Factor	CSA Survey Question #	MCAS Survey Question #	Research Focus
PA	1-9	1-6	Process Auditing
RA	10-18	7-14	Reward System
QC	19-22	15-20	Quality Control
RM	23-35	21-29	Risk Management
CC	36-61	30-43	Command & Control

Table derived from Naval Safety Center data obtained at: http://www.safetyclimatesurveys.org/mainpage.aspx

As an example**,** CSA survey questions 1-9 and MCAS survey questions 1-6 correlate (associated with the same principal factor) because the survey statements ask respondents to consider organizational processes that identify safety hazards and to evaluate procedures designed to correct the organizational practices that allow such hazards to manifest in the organization. An example is CSA2 (Command Safety Assessment Question 2), *"My command uses an internal audit and hazard reporting system to catch any problems that may lead to a mishap"*. PCA with promax rotation was conducted on the PA (Process Auditing) elements of all four data sets and the results are summarized in Table 5.5.

Table 5.5 Principle Factor Results for CSCAS Data

Factor	CSCAS question set	PCA factors/ variance	MLF χ^2 no factors/ χ^2 more factors	Variables generated
PA (Process-Auditing)	CSA(USN)	2 / 58%	sig/not sig	PA1, PA2
	CSA(USMC)	2 / 57%	sig/not sig	PA1, PA2
	MCAS(USN)	1 / 58%	sig/ not sig	PA1
	MCAS(USMC)	1 / 55%	sig/sig	PA1
RA (Reward System)	CSA(USN)	1 / 49%	sig/not sig	RA1
	CSA(USMC)	2 / 58%	sig/not sig	RA1, RA2
	MCAS(USN)	2 / 63%	sig/ not sig	RA1, RA2
	MCAS(USMC)	2 / 62%	sig/not sig	RA1, RA2
QC (Quality Control)	CSA(USN)	1 / 67%	sig/not sig	QC1
	CSA(USMC)	1 / 64%	sig/not sig	QC1
	MCAS(USN)	1 / 58%	sig/not sig	QC1
	MCAS(USMC)	1 / 56%	sig/not sig	QC1
RM (Risk Management)	CSA(USN)	3 / 63%	sig/not sig	RM1, RM2 RM3
	CSA(USMC)	3 / 59%	sig/not sig	RM1, RM2 RM3
	MCAS(USN)	1 / 48%	sig/not sig	RM1
	MCAS(USMC)	2 / 58%	sig/not sig	RM1, RM2
CC (Command and Control)	CSA(USN)	4 / 62%	sig/not sig	CC1, CC2, CC3, CC4
	CSA(USMC)	3 / 54%	sig/not sig	CC1, CC2, CC3
	MCAS(USN)	1 / 48%	sig/not sig	CC1
	MCAS(USMC)	1 / 52%	sig/not sig	CC1

Principal Component Analysis (PCA) with promax rotation
Maximum-Likelihood Factoring (MLF)
“sig”: significant, “not sig”: not significant

To help understand Table 5.5, consider the Process Auditing (PA) factor of the CSA(USN) dataset. PCA generates two factors with eigenvalues greater than 1.0 (the standard threshold for determining factor significance) that explains 58% of the nine variables combined variance (CSA1-CSA9). Factors with eigenvalues greater than 1.0 and subject to MLF can be used for statistical modeling instead of the full variable set. Again referring to the PA factor of the CSA(USN) data, MLF reveals that while the 2-factor model significantly improves upon a no-factor model (sig), the

2-factor model is not significantly worse than a perfect-fit model (not sig). It took a 4-factor MLF test to reject the hypothesis of equal variance among factors (not shown in Table 5.5). Because the MLF test yields multiple instances of negative variance among factors and one factor with zero uniqueness, the results might lack formal justification and will be viewed cautiously (improper solution). The same procedure was conducted on the remaining three datasets for each principal component in the MOSE model.

The variables shown in Table 5.5 will be used in the empirical modeling efforts during the data analysis phase and the results will be compared with a complete variable model. Factor scores are linear composites, formed by standardizing each variable to zero mean and unit variance, and then weighing with factor score coefficients and summing for each factor (Hamilton, 2004). Being standardized, these new factor variables have means close to zero and standard deviations equal to one and are measured in units of standard deviation from their means. One standard deviation away from the mean in either direction accounts for somewhere around 68 percent of the data, two standard deviations accounts for roughly 95 percent of the data and three standard deviations accounts for about 99 percent of the data. Each factor score represents the standardized distance from the mean each data point is within that factor category. Table 5.6 shows an example of the factor scores for the Navy CSA database. The remaining 3 sets of factor scores are not shown but display a similar pattern.

Table 5.6 Principle Factor Scores, CSA/USN Data Set

Factor Variables	Observations	Mean	Std. Dev	Min	Max
PA1	1783	-3.12e-09	1	-8.080742	3.00098
PA2	1783	1.22e-09	1	-5.035276	2.140173
RA1	1783	-3.06e-09	1	-8.04078	2.651947
QA1	1783	-1.52e-08	1	-7.502046	2.771927
RM1	1783	3.84e-10	1	-8.153972	3.264045
RM2	1783	1.83e-09	1	-3.676329	5.978342
RM3	1783	1.66e-09	1	-3.738338	2.694448
CC1	1783	-6.47e-11	1	-6.424253	2.446435
CC2	1783	1.27e-09	1	-6.072398	3.269277
CC3	1783	-5.37e-10	1	-3.82878	4.119328
CC4	1783	2.32e-09	1	-3.173315	8.219871

USN/CSA data set, STATA 8.2

Categorical variables such as those generated in response to survey questions in the CSA and MCAS instruments can become predictors in a regression when they are expressed as one or more dichotomies. Dummy variables were created for many of the predictor questions in Part II of the surveys using the following example to illustrate the technique. Question 18 of the MCAS instrument asked members to respond to the following statement, "*Maintenance on detachments is of the same quality as that at home station.*" Members selected their response on a seven-factor Likert scale. A dummy variable named *quality_1* was generated with a value of 1 assigned to those respondents who either "Agreed" or "Strongly Agreed" with the statement. A value of 0 was assigned to all other respondent choices. This technique was replicated for many of the survey statements of interest with a 1 always being assigned to a respondent who either agreed or highly agreed. Not all statements were used to generate dummy variables from each questionnaire. Question selection will be explained in a subsequent section along with a more complete explanation of this statistical technique. Each dummy variable was assigned a name that closely relates the content of the survey statement participants were asked to respond to. Table 5.7 displays the dummy variables generated for both surveys using this technique.

Table 5.7 Dummy Variables, CSA/MCAS Survey Instruments

Variable name*	CSA Survey Question #	MCAS Survey Question #
reportviolations	11	-
swiftcorrections	14	-
negreaction	18	-
quality_1	19	-
quality_2	20	-
humanfactorcouncil	7	-
humanfactorboard	8	-
tolerance	-	14
cuttingcorners	-	26
planning_1	26	1
planning_2	-	19
planning_3	-	36
riskassess_1	28	-
riskassess_2	27	-
riskassess_3	29	-
riskassess_4	30	-
riskmanagement	-	3
safetyedu	57	-
communication_1	41	32
communication_2	60	39
communication_3	55	12
communication_4	56	38
communication_5	-	39
communication_6	-	41
safetyculture	16	-
leadership_1	47	23
leadership_2	46	28
leadership_3	43	33
leadership_4	44	-
leadership_5	27	-
leadership_6	5	-
leadership_7	10	-
consequence_1	17	-

consequence_2	18	-
training	-	35
quality_1	-	18
quality_2	-	2
supervision_1	-	30
supervision_2	-	4
supervision_3	-	8
supervision_4	-	43
trust_2	36	-
trust_2	37	-
peerinfluence	-	9
motivation	50	-
respect_1	-	16
respect_2	-	31
rewards	-	11
overtasked_1	-	21
overtasked_2	-	37
overtasked_3	-	29

* Variable names were chosen to reflect the main focus of the survey statement.

Pre-policy and post-policy dummy variables were created to allow the data to be parsed into two sections based upon the date the survey was completed and relative to the May 2003 implementation date of SECDEF's policy mandate.

There exists some debate among social science researchers and behavioral scientists regarding the appropriate statistical techniques for analyzing survey data that represents individual attitudes and perceptions collected through Likert response scales. While acknowledging many social science researchers apply interval techniques to ordinal data such as that generated using CSCAS survey instruments, this researcher concludes that this particular data lacks "intervalness" and is not normally distributed (two important criteria necessary for applying interval techniques to ordinal variables). The aforementioned procedure takes a seven-response Likert scale and collapses it into a dichotomous (dummy variable) represented as a 1 or 0 response (yes or no). Some researchers consider this to be a procedure that wastes valuable data (more variation is better) because much can be gained from a response scale that offers a significant gradation in choice options. In addition, many researchers support using interval statistical procedures for ordinal data. In a recent review of the literature on this topic, Jaccard and Wan (1996) summarize, "for many statistical tests, rather severe departures (from intervalness) do not seem to affect Type I and Type II errors dramatically." Use of ordinal variables such as 5-point (or greater) Likert scales with interval techniques is the norm in contemporary social science. Use of scales with fewer values not only violates normality assumptions but also runs a heightened risk of confounding difficulty factors (Garson, 2007).

There is however an opposing viewpoint. Thomas Wilson (1971) concludes, "The ordinal level of measurement prohibits all but the weakest inferences concerning the fit between data and a theoretical model formulated in terms of interval variables." The researcher should attempt to discern if the values of the ordinal variable seem to display obvious marked departures from equal “intervalness” and qualify his or her inferences accordingly. “The decomposition of survey data (Likert) having ordinal properties into dummy (dichotomous) variables in order to employ correlation and regression techniques has now become a widely accepted practice. It should be noted, however, that this methodology uses only nominal information in the analysis. Using the full range of the scale would likely result in higher coefficients because more of the information would be used” (Albrecht and Carpenter, 1976).

The decision to employ the dummy variable technique was based upon an evaluation of the “intervalness” of the data. Analysis of both dependent and predictor variables reveal data summaries that lack order and equal intervals. The response scales have order, but the intervals between scale points seem uneven or skewed. Two factors influenced this conclusion. First, the distribution of response data is highly slewed (non-normal distribution) implying that the more appropriate statistical test would be based upon binomial theory rather than normal theory. For example, over 94% of the survey population (both Navy and Marine Corps officers) either “Agree” or ”Strongly Agree” with the safety climate assessment statement in the CSA survey (see Table 5.18). The policy question under consideration, and the relevant research, strives to illuminate organizational interventions and/or leadership best practices that might explain the distinction between these two cohorts. The remaining 6% (those participants who responded with anything other than “Agree” or “Strongly Agree”) are of less relevance in answering the policy question. The research focus is on the highest categorical affirmation amongst survey participants.

Second, random interviews with survey participants suggest that respondents seem to approach climate assessment statements with a binary choice attitude; meaning, participants choose a standard agreement (Agree) with most survey statements and only deviate from this pattern if they find a survey statement appreciably influential or persuasive in their assessment. Thus, the questionnaire can be reduced to a binary choice between “Agree” and/or “Strongly Agree” and everything else. For the purposes of this research, the dummy variable analytical method (collapsing ordinal Likert responses into a dichotomous variable) does not significantly reduce the analytical potential of the database. To the contrary, STATA 8.2 offers a full range of techniques for modeling categorical (ordinal) variables, many of which will be described in greater detail later. Perhaps most significant, is the value of logistical regression (dprobit), a technique that provides for meaningful interpretation of modeling results (i.e. gives changes in probabilities (marginal effects), rather than coefficients). In addition, several statistical techniques such as ANOVA and t-tests which can be used to evaluate continuous variables were used to offer analytical balance. These techniques will also be described in much greater detail later.

Dependent Variables (Phase 1)

Survey questions were evaluated for their relevance in determining an individual's assessment or perception of the operational safety environment within which they work (safety climate). While not directly assessing the safety climate of their organization, the following questions were determined to be reasonable predictors and were selected to serve as dependent proxies in empirical models and statistical analysis. Table 5.8 outlines the dependent variables created to represent safety climate.

Table 5.8 Dependent Variables in CSA Survey Instrument

Variable name	CSA #	Survey statement	Survey response
safetyclimate_1	42	*"My command provides a positive command climate that promotes safe flight operations."*	Agree/Strongly agree
safetyclimate_11	42		Strongly agree
safetyclimate_2	13	*"In my command, we believe safety is an integral part of all flight operations."*	Agree/Strongly agree
safetyclimate_21	13		Strongly agree
safetyclimate_3	40	*"My command is genuinely concerned about safety."*	Agree/Strongly agree
safetyclimate_31	40		Strongly agree

In the above table, two dependent dummy variables were created from each survey statement based upon the response strength of the individual completing the questionnaire. This researcher acknowledges that response bias is difficult to assess regardless of how much anonymity is promised from survey administrators and command authority. It is common in military surveys to have inflated responses meaning many respondents will agree in general with positive statements and disagree with negative statements particularly when the statements deal with the command in general rather than the individual completing the survey in specific. This would suggest that a dummy variable that assigned a value of 1 to all positive respondents, "Agree" or "Strongly Agree" would be skewed (or inflated) with many respondents who felt neutral about the statement but were biased to over assess their feelings about the statement. Some researchers suggest that a dummy variable created from just those respondents who "Strongly Agree" with a survey statement gives a more accurate indication of the questionnaire population that really has a positive emotion or opinion about the statement in question. Following this logic, two dummy variables were created for each survey statement chosen to serve as a proxy for safety climate. The strength of validity was assessed by the researcher and the variable numbering reflects the order of analytical relevance assigned. Table 5.9 shows the dependent variables generated from the MCAS survey instrument.

Table 5.9 Dependent Variables in MCAS Survey Instrument

Variable name	MCAS #	Survey statement	Survey response
safetyclimate_1	7	*"Our command climate promotes safe operations."*	Agree/Strongly agree
safetyclimate_11	7		Strongly agree
safetyclimate_2	15	*"The command has a reputation for quality maintenance and sets standards to maintain quality control."*	Agree/Strongly agree
safetyclimate_21	15		Strongly agree
safetyclimate_3	34	*"In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety."*	Agree/Strongly agree
safetyclimate_31	34		Strongly agree

In both survey instruments, s*afetyclimate_1* provides the best assessment of safety climate in the organization because the statement specifically requires the respondent to specifically consider climate as opposed to more specific command policies and procedures. *Safetyclimate_2* and *safetyclimate_3* were created to provide increased confidence in the interpretation of *safetyclimate_1* results although neither statement specifically deals with the organizational dimension of climate. This researcher predicts there will be some consistency between the analyses of all three dependent variables.

The maximum likelihood estimation model *dprobit* will be used to apply the interpretive benefits of Ordinary Least Squares (OLS) analysis to dichotomous variables. The model *dprobit* was chosen because the data tends to be "skewed" and since *dprobit* evaluates averages (means), this model is much tighter at the tails.

H_0= There is no correlation between leadership intervention (best practices) and safety climate.

The basic model can be expressed:

$$\mathbf{Y_i = \beta_0 + \beta_{pi}(PA)_{pi} + \beta_{ri}(RS)_{ri} + \beta_{qi}(QC)_{qi} + \beta_{mi}(RM)_{mi} + \beta_{ci}(CC)_{ci} + \epsilon_I}$$

Where:

Y_i = safety climate (CSA #42 or 13; MCAS #7 or 34)

p = number of Process Auditing (PA) dummy variables (CSA #1-9; MCAS #1-6)

r = number of Reward System (RS) dummy variables (CSA #10-18; MCAS #7-14)

q = number of Quality Control (QC) dummy variables (CSA #19-22; MCAS #15-20)

m = number of Risk Management (RM) dummy variables (CSA #23-35; MCAS #21-29)

c = number of Command and Control (CC) dummy variables (CSA #36-61; MCAS #30-37)

I = number of observations

Policy Correlation

In order to accomplish relevant policy analysis, the leadership intervention best practices outlined in the DON policy memorandum had to be matched with survey statements in the CSA and MCAS surveys for quantitative analysis. In general, there was ample similarity between guidance in the FRP memo and the organizational practices surveyed in the CSCAS instruments to find reasonable policy proxies from the two questionnaires. It must be emphasized that the CSA and MCAS surveys were not designed to evaluate policy performance rather they were designed to provide unit commanders with a snapshot of organizational climate. This researcher has selected specific CSA and MCAS survey statements to model the policy recommendations outlined in the guidance messages to unit commanders outlined in Chapter 1.

Phase 1 is designed to investigate if certain leadership interventions, like the ones outlined in COMNAVAIRFOR's Fleet Response Plan (FRP) message (272254Z APR 04), correlate with enhanced or elevated safety climate. Certain questions in the CSA and MCAS survey will be used as proxies for several of the leadership interventions recommended by naval authorities outlined in Table 5.10.

Table 5.10 Leadership Best Practices Policy Recommendations

FRP Category/Theme	Best Practices outlined in FRP
Complacency	
1. Air Combat Training Continuum (ACTC) like fundamentals program	- Institute program focused on basic flying skills
2. Empower people to eradicate this attitude	- Purge culture of complacency - Take ownership of issue
3. Complacency War Council	- Use safety councils to identify immediate threats

	- All hands tasked with responsibility and given authority to correct unsafe situations
4. Intensity ashore equals intensity afloat	- Emphasize mastering basics
5. NATOPS Scenario Training	- Use mishap trends for training - Avoid repeat performances
6. Communication tools	- Clever construct, constant reinforcement - Face-to-face and/or other media - Safety and ORM messages constant, renewed visibility. Top down from C.O.
7. Develop a culture of mission first, safety always	- Start with check-in - All circumstances, all evolutions
8. Expanding Human Factors Council	- Use ORM risk assessment matrix to assign people to job/mission - Assess individual strengths/weaknesses
Change and Uncertainty	
1. Crawl, walk, run philosophy	- Provide facts early and often - Emphasize big picture
2. A clear and relevant vision	- COs must articulate command expectations and mission
Personal Behavior and Taking Care of Sailors	
1. Life Skills Program	- Team effort to promote healthy lifestyle - Alcohol/drug education, stress and anger management, suicide awareness and prevention, sexual harassment, hazing, nutrition and fitness awareness and financial management
2. Mentor Program	- None
3. Personnel Human Factors Meetings	- Identify Sailors at risk
4. Division Quarters	- None
5. Leadership wake-up call	- Real intervention requires face-to-face interaction with Sailors

[1] COMNAVAIRFOR's Fleet Response Plan (FRP) message (272254Z APR 04)

Table 5.11 presents an outline of the survey questions that will be used as leadership intervention proxies. As will be discussed later in the data analysis section, many of the proxies have strong similarities with the leadership best practices outlined in the DON's policy message. Other proxies are less strongly related while certain best practices have no correlative counterparts in the CSA or MCAS survey.

Table 5.11 Leadership Best Practices, Proxies in CSA/MCAS Survey

FRP Best practices	CSA or MCAS survey statement proxy[1]
Complacency	
- Institute program focused on basic flying skills	None
- Purge culture of complacency	- *Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions.* **CSA #11 (*reportviolations*)** - *In my command, anyone who intentionally violates standard procedures or safety rules is swiftly corrected.* **CSA #14 (*swiftcorrection*)** - *Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners.* **MCAS #26 (*cuttingcorners*)**
- Take ownership of issue	- *My command restricts maintainers who are having problems.* **MCAS #30 (*supervision_1*)** - *Unprofessional behavior is not tolerated in this command.* **MCAS #14 (*tolerance*)**
- Use safety councils to identify immediate threats	- *Human Factors Councils have been successful in identifying aircrew members who pose a risk to safety.* **CSA #7 (*humanfactorcouncil*)** - *Human Factors Boards have been successful reducing chances of an aircraft mishap due to high-risk aviator.* **CSA #8 (*humanfactorboard*)** - *Command uses safety and medical staff to identify/manage personnel at risk.* **MCAS #3 (*riskmanagement*)**
- All tasked with responsibility and given authority to correct unsafe situations.	- *Command leadership encourages reporting safety discrepancies without the fear of negative repercussions.* **CSA #10 (*leadership_7*)**

	- *I am not comfortable reporting a safety violation, because people in my command would react negatively towards me.* **CSA #18 (*negreaction*)** - *Peer influence discourages SOP, NAMP[1] or other violations and encourages reporting safety concerns.* **MCAS #9 (*peerinfluence*)**
- Emphasize mastering basics	- *Maintenance on detachment is of the same quality at home station.* **MCAS #18 (*quality_1*)**
- Use mishap trends for training	- *Safety education and training are adequate in my command.* **CSA #57 (*safetyedu*)** - *Safety education and training are comprehensive and effective.* **MCAS #35 (*training*)**
- Avoid repeat performances	- *In this command, an aviator who persistently violates flight standards and rules will seriously jeopardize his/her career.* **CSA #17 *(consequences)*** - *Maintainers are briefed on potential hazards associated with maintenance activities.* **MCAS #43 (*supervision_4*)**
- Communication tools, clever construct, constant reinforcement - Face-to-face and/or other media - Safety and ORM messages constant, renewed visibility. - Top down from C.O.	- *Command leadership is successful in communicating its safety goals to unit personnel.* **CSA #41 (*communication_1*)** - *My command's safety department keeps me well informed regarding important safety information.* **CSA #60 (*communication_2*)** - *The command adequately reviews and updates safety procedures.* **MCAS #1 (*planning_1*)** - *Supervisors communicate command safety goals and are actively engaged in the safety program.* **MCAS #32 (*communication_1*)** - *I get all the information I need to do my job safely.* **MCAS #39 (*communication_2*)**
- Develop a culture of mission first, safety always: - Start with check-in - All circumstances, all evolutions	- *In my command, safety is an integral part of all flight operations.* **CSA #13 (*safetyclimate_2*)** - *Leaders in my command encourage everyone to be safety conscious and to follow the rules.* **CSA #16 (*safetyculture_1*)** - *In my command, safety is a key part of all maintenance operations and all are responsible/accountable for safety.* **MCAS #34 (*safetyclimate_3*)**

- Use ORM risk assessment matrix to assign people to job/mission - Assess individual strengths/weaknesses	- *My command takes the time to identify and assess risks associated with its flight operations***. CSA #28 (*riskassess_1*)** - *The command monitors maintainer qualifications and has a program that targets training deficiencies.* **MCAS #2 (*quality_2*)**
Change and Uncertainty	
- Crawl, walk, run philosophy - Provide facts early and often - Emphasize big picture	- *Command leadership reacts well to unexpected changes to its plans.* **CSA #47 (*leadership_1*)** - *Within my command, good communications flow exists up and down the chain of command.* **CSA #55 (*communication_3*)** - *Effective communication exists up/down the chain of command.* **MCAS #38 (*communication_4*)** - *I get all the information I need to do my job safely.* **MCAS #39 (*communication_2*)**
- COs must articulate command expectations and mission.	None
Personal Behavior and Taking Care of Sailors	
- Team effort to promote healthy lifestyle - Alcohol/drug education, stress and anger management, suicide awareness and prevention, sexual harassment, hazing, nutrition and fitness awareness and financial management	- *Command leadership is actively involved in the safety program and management of safety matters.* **CSA #5 (*leadership_6*)** - *Personnel are comfortable approaching supervisors about personal problems/illness.* **MCAS #12 (*gethelp*)**
- Mentor Program:	None
- Identify Sailors at risk	- *The command uses safety and medical staff to identify/manage personnel at risk.* **MCAS #3 (*highrisk*)**
- Division Quarters	None
- Real intervention requires face-to-face interaction with Sailors.	None

[1] Naval Aviation Maintenance Program (NAMP)
Associated dummy variable names are in parentheses

Phase 1 Descriptive Statistics

Four separate sets of data were used for Phase 1 analysis and Tables 5.12 through 5.15 shows a demographic summary of each survey cohort. The parent command for Commander Naval Air Forces Atlantic (CNAL) and Commander Naval Air Forces Pacific (CNAP) are organized geographically with a notional distribution of military forces on the east and west coast respectively while Commander Naval Air Rework Facilities (CNARF) and Commander Naval Air Training Activities (CNATRA) have operating locations throughout the United States. CNAL and CNAP are operational frontline combat aviation units while CNARF is a shore-based support command responsible for the depot-level repair and refurbishment of aviation equipment including aircraft and support equipment. CNATRA is a shore-based education and training component for both officer and enlisted aviation replacements (meaning they are trained to fill rotational assignments in operational units). Naval Air Systems Command (NAVAIR) includes those operational units responsible for the test and evaluation of new or enhanced aircraft systems.

It should be noted that neither survey instrument queries traditional demographic information such as gender, race, age, education or marital status. Survey sponsors felt there existed a sizable risk that these questions might compromise the condition of anonymity upon which the value and power of this survey instrument is based. If respondents felt their identity might be traceable, they might be less inclined to complete the survey accurately and honestly. This is an obvious tradeoff that has significant implications for social science researchers. Table 5.12 represents the Navy officer/aviator (CSA) survey cohort.

Table 5.12 Demographic Summary of CSA survey (USN/VFA)

Demographic variables	n (number of respondents)	% (survey population)
Rank		
Junior Officer (O-1 to O-3)	1,153	64.7
Senior Officer (O-4 to O-6)	630	35.3
Designation		
Pilot	1,546	86.7
NFO	237	13.3
Total flight hours		
Flight Hours < 500	255	14.3
Flight Hours ≥500 ; <1000	478	26.8
Flight Hours ≥1000; <2000	600	33.7
Flight Hours ≥2000	450	25.2
Authority		
Non-Department Head	1,375	77.1
Department Head	408	22.9
Status		
Regular	1,367	76.7
Active Reserve	338	19.0
Drilling Reserve	34	1.9
Parent Command		
CNAL	553	31.0
CNAP	748	42.0
CNARF	47	2.6
CNATRA	20	1.1
NAVAIR	293	16.4
Other	122	6.8
Unit's location		
Ashore	1,222	68.5
Afloat	203	11.4
FRS	161	9.0
Overseas	197	11.1

n=1783. Survey data collected between November 2000 and June 2005.

Table 5.13 displays a demographic summary of the Marine Corps officer/aviator (CSA) cohort. The 1st Marine Aircraft Wing (1MAW) is located in Okinawa, Japan, the 2MAW at Cherry Point, NC, the 3MAW at Miramar, CA and the 4MAW is the reserve component headquartered in New Orleans, LA.

Table 5.13 Demographic Summary CSA survey (USMC/VMFA)

Demographic variables	n (number of respondents)	% (survey population)
Rank		
Junior Officer (O-1 to O-3)	787	67.8
Senior Officer (O-4 to O-6)	373	32.1
Designation		
Pilot	858	74.0
NFO	302	26.0
Total flight hours		
Flight Hours < 500	341	29.4
Flight Hours ≥500 ; <1000	232	20.0
Flight Hours ≥1000; <2000	347	29.9
Flight Hours ≥2000	240	20.7
Authority		
Non-Department Head	862	74.3
Department Head	298	25.7
Status		
Regular	892	76.9
Active Reserve	165	14.2
Drilling Reserve	70	6.0
Parent Command		
1 MAW	161	13.9
2 MAW	278	24.0
3 MAW	578	49.8
4 MAW	134	11.6
Unit's location		
Ashore	709	61.1
Afloat	6	0.5
FRS	218	18.8
Overseas	220	19.0

n=1160. Survey data collected between November 2000 and June 2005.

Tables 5.14 and 5.15 show the data for the Navy and Marine Corps maintenance (MCAS) cohorts respectively. These survey respondents were comprised primarily of enlisted personnel although each data set includes some officer personnel specializing in maintenance.

Table 5.14 Demographic Summary MCAS survey (USN/VFA)

Demographic variables	n (number of respondents)	% (survey population)
Rank		
E-1 to E-3	4,420	31.0
E-4 to E-5	6,407	45.0
E-6 to E-7	2,667	18.7
E-8 to E-9	292	2.1
WO-1 to CWO-5	64	0.5
O-1 to O-3	231	1.6
O-4 to O-6	36	0.3
Work center		
Airframes	1,504	10.6
Avionics	2,313	16.2
Flight line	2,848	20.0
Ordnance	1,805	12.7
Power plants	1,135	8.0
Quality assurance	728	5.1
Survival	1,032	7.3
Maintenance Control	1,113	7.8
Other	1,639	11.5
Primary Shift		
Day check	8,481	59.5
Night check	5,761	40.5
Status		
Regular	13,250	93.0
Active reserve	750	5.3
Drilling reserve	117	0.8
Parent Command		
CNAL	3,445	24.2
CNAP	4,985	35.0
CNARF	353	2.5
CNATRA	59	0.4
NAVAIR	3,257	22.9
Other	2,059	14.5
Unit's location		
Ashore	10,331	72.5
Afloat	2,079	14.6
FRS	434	3.1
Overseas	1,314	9.2

n=14,242. Survey data collected between November 2000 and June 2005.

Table 5.15 Demographic Summary MCAS survey (USMC/VMFA)

Demographic variables	n (number of respondents)	% (survey population)
Rank		
E-1 to E-3	2,299	32.2
E-4 to E-5	3,223	45.2
E-6 to E-7	1,134	15.9
E-8 to E-9	133	1.9
WO-1 to CWO-5	96	1.4
O-1 to O-3	60	0.8
O-4 to O-6	17	0.2
Work center		
Airframes	914	12.8
Avionics	1,445	20.3
Flight line	430	6.0
Ordnance	1,212	17.0
Power plants	759	10.6
Quality assurance	346	4.9
Survival	481	6.7
Maintenance Control	442	6.2
Other	933	13.1
Primary Shift		
Day check	4,425	62.0
Night check	2,537	35.6
Status		
Regular	6,081	85.2
Active reserve	529	7.4
Drilling reserve	352	4.9
Parent Command		
1 MAW	724	10.2
2 MAW	2,173	30.5
3 MAW	2,948	41.3
4 MAW	1,064	14.9
Other	108	1.5
Unit's location		
Ashore	5,429	76.1
Afloat	45	0.5
FRS	253	3.6
Overseas	1,290	18.1

n=7,134. Survey data collected between November 2000 and June 2005.

Table 5.16 shows a summary of response means for the independent variables categorized by the principal components in the MOSE model.

Table 5.16 Principal Factors, CSA/MCAS Survey Means

MOSE Principal Factor	CSA Question #	Response Means*		MCAS Question #	Response Means*	
		USN	USMC		USN	USMC
PA (Process Auditing)	1-9	4.34	4.34	1-6	3.97	3.98
RA (Reward System)	10-18	4.10	4.06	7-14	3.75	3.69
QC (Quality Control)	19-22	4.38	4.28	15-20	3.91	3.84
RM (Risk Management)	23-35	3.53	3.53	21-29	3.58	3.49
CC (Command & Control)	36-61	4.25	4.22	30-43	3.75	3.72

* Means calculated from Likert response scale
0=N/A, 1=Strongly Disagree, 2 Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree, 6=Don't know

Table 5.17 shows response means for the independent variables used to model the FRP mishap reduction policy plan. Each question represents a specific policy predictor modeled after the leadership best practices outlined by Navy leadership. The policy proxies are summarized for both the CSA and MCAS cohorts. Appendix G provides a demographic summary of response means for each cohort .

Table 5.17 Mishap Reduction Policy Proxies, CSA/MCAS Response Means

CSA/MCAS Survey Question #	Response Means* USN	USMC
CSA5	4.43	4.45
CSA7	4.41	4.52
CSA8	4.24	4.34
CSA10	4.44	4.35
CSA11	4.30	4.23
CSA13	4.56	4.49
CSA14	4.31	4.30
CSA16	4.51	4.49
CSA17	4.47	4.44
CSA18	4.26**	4.16**
CSA28	4.36	4.35
CSA41	4.32	4.26
CSA47	4.22	4.15
CSA55	4.10	4.08
CSA57	4.24	4.21
CSA60	4.30	4.26
MCAS1	4.02	4.05
MCAS2	3.96	3.95
MCAS3	3.82	3.84
MCAS9	3.69	3.67
MCAS12	3.72	3.81
MCAS14	3.79	3.77
MCAS18	3.93	3.94
MCAS26	3.64	3.54
MCAS30	3.73	3.74
MCAS32	3.83	3.83
MCAS34	3.91	3.90
MCAS35	3.79	3.76
MCAS39	3.77	3.80
MCAS43	3.84	3.84

* Means calculated from Likert response scale
0=N/A, 1=Strongly Disagree, 2 Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree, 6=Don't know
** CSA18 is a negative question. USN mean = 1.76, USMC mean = 1.88. Mean recalculated for positive statement comparison

Positive response rates to the dependent variable safety climate survey statements in the CSA and MCAS surveys are summarized in Table 5.18 and 5.19.

Table 5.18 Summary of Safety Climate Assessment, (USN/USMC CSA)

Variable	Survey statement	Survey response	USN* (pop %)	USMC** (pop %)
SC1	*"My command provides a positive command climate that promotes safe flight operations."*	Agree/Strongly agree	93.9	93.5
SC11		Strongly agree	43.8	38.5
SC2	*"In my command, we believe safety is an integral part of all flight operations."*	Agree/Strongly agree	96.3	78.8
SC21		Strongly agree	58.4	51.4
SC3	*"My command is genuinely concerned about safety."*	Agree/Strongly agree	96.7	95.9
SC31		Strongly agree	51.4	49.6

*n= 1783 for USN/CSA cohort
**n=1160 for USMC/CSA cohort
Survey data collected between November 2000 and June 2005.

Table 5.19 Summary of Safety Climate Assessment, (USN/USMC MCAS)

Variable	Survey statement	Survey response	USN* (pop %)	USMC** (pop %)
SC1	*"Our command climate promotes safe operations."*	Agree/Strongly agree	76.3	74.7
SC11		Strongly agree	22.1	24.3
SC2	*"The command has a reputation for quality maintenance and sets standards to maintain quality control."*	Agree/Strongly agree	77.9	75.1
SC21		Strongly agree	26.7	25.6
SC3	*"In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety."*	Agree/Strongly agree	75.9	74.1
SC31		Strongly agree	16.7	16.9

* n= 14,242 for USN/MCAS cohort
**n= 7,134 for USMC/MCAS cohort
Survey data collected between November 2000 and June 2005.

Data and Phase 2 Sample

This researcher designed a survey instrument that was approved by the Institutional Review Board (IRB) at the University of Maryland in January 2006 and meets all of the requirements for the protection of human subjects outlined in the Code of Federal Regulations, Title 32, Part 219, section 101, and the Secretary of the Navy Instruction 3900.39C, dated 25 February 2002. The officer survey (Appendix C) and enlisted survey (Appendix D) are both 86 question surveys formatted in seven sections. The surveys were very similar and varied only when investigating areas that were specific to the different cohorts.

The survey instrument underwent Beta testing prior to the data collection phase. The survey was originally reviewed by the researcher's dissertation committee in May 2005. Comments and suggestions were incorporated into a second draft that was forwarded to two organizations for review. The F-18 aircraft analyst at the Naval Safety Center in Norfolk Virginia provided the draft survey to his staff for voluntary review. The survey was completed anonymously and comments were provided by each participant. Comments were received from both officer and enlisted respondents. A modified survey was then forwarded to the staff of Commander Strike Fighter Wing Atlantic at NAS Oceana Virginia. The Aviation Safety staff completed a similar review and provided comments regarding the content, question format, language, design utility and their time completion estimate. These comments were incorporated into a final product that included all IRB language requirements for voluntary participation and anonymity (consent statement).

The survey instrument was administered to four separate strike fighter squadrons at NAS Oceana Virginia from August 6-12, 2006. The squadrons surveyed will remain anonymous for the purpose of this research and will be referred to throughout as Unit's 1-4. Table 5.20 outlines response rates of the survey sample.

Table 5.20 Phase 2 Data Summary

Unit	Unit Population[1] Officer/Enlisted	Surveys distributed Officer/Enlisted	Responses(rate) Officer/Enlisted
1	27/205	27/150	12(45%) / 68(33%)
2	38/225	38/150	12(32%) / 122(54%)
3	37/219	37/150	13(35%) / 70(32%)
4	72/625	72/350	15(21%) / 284(45%)

[1]Numbers based on permanent staff. (excludes officer students, FRAMP and transition units)
Total usable surveys collected, 51 (officer), 544 (enlisted)

All officer surveys received from the 4 units were usable, meaning they met the researcher's criteria for accuracy and completeness. 13 enlisted surveys were not used for the following reasons. Six of the surveys indicated that the respondent did not want to participate. Seven completed questionnaires had a "flat-line" response, meaning the same response option was selected for every category.

Variables

Independent Variables (Phase 2)

The officer and enlisted survey instruments developed for Phase 2 are divided into four principal components and are organized in each survey as Part's 2-5. Table 5.21 summarizes the research focus of each principal component in the questionnaire and is the same for both the officer and enlisted instrument.

Table 5.21 Principal Factors, Phase 2 Survey Instruments

Principal Factor	Research Focus
SC "Safety Climate" Questions 33-43	Respondent's perception of the safety climate; how they interpret the safety condition of their work environment and how it guides behavior.
SP "Safety Programs" Questions 44-56	Respondent's assessment of the safety programs in the unit.
UP "Unit Programs" Questions 57-66	Respondent's assessment of the management and leadership programs in the unit.
LS "Leadership Style" Questions 67-84	Respondent's assessment of the leadership style and behavior of their most immediate supervisor.

Similar to the Phase 1 survey, principal factors were created under the presumption that certain survey statements (variables) would elicit correlated responses and could be combined into a smaller number of underlying dimensions. As an example**,** survey questions 67-84 (Leadership Style) might potentially be simplified because the survey statements ask respondents to consider the leadership style of the supervisor that most closely influences their daily behavior. An example is question 68, *"My supervisor promotes a collective sense of mission"*. PCA with promax rotation was conducted on the LS (Leadership Style) elements of both the officer and enlisted data sets. The officer dataset yielded five factors with Eigenvalues greater than 1.0 that explained 76% of the 18 variables combined variance (Questions 67-84). Maximum-Likelihood Factoring reveals that while the 5-factor model significantly improves upon a no-factor model, the 5-factor model is significantly worse than a perfect-fit model. It took a 7-factor MLF test to derive a p-value adequate to accept the hypothesis that the model fits as well as a more complicated, perfect-fit model. The same procedure was conducted on both the officer and enlisted datasets for each principal component and the results are summarized in Table 5.22.

Table 5.22 Principle Factor Results for Oceana Data

Factor	Phase 2 question set	PCA factors/ variance	MLF χ^2 none/ χ^2 more factors	Variables generated
SC (Safety Climate)	Officer	3 / 61%	* / **	SC1 SC2 SC3
	Enlisted	2 / 53%	* / --	SC1 SC2
SP (Safety Programs)	Officer	5 / 73%	* / **	SP1 SP2 SP3 SP4 SP5
	Enlisted	2 / 47%	* / --	SP1 SP2
UP (Unit Programs)	Officer	3 / 67%	* / **	UP1 UP2 UP3
	Enlisted	2 / 52%	* / --	UP1 UP2
LS (Leadership Style)	Officer	5 / 76%	* / --	LS1 LS2 LS3 LS4 LS5
	Enlisted	3 / 58%	* / --	LS1 LS2 LS3

* Factor model significantly improves upon a no-factor model
- Factor model *fails* to significantly improve upon a no-factor model.
** Factor model *is not* significantly worse than a perfect fit model
-- Factor model is significantly worse than a perfect fit model

The variables shown in Table 5.22 will be used in the empirical modeling efforts during the principal components data analysis phase and will compared with complete variable modeling results.

Categorical variables such as those generated in Phase 1 were created based upon responses to predictor questions in the Phase 2 survey. Since the Phase 2 survey was created using response options graded on a seven-factor Likert scale like in the Phase 1 instrument, dummy variables were generated using a similar methodology. A value of 1 was assigned to those respondents who either “Agreed” or “Strongly Agreed” with the survey statement while a value of 0 was assigned to all other respondent choices. This technique was replicated for many of the survey statements of interest with a 1 always being assigned to a respondent who either agreed or highly agreed. Not all statements were used to generate dummy variables from each questionnaire. One significant distinction should be noted among the variable annotation in Phase 2. Variables that end in the numeric "1", were generated from the same survey question as their non-numeric counterparts, however, the categorical distinction was drawn between those respondents who "Strongly Agreed" with the survey statement and all other choices. This rationale is based upon a perceived inflation bias among survey participants and will be discussed in further detail in the data analysis section. Table 5.23 displays the dummy variables generated for both surveys using this technique.

Table 5.23 Dummy Variables, Oceana Survey Instrument

Variable name*	Officer Survey Question #	Enlisted Survey Question #
safetypriority	36	36
recommendtofriend	38	38
morale	39	39
myopinion	40	40
expectedaccidents	41	41
standdowns	43	43
humanfactorbds	45	--
orm	46	45
handleschange	--	48
safetystats	--	49
safetydata	51	50
fairassessment	--	51
safetyawards	53	52
empowered	--	53
sufficienttime	--	54
bestpeoplesafety	56	55
injuriesreported	--	56
counselingguidlines	57	57
counselinghelpful	58	58
evaluation	--	59
mentoring	60	60
meaningfulreward	61	61
familyimpact	62	62
prodevplan	63	63
perfjobassignment	64	64
leaderdevelopment	--	66
leaderpride	67	67
leaderinspiration	69	69
leadersacrifice	70	70
leadermoralstand	73	73
goalsknown	74	74
leaderawardrec	75	75
leaderperfawareness	77	77
leaderdecide	79	79
leadermicro	82	82
leadergetsit	84	84

* variable names were chosen to reflect the main focus of the survey statement

Dependent Variables (Phase 2)

Survey question number 33 of both the officer and enlisted survey was designed to measure a respondent's assessment of the safety climate in their particular unit. The statement read, *"I consider the safety climate in this command to be very high."* A dummy variable *safetyclimate* was generated for those respondents who either "Agreed" or "Strongly Agree" with the survey statement and a variable *safetyclimate1* for those who "Strongly Agreed". Unlike the CSA or MCAS survey instrument, the Oceana survey only had one question to assess safety climate. Table 5.24 summarizes officer and enlisted responses to the safety climate assessment question.

Table 5.24 Officer and Enlisted Response Summary (*safetyclimate*, Q33)

Survey Cohort	Question 33 "safetyclimate" response options						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
Officer	0	0	0	28 (54%)	24 (46%)	0	0
Enlisted	6 (1%)	23 (4%)	149 (27%)	264 (49%)	93 (17%)	8 (2%)	1 (.2%)

n=52 (officers), 544(enlisted)

As can be seen from the above table, 100 percent of officer respondents either "Agreed" or "Strongly Agreed" with the safety climate assessment statement while 93 percent of the enlisted cohort either "Agreed", "Strongly Agreed" or were "Neutral" about the statement.

Phase 2 Descriptive Statistics

The Phase 2 survey instrument was organized into seven different sections. Part 1, the demographic data section presented both cohorts with thirty two questions asking respondents to circle an appropriate option. Demographic data for the officer respondents are summarized in Table 5.25.

Table 5.25 Demographic Data Summary, NAS Oceana Survey (Officers)

Demographic variables	n (number of respondents)	% (survey population)
Organization		
Squadron 1	12	23.1
Squadron 2	12	23.1
Squadron 3	13	25.0
Squadron 4	15	28.8
Rank		
Junior Officer (CWO to O-3)	39	75.0
Senior Officer (O-4 to O-6)	13	25.0
Gender		
Male	47	90.4
Female	5	9.6
Designation		
Pilot	35	67.3
NFO	12	23.1
Maintenance	3	5.8
Intelligence	1	1.9
Other	1	1.9
Race		
Caucasian	48	92.4
African American	2	3.8
Other	2	3.8
Total flight hours		
Flight Hours: < 500	9	17.3
Flight Hours: 500-1000	16	30.8
Flight Hours: 1001-1500	8	15.4
Flight Hours: 1501-2000	8	15.4
Flight Hours: 2001-2500	3	5.8
Flight Hours: >2500	3	5.8
N/A	5	9.6
Authority		
Non-Department Head	44	84.6
Department Head/XO/CO	8	15.4
Marital Status		
Married	37	71.2
Single	15	28.8

Spouse’s living arrangements		
Spouse lives with member	36	69.2
Spouse lives elsewhere	1	1.9
N/A	15	30.8
Spouse’s work		
Works full time	18	34.6
Works part time	5	9.6
Not employed	14	26.9
N/A	15	28.9
Spouse’s occupation		
Serves in military	4	7.7
Does not serve in military	35	67.3
N/A	13	25.0
Children		
0	26	50.0
1-2	22	42.3
3-4	3	5.8
5+	1	1.9
Education		
2 year degree	3	5.8
4 year degree	45	86.5
Masters degree	3	5.8
Other	1	1.9
Commissioning Source		
U.S. Naval Academy (USNA)	21	40.4
Officer Candidate School (OCS)	17	32.7
Reserve Officer Training Corps	9	17.3
(ROTC)	5	9.6
Other		
Geographic Region		
North East	15	28.8
North West	4	7.7
South East	18	34.6
South West	7	13.5
Mid West	8	15.4
Geographic Setting		
Suburban	26	50.0
Urban	8	15.4
Rural	17	32.7
Other	1	1.9

Military Parents		
Both	1	1.9
One	31	59.6
None	20	38.5
Tenure in Squadron (years)		
<1	24	46.2
1-2	13	25.0
2-3	12	23.1
3-4	2	3.8
>4	1	1.9
Sleep (Avg hours per night)		
5-6	3	5.8
6-7	29	55.8
7-8	17	32.7
8-9	2	3.8
>9	1	1.9
Promotion recommendation		
Promotable (P)	4	7.7
Must Promote (MP)	17	32.7
Early promote (EP)	23	44.2
Don't Know	7	13.5
Not Observed (NOB)	1	1.9
Served in Safety Department		
Yes	13	25.0
No	39	75.0

n=52. Survey data collected August 2006.

Demographic data for the enlisted respondents are summarized in Table 5.26.

Table 5.26 Demographic Data Summary, NAS Oceana Survey (Enlisted)

Demographic variables	n (number of respondents)	% (survey population)
Organization		
Squadron 1	68	12.5
Squadron 2	122	22.4
Squadron 3	70	12.9
Squadron 4	284	52.2
Rank		
E-1/2	61	11.2
E-3	152	27.9

E-4	112	20.6
E-5	136	25.0
E-6	72	13.2
E-7	5	0.9
E-8/9	6	1.1
Gender		
Male	450	82.2
Female	94	17.3
Citizenship		
U.S. born	497	91.4
U.S. naturalized	39	7.2
Non U.S. citizen	8	1.5
Specialization		
Maintenance	502	92.3
Administration	33	6.1
Service	5	0.9
Other	4	0.7
Race		
Caucasian	349	64.2
African American	90	16.5
Hispanic	54	9.9
Native American	5	0.9
Asian	10	1.8
Pacific Islander	7	1.3
Other	29	5.3
Work center		
Maintenance Control	42	7.7
Quality Assurance	21	3.9
Power Plants	57	10.5
Air frames	61	11.2
Avionics	109	20.0
Ordnance	43	7.9
Line	117	21.5
Corrosion	21	3.9
Survival	36	6.6
Parachute Rigger	6	1.1
Other	3	0.6
N/A	28	5.2
Work Shift		
Day check	290	53.3
Night check	177	32.5
Mid check	77	14.2
Marital Status		
Married	246	45.2
Single	250	46.0
Separated	25	4.6

Divorced	23	4.2
Spouse's living arrangements		
Spouse lives with member	218	40.1
Spouse lives elsewhere	55	10.1
N/A	271	49.8
Spouse's work		
Works full time	145	26.7
Works part time	42	7.7
Not employed	85	15.6
N/A	272	50.0
Spouse's occupation		
Serves in military	46	8.5
Does not serve in military	228	41.9
N/A	270	49.6
Children		
0	326	59.9
1-2	172	31.6
3-4	43	7.9
5+	3	0.6
Education		
Some High School	7	1.3
High School diploma	262	48.2
GED	21	3.9
Some College	216	39.7
College degree	33	6.1
Masters degree	2	0.4
Other	3	0.6
Authority		
Worker	387	71.1
Leading Petty Officer	31	5.7
Shift supervisor	89	16.4
Work center supervisor	30	5.5
Branch Chief Petty Officer	2	0.4
Division Chief Petty Officer	5	0.9
Geographic Region		
North East	132	24.3
North West	26	4.8
South East	158	29.0
South West	57	10.5
Mid West	127	23.4
Pacific Islands	4	0.7
N/A	40	7.4
Geographic Setting		
Suburban	125	23.0
Urban	231	42.5
Rural	175	32.2

Other	13	2.4
Military Parents		
Both	26	4.8
One	189	34.7
None	329	60.5
Tenure in Squadron (years)		
<1	183	33.6
1-2	193	35.5
2-3	107	19.7
3-4	46	8.5
>4	15	2.8
Sleep (Avg hours per night)		
<5	74	13.6
5-6	197	36.2
6-7	164	30.2
7-8	86	15.8
8-9	18	3.3
>9	5	0.9
Promotion recommendation		
Promotable (P)	59	10.9
Must Promote (MP)	289	53.1
Early promote (EP)	146	26.8
Don't Know	42	7.7
Served in Safety Department		
Yes	28	5.2
No	516	94.8

n=544. Survey data collected August 2006.

Section 1 asks several questions designed to assess each unit's accident and injury statistics. Questions 22 and 23 ask for personal injury data (both at work and during leisure time), while questions 24 and 25 question mishap involvement. Question 27 asks respondents to assess the number of unit members they have seen injured at work over the past year. The variable names, survey statement and selection choices are summarized in Table 5.27.

Table 5.28 summarizes survey responses to these five variables for both the officer and enlisted cohorts. A more detailed set of figures displaying specific injury and mishap variable distributions by unit is included in Appendix E.

Table 5.27 Injury and Mishap Variables

Variable name	Survey statement	Selection choices
injury1	*"Over the past year, I have been injured on the job (mild to serious)"* (Q22)	none, 1, 2, 3, >3
injury2	*"Over the past year, I have been injured during leisure time (mild to serious)"* (Q23)	none, 1, 2, 3, >3
injury3	*"Number of people I have seen injured at work over the past year(mild to serious)"* (Q27)	0, 1-2, 3-4, 5-6, >6
mishap1	*"Over the past year, I have been involved in a workplace mishap."* (Q24)	none, 1, 2, 3, >3
mishap2	*"Over the past year, this command has had a Class A, B, or C aircraft mishap"* (Q25)	none, 1, 2, 3, >3

Table 5.28 Summary of Injury and Mishap Variable Responses

Variable	Cohort	Survey response options (n per cohort)				
		none	1	2	3	>3
injury1	Officer	51	1	0	0	0
	Enlisted	440	73	19	5	7
injury2	Officer	39	10	3	0	0
	Enlisted	428	75	25	8	8
mishap1	Officer	51	1	0	0	0
	Enlisted	513	23	5	1	2
mishap2	Officer	27	14	2	7	2
	Enlisted	324	127	59	27	7
Variable	Cohort	Survey response options				
		0	1-2	3-4	5-6	>6
injury3	Officer	28	18	5	1	0
	Enlisted	211	227	79	17	10

n=52 (Officers); n=544 (Enlisted). Survey data collected August 2006

Finally, section 1 asks three questions regarding a participant's assessment of organization performance (both operational and safety), and their current level of job satisfaction. The variable names, survey statement and selection choices are summarized in Table 5.29.

Table 5.29 Performance Appraisal and Job Satisfaction

Variable name	Survey statement	Selection choices
opperf	*"My assessment of this command's operational performance" Scale: 1=poor, 6=exceptional* (Q28)	1, 2, 3, 4, 5, 6
saperf	*"My assessment of this command's safety performance" Scale: 1=poor, 6=exceptional* (Q29)	1, 2, 3, 4, 5, 6
jobsat	*"My job satisfaction is" Scale: 1=low, 6=high (Q30)*	1, 2, 3, 4, 5, 6

Table 5.30 summarizes survey responses to these three variables for the officer and enlisted cohorts. A more detailed set of figures displaying specific injury and mishap variable distributions are included in Appendix F.

Table 5.30 Summary of Injury and Mishap Variable Responses

Variable	Cohort	1	2	3	4	5	6
opperf	Officer	1(1.9)	0(0.0)	2(3.9)	10(19.2)	22(42.3)	17(32.7)
	Enlisted	9(1.7)	26(4.8)	94(17.3)	178(32.7)	167(30.7)	70(12.9)
saperf	Officer	1(1.9)	0(0.0)	1(1.9)	4(7.7)	25(48.1)	21(40.4)
	Enlisted	6(1.1)	21(3.9)	84(15.4)	148(27.1)	193(35.5)	92(16.9)
jobsat	Officer	1(1.9)	2(3.9)	4(7.7)	5(9.6)	23(44.2)	17(32.7)
	Enlisted	41(7.5)	49(9.0)	99(18.2)	124(22.8)	151(27.8)	80(14.7)

n=52 (Officers); n=544 (Enlisted). Survey data collected August 2006

Parts 2-5 of both the officer and enlisted survey instrument presented survey statements that asked participants to respond to organizational statements graded on a

Likert scale similar to the one used in the CSA/MCAS instruments. Several reverse statements were included as a precaution against respondents who might be flat-lining their responses (Questions 41, 78, 79 and 82). Table 5.31 outlines the categorization and distribution of survey questions.

Table 5.31 Oceana Survey Instrument, Statement Categories

	Part 2	Part 3	Part 4	Part 5
	Safety Climate (SC)	Safety Programs (SP)	Unit Programs (UP)	Leadership Style (LS)
Officer Survey Question #	33-43	44-56	57-66	67-84
Enlisted Survey Question #	33-43	44-56	57-66	67-84

Part 6 of the survey asked participants to assess potential ways to improve the safety climate within their respective units. Respondents were asked to rank their top three choices from a pre-determined set of 23 options with the opportunity to write-in a non-listed preference as option 24. Table 5.32 outlines the pre-determined choices available to respondents in question 85.

Table 5.32 Safety Climate Improvement Options (Question 85, Oceana Survey)

Option #	Choice Description
1	Establish a functional mentor program
2	Publish safety statistics
3	Improve squadron resources
4	Reduce operational tempo
5	Give out more awards
6	Take better care of my family
7	More objective and concrete feedback
8	Better hardware(aircraft, tools, parts)
9	Improve base housing
10	Increase unit diversity (e.g. race, gender)
11	More medical personnel (e.g. flight surgeon)
12	Better professional growth programs
13	Institute a merit-based ranking system
14	Improve squadron communications
15	Increase my pay and benefits
16	Increase tour length/reduce turnover
17	Improve technical training
18	Make decision-making more participatory
19	More individual autonomy, less micro-management
20	Improve workspaces (equipment, habitability)
21	Improved medical care for my family
22	Improve family advocacy programs
23	Get rid of poor performers
24	(fill-in)

Figures 5.1 and 5.2 display the distribution of first choice options selected when completing question 85 of the Program Assessment section for officers and enlisted personnel respectively. A more comprehensive set of figures showing the first choice distribution by unit and second and third choice distribution by both total and unit is included in Appendix F.

Figure 5.1 Safety Climate Improvement Choices, Officer (First Choice)

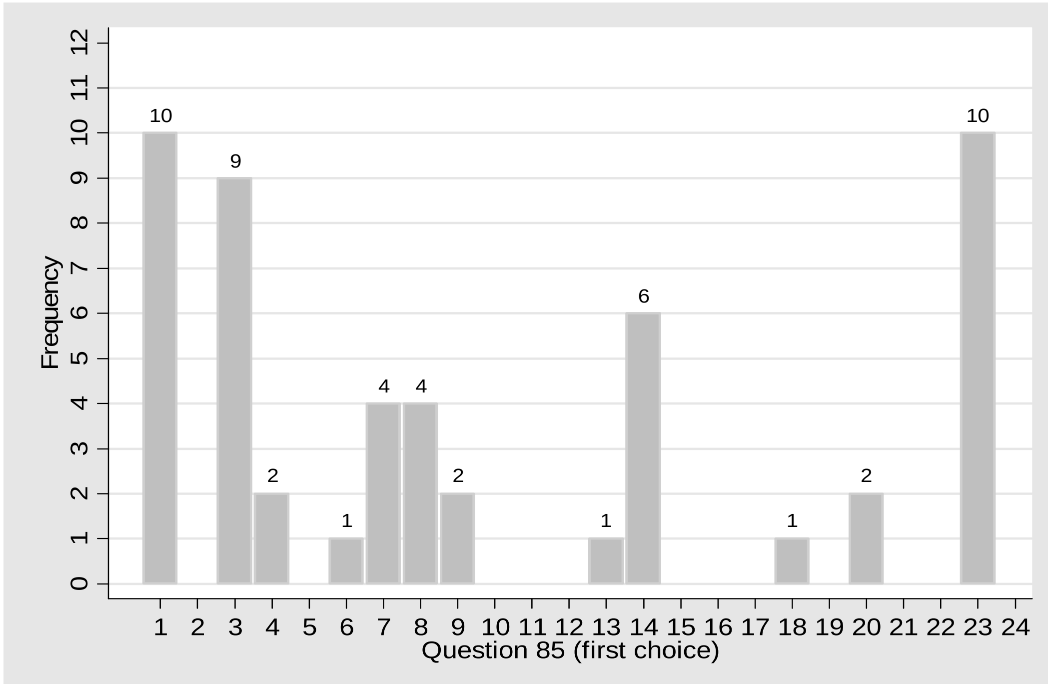
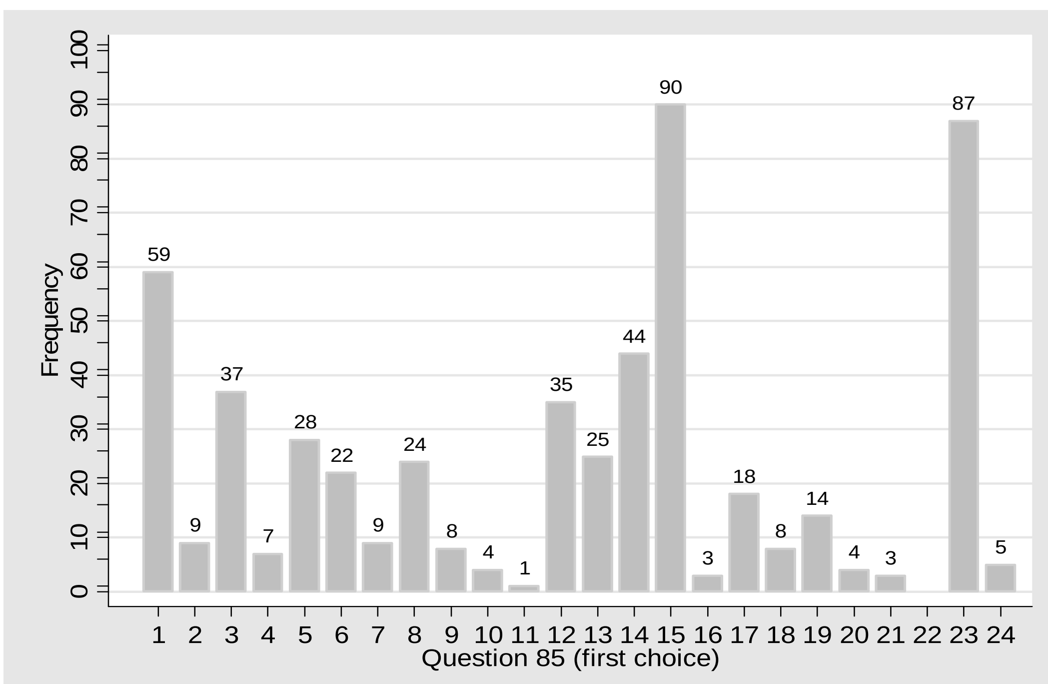


Figure 5.2 Safety Climate Improvement Choices, Enlisted (First Choice)



Positive response rates to the dependent variable safety climate survey statement (question # 33) in the officer and enlisted surveys are summarized in Table 5.33 and 5.34. Tables which summarize safety climate assessment by demographic category are included in Appendix H.

Table 5.33 Summary of Safety Climate Assessment Oceana (Officer)

Survey Question	Response Option	n/pop%
#33 *"I consider the safety climate in this command to be very high"*	Strongly Agree	24 / 46.2
	Agree	28 / 53.8
	Neutral	-
	Disagree	-
	Strongly Disagree	-
	Don't know / N/A	-

n=52, survey data collected August 2006

Table 5.34 Summary of Safety Climate Assessment Oceana (Enlisted)

Survey Question	Response Option	n/pop%
#33 *"I consider the safety climate in this command to be very high"*	Strongly Agree	93 / 17.1
	Agree	264 / 48.5
	Neutral	149 / 27.4
	Disagree	23 / 4.2
	Strongly Disagree	6 / 1.1
	Don't know / N/A	9 / 1.6

n=544, survey data collected August 2006

Table 5.35 displays the mean scores categorized by principal factor for both the officer and enlisted cohort.

Table 5.35 Principal Factor Means, Oceana Survey

Principal Factor	Survey Question #	Response Means	
		Officer	Enlisted
SC (Safety Climate)	33-43	3.78	3.37
SP (Safety Programs)	44-56	4.13	3.70
UP (Unit Programs)	57-66	3.77	3.30
LS (Leadership Style)	67-84	3.47	3.36

n=51 (officers), 544 (enlisted), survey data collected August 2006

Table 5.36 summarizes response means for the independent variables.

Table 5.36 Independent Variable Response Means, Oceana Survey

Dummy Variable	Officer Survey Question #	Officer Response mean/SD	Enlisted Survey Question #	Enlisted Response mean/SD
safetypriority	36	4.54/.67	36	3.67/1.15
recommendtofriend	38	4.44/.75	38	2.99/1.31
morale	39	4.13/.93	39	2.89/1.15
myopinion	40	4.01/.90	40	2.97/1.30
expectedaccidents	41*	1.71/.82	41*	2.96/1.28
standdowns	43	3.65/.90	43	3.51/1.12
humanfactorbds	45	4.38/1.32	--	--
orm	46	4.33/.71	45	3.85/.90
handleschange	--	--	48	3.57/1.11
safetystats	--	--	49	4.01/2.45
safetydata	51	4.35/1.04	50	3.94/1.16
fairassessment	--	--	51	3.61/1.12
safetyawards	53	3.69/.98	52	3.41/1.33
empowered	--	--	53	3.61/1.13
sufficienttime	--	--	54	3.71/1.55
bestpeoplesafety	56	3.50/1.21	55	3.52/1.43
injuriesreported	--	--	56	3.78/1.23
counselingguidlines	57	3.85/1.11	57	3.58/1.13
counselinghelpful	58	3.67/1.21	58	3.39/1.23
evaluation	--	--	59	3.48/1.22
mentoring	60	3.35/1.23	60	3.23/1.25
meaningfulreward	61	3.75/.88	61	3.19/1.29
familyimpact	62	3.65/1.44	62	2.88/1.42
prodevplan	63	3.02/1.46	63	3.06/1.20
perfjobassignment	64	3.90/1.05	64	3.18/1.27
leaderdevelopment	--	--	66	3.68/3.08
leaderpride	67	3.98/.85	67	3.42/1.08
leaderinspiration	69	3.94/.92	69	3.35/1.11
leadersacrifice	70	4.15/.92	70	3.61/1.21
leadermoralstand	73	3.88/.96	73	3.49/1.18
goalsknown	74	4.21/.87	74	3.80/2.42
leaderawardrec	75	3.96/.88	75	3.39/1.18
leaderperfawareness	77	3.75/1.05	77	3.58/1.10
leaderdecide	79*	1.82/.90	79*	2.84/1.24
leadermicro	82*	1.94/.89	82*	2.80/1.22
leadergetsit	84	4.12/.88	84	3.63/1.10

* negative question
n=51 (officers), 544 (enlisted)

Modeling Leadership Style

An important part of this research plan is to identify relationships between leadership style and a respondent's assessment of their organization's safety climate. While the survey instruments are different in Phase 1 and Phase 2, the methodology is similar. In both research phases, several survey statements were determined to be suitable proxies for leadership style assessment purposes. These survey statements are based upon the Full Range Leadership Model developed by Bernard Bass and Bruce Avolio (1989). Using these survey results, particular leadership styles (types) will be subject to quantitative modeling in order to evaluate any empirical correlation between style factors and an individual's safety climate assessment. As depicted earlier in Figure 3.2, the transformational leader elevates followers' efforts by raising their confidence and by increasing the value of the possible outcomes by:

- Expanding the follower's needs
- Transcending the follower's self interests (placing the group above the individual)
- Elevating/altering or widening the follower's level of needs on Maslow's scale

The principal behavior of the transactional leader is to motivate follower behavior through a series of exchange relationships facilitated by trading awards and incentives for services rendered. A broader concern for the individual actualization of subordinates is overshadowed by an immediate interest in unit objectives and short term goals.

In the Phase 1 survey instrument, participants were not asked specifically to comment on the leadership style of their direct supervisor, rather the survey statements referred broadly to command level practices and command level observations from which a supervisor's style propensity might be deduced. Therefore, survey statements used to model leadership style were evaluated based upon how well they conformed to the following criteria for determining a certain leadership environment within the respondent's organization.

A leadership environment was considered transformational if respondents reported leadership practices within their organization that facilitated open communications (regarding mission, safety, schedule, personnel management, and job performance) and/or expressed concern for subordinate development and individual welfare. The leadership environment was considered transactional if a respondent determined the dominant supervisory practices in place were based upon exchange relationships and considered laissez-faire if their leader was autonomous.

The Phase 2 survey instrument presents 18 survey statements (Questions 67-84) designed to place a respondent's leader in one of three broad leadership style categories, i.e. transformational, transactional or laissez-faire. Questions 67-73 and 84 are designed to identify those respondents who work for transformational leaders if they respond in the affirmative. Questions 74-78, 80 and 82 are designed to assess the transactional supervisor.

Question 79 assesses if a supervisor or leader is actually engaged in any aspect of leadership as assessed by the respondent. Agreement with this survey statement implies the respondent judges their leader as one who avoids responsibility (is uninvolved in the decision-making process) and is essentially an autonomous entity in the chain of command (i.e. a laissez-faire leader). Questions 81 and 83 assess changes in leadership style due to increases in operational demand or tempo.

It is important to note that while individuals often exhibit a specific leadership style in their leadership behavior, it is not uncommon for followers to be subject to a variety of leadership interventions simultaneously, many that may represent different leadership styles or types. It is also not uncommon for a particular leadership practice to have both transformational and transactional components. The important research challenge is to identify a certain leadership style, manifested in a distinct (and observable) intervention practice that correlates with a follower's assessment of their organizational safety climate.

Phase 2 Personnel Interviews

During the Phase 2 data collection phase, this researcher was authorized to conduct interviews with unit personnel. These interviews were voluntary and every effort was made to make the interview cohort a random sample from each of the 4 units participating in the survey. Because these are operational military units, interview participants were chosen at the discretion of the participating unit, relying in large measure on the operational necessity of the participants during the interview windows. This researcher acknowledges a certain selection bias might exist (interview participants may have been the least engaged or important workers) however, every effort was made to include participants who represented all ranks, ratings, specializations, gender and work shift. The interviews were conducted both individually and in groups; held in private spaces with only the researcher and interviewees present. Interviews were not recorded however the researcher had permission to take hand-written notes. No other supervisory personnel were in attendance nor were parent unit supervisors allowed to see the interview notes. Interviews lasted from 30 to 60 minutes and participants were allowed complete control over their level of participation. The researcher's military rank was not disclosed and he wore civilian clothes. Interviews were started using a bank of question prompts included in Appendix I. Table 5.37 provides a general overview of the interviews conducted during Phase 2. Additional interviews were conducted with CSFWL staff personnel including the Commodore, chief of staff, maintenance officer, safety officer, staff Corpsman, and maintenance Master Chief.

Table 5.37 Phase 2 Interview Participants (Oceana Survey)

Interview #	Unit	Number of participants	Officer/Enlisted	General description
1	1	1	Officer	O-4
2	1	1	Enlisted	E-9
3	1	1	Officer	O-4
4	1	15	Enlisted	E-1 to E-3
5	1	13	Enlisted	E-6
6	2	6	Officer	O-1/2
7	2	1	Officer	O-5
8	2	4	Enlisted	E-4
9	2	1	Enlisted	E-6
10	2	1	Officer	O-3
11	3	1	Officer	O-4
12	3	1	Officer	O-3
13	3	1	Officer	O-2
14	3	1	Officer	O-5
15	3	3	Enlisted	E-7
16	4	5	Enlisted	E-1 to E-3
17	4	1	Enlisted	E-6
18	4	1	Officer	O-4
19	4	6	Officer	O-2/O-3
20	4	15	Enlisted	E-4 to E-5

Interviews were conducted, August 2006.
Participation was voluntary. Sessions occurred during all three work shifts and endeavored to attain fair rank, gender, and race representation.

In general, interviews were very informal and quite informative (revealing). Sessions occurred during all three work shifts and endeavored to attain fair equitable gender, and race representation. It took very little prompting to get people to participate in the large focus group settings while the individual interviews took longer to gain some interactive tempo. Some people were reluctant to participate and some were curious about the chance of attribution. All participants signed consent forms and were briefed on the conditions of volunteerism, non-disclosure and anonymity. The researcher intentionally prompted quiet participants to encourage participation but did not coerce individuals in single interviews or invite peer pressure to coax personnel in group interviews. No one refused to participate and no one objected to the researcher taking notes. The researcher was primarily interested in a few topics and drove the interviews in a specific direction using the following prompts:

1. Describe the safety environment/climate. Does this climate influence how you perform? On the job? During off-duty hours?
2. What are the things your supervisor does that improves this climate? Degrades the climate?
3. Explain why certain leader actions have either a positive or negative effect on your perception of safety climate.

There was considerable consistency in the discussions and the information gathered during these interview sessions will be introduced in Chapter 7 as applicable to illuminate the empirical findings.

Chapter 6: Phase 1 Analysis: Assessing the Navy's Mishap Reduction Policy

Phase 1 of this research investigates the relationships between certain organizational variables (demographics, safety policies and programs) and safety climate in high-risk organizations such as naval aviation strike fighter squadrons (specifically F/A-18 aviation squadrons). Of specific interest is the 2003 DOD policy aimed at reducing preventable accidents and mishaps. The focus of the Navy's intervention strategy (policy) was to elevate safety climate in these organizations presuming this change would improve individual behavior and decision-making as it relates to safety performance. Three specific questions were proposed in Chapter 4 for Phase 1 research that will be investigated using a secondary data set designed to collect safety climate data within these high-risk units of interest. These questions will facilitate a broader understanding of: the efficacy of the Navy's mishap reduction strategy; how safety program intervention policies might influence such organizational factors as climate; and offer insight on ways to improve future policies designed to ultimately reduce preventable mishaps.

The Phase 1 data focuses specifically on traditional policies, programs and procedures within the formal construct of the Naval Aviation Safety Program (OPNAVINST 3750.6R, 2001). This program is based upon the principle of "necessitarianism" which means every event (mishap) is a result of organizational antecedents that had some influence on the event's occurrence (things just don't happen). Identifying, and then eliminating these causes is at the core of the Naval Aviation Safety Program. Phase 1 takes the first step in trying to identify some of these organizational antecedents to mishaps looking for associations between unit demographics and safety climate. Second, this phase analyzes the relationship between certain safety program interventions (best-practices) and their influence on safety climate. Finally, Phase 1 evaluates how effective the Navy's mishap reduction strategy was in meeting the 50% reduction goal imposed by the Secretary of Defense in 2003.

Squadron Demographics and Safety Climate

The Navy's mishap reduction strategy outlined in Chapter 1 is focused at the unit-level, broadly considering each organization (strike-fighter squadron) to be relatively homogeneous in terms of personnel composition. The FRP policy does not reflect the demographic differences of unit members, choosing to ignore the potentially distinct correlation a specific demographic might have with an individual's assessment of safety climate. Upon closer consideration, this knowledge of demographic distinctions seems potentially relevant to crafting a policy designed to elevate a member's perception of the safety climate in their unit. An important first step would be to baseline the relationship between demographics and organizational perceptions regarding safety climate before crafting an intervention strategy that applies comprehensively to an entire unit.

Several consequences seem possible without this analysis. First, precious resources, particularly time and manpower might be wasted on cohorts not necessarily in need of a specific policy treatment. Why waste the time and effort on a group of unit members who require little if any of the policy lever? Second, applying policy to a cohort not in need of the intervention could invite a negative reaction from a demographically definable group of constituents. An example might be offering private education vouchers in a public school district that has a few schools exceeding established standards for teacher and student performance. The treatment might be universally applied to a geographic region or certain school board district with pockets of underperforming schools while the reaction from parents in the high performance areas could potentially manifest in student transfers, increased home sales and parental unrest. What may be good for some may not necessarily be good for others. Finally, failure to baseline unit demographics makes policy analysis difficult if not impossible. Evaluating the influence of a policy treatment can only be measured with confidence if the pre-policy perceptions of the study group are well known and documented (controlled for). Measuring policy success or failure requires a credible evaluation of interventions and outcomes, the validity of which cannot be determined without a baseline measure of the policy cohort.

The first step in demographic analysis is to compare the means of variable y across categories of variables x investigating the null hypothesis that there is no statistical difference between means. In this case, y represents the unit's safety climate assessment as measured by question #42 in the CSA (Table 5.7) and question #7 in the MCAS (Table 5.8) survey and x represents the ten demographic questions asked of each survey respondent as outlined in Table 5.2. Tables 6.1 through 6.4 summarize the statistically significant means differences for both the Navy and Marine Corps CSA and MCAS cohorts. These differences will be evaluated in the subsequent paragraphs.

Table 6.1 Safety Climate, ANOVA Means Comparison (USN/VFA, CSA)

Respondent's assessment of safety climate in unit (CSA42) (0-5 Likert scale)							
Demographic Variables	n	mean	SD	means comparison/statistical significance[1]			
Rank				a	b	c	d
a. Junior Off (O-1 to O-3)	1153	4.31	0.72	–			
b. Senior Off (O-4 to O-6)	630	4.47	0.60	0.16***			
Total flight hours							
a. Flight Hours < 500	255	4.35	0.65	–			
b. Flight Hours ≥500 ; <1000	478	4.27	0.78	0.08	–		
c. Flight Hours ≥1000; <2000	600	4.36	0.68	0.01	0.09	–	
d. Flight Hours ≥2000	450	4.50	0.57	0.15*	0.23***	0.14***	–
Authority							
a. Non-Department Head	1419	4.34	0.70	–			
b. Department Head	364	4.47	0.60	0.13**			

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 Analysis of Variance (ANOVA)
Scheffe's multiple comparison test, Bartlett's test for equal variance

Table 6.2 Safety Climate, ANOVA Means Comparison (USMC/VMFA, CSA)

Respondent's assessment of safety climate in unit (CSA42) (0-5 Likert scale)							
Demographic Variables	n	mean	SD	means comparison/statistical significance[1]			
Rank				a	b	c	d
a. Junior Off (O-1 to O-3)	787	4.28	0.64	–			
b. Senior Off (O-4 to O-6)	329	4.46	0.61	.18***			
Total flight hours							
a. Flight Hours < 500	341	4.32	0.58	–			
b. Flight Hours ≥500 ; <1000	232	4.19	0.69	.13	–		
c. Flight Hours ≥1000; <2000	347	4.36	0.67	.04	.17*	–	
d. Flight Hours ≥2000	233	4.46	0.59	.14	.27***	.10	–
Authority							
a. Non-Department Head	829	4.32	0.64	-			
b. Department Head	298	4.35	0.64	.03	-		
Status							
a. Regular	892	4.31	0.64	–			
b. Active Reserve	165	4.34	0.62	.03*	–		
c. Drilling Reserve	70	4.60	0.52	.29	.26***	–	
Parent Command							
a. 1 MAW	161	4.20	0.64	–			
b. 2 MAW	278	4.33	0.68	.13	–		
c. 3 MAW	578	4.34	0.62	.14	.01	–	
d. 4 MAW	134	4.50	0.58	.30**	.17	.16	–

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 Analysis of Variance (ANOVA)
Scheffe's multiple comparison test, Bartlett's test for equal variance

Table 6.3 Safety Climate, ANOVA Means Comparison (USN/VFA, MCAS)

Respondent's assessment of safety climate in unit (MCAS7) (0-5 Likert scale)												
Demographic Variables	n	mean	SD	means comparison/statistical significance[1]								
Rank				a	b	c	d	e	f	g	h	i
a. E-1 to E-3	4,420	3.98	.86	-								
b. E-4 to E-5	6,407	3.83	.92	.15***	-							
c. E-6 to E-7	2,664	4.00	.85	.02	.17***	-						
d. E-7 to E-8	3	4.00	0.0	.02	.17	0.0	-					
e. E-8 to E-9	292	4.33	.75	.35***	.50***	.33	.33***	-				
f. O-1 to O-3	231	4.38	.73	.40***	.55***	.38	.38***	.05	-			
g. O-4 to O-6	36	4.63	.63	.65*	.80***	.63	.63*	.30	.25			
h. WO1 to CWO5	64	4.43	.77	.45*	.60***	.43	.43	.10	.05	.20	-	
Work center												
a. Airframes	1,504	3.82	.88	-								
b. Avionics	2,313	3.80	.94	.02	-							
c. Flight line	2,848	3.96	.85	.14**	.16***	-						
d. Ordnance	1,805	4.00	.85	.18***	.20***	.04**	-					
e. Power Plants	1,135	3.88	.87	.06	.08	.08	.12	-				
f. QA	728	4.02	.86	.20**	.22***	.06	.02	.14	-			
g. Survival	1,032	3.93	.88	.11	.13*	.03	.07	.05	.09	-		
h. Maint Control	1,113	4.17	.84	.35***	.37***	.21***	.17**	.29	.15	.24***	-	
i. Other	1,639	3.97	.97	.15**	.17***	.01	.03	.09	.05	.04	.20***	-
Primary Shift												
a. Day check	8,481	4.00	.88	-								
b. Night check	5,636	3.85	.91	.15***	-							

[1] absolute value of means difference

*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001

STATA 8.2 Analysis of Variance (ANOVA)

Scheffe's multiple comparison test, Bartlett's test for equal variance

Table 6.4 Safety Climate, ANOVA Means Comparison (USMC/VMFA, MCAS)

Respondent's assessment of safety climate in unit (MCAS7) (0-5 Likert scale)												
Demographic Variables	n	mean	SD	means comparison/statistical significance[1]								
Rank				a	b	c	d	e	f	g	h	i
a. E-1 to E-3	2,299	4.07	.87	-								
b. E-4 to E-5	3,223	3.83	.97	.24***	-							
c. E-6 to E-7	1,134	3.88	.95	.19***	.05	-						
d. E-8 to E-9	133	4.34	.75	.27	.51***	.46***	-					
e. O-1 to O-3	60	4.38	.72	.31	.55**	.50**	.04	-				
f. O-4 to O-6	17	4.65	.49	.58	.82*	.77	.31	.27	-			
g. WO1 to CWO5	96	4.45	.66	.38*	.62***	.57***	.11	.07	.20	-		
Work center												
a. Airframes	914	3.90	.87	-								
b. Avionics	1,445	3.92	.93	.02	-							
c. Flight line	430	3.87	1.0	.03	.05	-						
d. Ordnance	1,212	4.04	.84	.14	.12	.17	-					
e. Power plants	759	3.81	.99	.09	.11	.06	.23***	-				
f. QA	346	3.77	.99	.13	.15	.10	.27**	.04	-			
g. Survival	481	3.91	.92	.01	.01	.04	.13	.10	.14	-		
h. Maint Control	442	4.06	.85	.16	.14	.19	.02	.25*	.29*	.15	-	
i. Other	933	4.06	1.0	.16	.14	.19	.02	.25***	.29**	.15	0.0	-
Primary Shift												
a. Day check	4,425	3.99	.93	-								
b. Night check	2,537	3.86	.94	.13***	-							
Status												
a. Regular	6,081	3.93	.94	-								
b. Active Reserve	529	3.89	1.0	.04	-							
c. Drill Reserve	352	4.22	.72	.29***	.33***	-						

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 Analysis of Variance (ANOVA)
Scheffe's multiple comparison test, Bartlett's test for equal variance

In general, there are statistically significant means differences regarding safety climate assessment amongst different rank, experience and authority cohorts. Safety climate assessment tends to positively correlate with an increase in rank, experience and authority.

Military Rank and Authority

Junior officers have lower safety climate assessment than their senior officer counterparts in both Navy and Marine Corps aviation units (Tables 6.1 and 6.2). Both cohorts have similar means and the differences between rank categories (junior vs. senior officers) are similar in both size and direction. Senior officers in these aviation units tend to be leaders (policy makers) and managers while junior officers are the followers when it comes to unit policies and programs. Senior officers tend to be strong advocates for unit policies on two levels. First, they have been members of the formal organization (Navy or Marine Corps) longer than their junior officer counterparts. In an all volunteer force, this means they have chosen to remain within the organization. This implies a certain organizational self-selection, meaning those individuals who oppose organizational policies that have an adverse effect on safety might leave the organization over time while those who feel the organization fulfills their needs or promotes their priority for safety might naturally decide to stay. These are broad generalizations and not all officers, either junior or senior, have a priority for safety. This correlation between rank and safety climate assessment is consistent with researchers who suggest a correlation between climate and certain satisfactions that can be derived from the influence of organizational climate including achievement, affiliation, power and job satisfaction (Litwin and Stringer, 1968).

A second explanation might be that senior officers are empowered to influence, shape or change local safety policies and procedures to fit their management and leadership priorities. Policy makers struggle with objectivity when asked to evaluate the programs they are responsible for implementing. With an almost prophetic bias, senior officers believe their policies are working while junior officers are more inclined to be critical of those things they have had little responsibility in creating. This intuitive and yet critical finding has significant implications for crafting a mishap reduction policy that might actually work, i.e.

elevate safety climate. First, the mishap reduction policy must be based upon empirical evidence and data that cannot be influenced by the subjective bias of senior policy makers motivated to be their very own policy advocates. Second, senior officers must acknowledge the safety climate assessment difference between them and their junior officer squadron mates acknowledging the critical importance of trying to ascertain why the shared perceptions among a sizable and influential component of the overall unit is lower than their own.

The same rationale applies to the authority demographic which highlights the distinction between officers serving as Department Heads (DH) and those not in a department head billet. The department head mean for safety climate assessment is statistically higher than the non-department head mean in Navy units. This is not the case with Marine Corps units. Among the Navy cohort, this finding is consistent with the rank demographic because department heads are traditionally senior officers, typically holding the rank of Lieutenant Commander (O-4). There are exceptions to this rule in the Navy which requires a brief explanation. In some operational F-18 squadrons, senior Lieutenants (O-3) can serve as a DH. This occurs when manpower shortages have a unit manned below their O-4 multiple or when a Lieutenant demonstrates exceptional leadership acumen and the Commanding Officer is accelerating the individual’s professional development and career timeline. These exceptions are rare and would not exist in large enough numbers to influence the assessment gap noted between demographic groups.

The Marine Corps data is quite interesting. While a statistically significant safety climate assessment means difference exists between junior and senior officers, safety climate assessment between DHs and their non-DH counterparts are almost identical (4.32 vs. 4.35). Two explanations seem plausible. First, junior officers serve as DHs more frequently in Marine Corps squadrons than their Navy counterparts. Marine Corps promotion to Major (O-4) is traditionally 12-18 months behind a Navy counterpart who was commissioned on a similar date. Because tour lengths and professional assignment timelines are similar within the two sea services, aviators are serving in their DH tours during the 10 to 12.5 year point from service commissioning date (Navy Personnel Command, 2005). Fiscal year 2007 promotion zone predictions to Lieutenant Commander is 9 years and 10 months (Navy Personnel Command, 2006) while Marine Corps promotion plans to the rank of Major are a full one-year later (Marine Personnel Plan, 2006).

Second, command relationships between COs/XOs and DHs are considerably more formal in USMC units than they are in their USN counterparts. While difficult to assess empirically, USMC units are a bit more regimented and particular about rank structure and this is reflected in the professional relationships between these two management groups. This suggests perhaps that DHs in USMC units enjoy less familiarity with their senior’s motivations and intentions when formulating policies that might influence a unit’s climate. With less professional intimacy on planning and leading matters, USMC DHs might be more aligned perceptually with their JO counterparts explaining the near identical climate assessment.

Both USN and USMC enlisted survey groups show a unique safety climate assessment trend in Tables 6.3 and 6.4. There exists a statistically significant difference in safety climate assessment means between the most junior cohort (E-1 to

E-3) and the mid-grade enlisted survey group (E-4 to E-5) that in all likelihood can be attributed to several organizational factors including work hours, stress and time on the job (Pflantz, 2006). Most E-4s and E-5s are still on their first enlistment and are serving in their first operational unit assignment. As their rank increases, so does their job responsibility which also correlates directly with longer work hours (by practice, not policy). Also, these mid-grade enlisted technicians are striving to flex their management and decision-making muscle while still feeling the restriction of being junior personnel. Very few members in this E-4 to E-5 peer group are serving as anything higher than a maintenance team leader or shift supervisor. This burden to perform more complex tasks without a commensurate rise in authority can cause frustration, potentially leading to a more critical assessment of senior management and supervisors (the "only if I could do it my way" syndrome). Second and third tour technicians in the E-6 to E-7 rank category have a much higher safety climate assessment due to an amelioration of all the supervisory and management challenges facing the E-4 to E-5 cohort. They have enjoyed both a formal and informal rise in decision making authority and their elevated safety climate assessment seems to be more in line with the explanation offered for the elevated assessment in the DH cohort.

Because the enlisted participants in the MCAS survey responded to a different question regarding safety climate assessment, care is taken when comparing the officer and enlisted cohort. Overall, the enlisted safety climate assessment means are lower than the officer cohort while there is a close similarity between aviation officers and their maintenance officer counterparts. It certainly appears that where one exists in the military (organizational hierarchy) seems to influence directly one's perception of the safety climate in their particular unit. While certain units might have a particularly positive emphasis or focus on improving safety policies and procedures, it seems as if there exists some organizational influences on climate that are unique to these particular types of units. What seems consequential is the fact that safety climate assessment has high predictability when it comes to the demographic constructs of military rank and organizational authority and that most leaders have a significantly higher perception of safety climate than their followers.

Flight Experience

Tables 6.1 and 6.2 reveal a safety climate assessment non-linearity for aviators' experience level similar to the rank inconsistency among maintenance technicians. Young aviators, those with less than 500 hours of flight experience baseline safety climate assessment means at 4.35 and 4.32 respectively for USN and USMC members. There exists a subsequent reduction in means for the next experience category (≥500 and <1000 hours) followed by a linear increase among the remaining experience categories. This safety climate assessment drop is likely attributable to the tenure explanation offered in the previous section with potentially some additional explanations. The first two flight experience categories are transitioned by first tour aviators, with the 500 hour barrier broken sometime around the mid-point of a member's first tour. It is around this time that a young aviator starts to question the rationale and justification for certain policies and procedures. Prior to that, they were typically consumed with the challenge of operational flying, particularly on and off an aircraft carrier. Once their comfort level increases and they start getting more flight authority (like being designated a formation leader or a section leader), young aviators start to analyze unit policies that might influence their perception of the safety climate (i.e. crew selections, mission assignments, currency requirements, advancement and promotion policies, etc.). These generalizations are broadly defined and certainly vary based upon a variety of factors. Anecdotally, some might suggest that novice aviators do not know any better during the initial phase of their first tour and it is not until some of the initial challenge wears off that young pilots and NFOs begin a more critical assessment of unit operations including safety relevant leadership decisions.

Many aviators, particularly those flying military high performance aircraft have a great mortality revelation sometime during their first tour (the powerful recognition that flying can kill you). This revelation entails a vivid realization of the dangers of their chosen occupation and a reaction that invites the close discrimination of the policies and procedures that directly influence their assessment of their personal survival and safety. This typically happens midway during the first tour and aligns nicely with the means perturbation displayed in the tables above. When one questions their basic needs such as safety and survival, the environment within which they are asked to function is often called into close discriminating question.

The more experienced flight categories show a nice linear trend with the most experienced aviators demonstrating the highest safety climate assessment. More flight experience correlates directly with higher rank and authority which therefore shares the previously explained justifications for such an association. The self selection phenomenon is also potentially applicable. The all volunteer force culls out many disenfranchised aviators and attrites marginal performers through performance appraisals, voluntary resignations and Field Naval Aviator Evaluation Boards (FNAEB). Therefore, the preponderance of highly experienced aviators have performed at an exceptional level, have embraced the organizational programs that govern flight operations and safety, and are now serving in positions of responsibility and authority; all attributes that correlate directly with higher rates of safety climate assessment.

Reserve Personnel

Marine Corps reserve aviators, both drilling officers and those recalled to active duty, have a higher safety climate assessment than their active duty counterparts. This finding is consistent with the parent command data which reveals a safety climate assessment mean in the reserve wing (MAW4) significantly higher than the remaining three active duty wings. Navy reserve officers do not show a similar trend and there is not a reserve component represented among the Navy's parent commands. Explaining this finding is difficult because comparing reserve and active duty units is subject to many distinct variations. Drilling members serve one weekend a month and two weeks a year on active duty while their active duty counterparts are full-time unit members. Drill officers have civilian full-time jobs with a sizable component serving as civilian commercial airline pilots. Comparing these cohorts lacks measurable control although it is not unreasonable to conclude that job satisfaction might be a valid predictor of higher safety climate assessment. Drill officers serve voluntarily and get enormous pleasure from flying military aircraft on a part-time, almost hobby-like basis while their active duty counterparts endure the challenge of cyclical deployments, family separation and high work tempo. This factor has significantly changed in recent years with a high level of active duty force activation for reserve members due to the war on terror (particularly Afghanistan and Iraq).

This explanation fails to explain why recalled to active duty aviators have a higher safety climate assessment than their active duty counterparts. Two reasons seem plausible. One, the majority of recalled officers are junior officers who may be either in civilian job transition (waiting to be hired or just recently furloughed from a commercial airline), volunteers of reserve duty or volunteers of activation, and/or members who regret their active duty separation decision (miss flying jet aircraft). Activation is perceived by some as a desirable hiring, a paycheck which equates to higher morale and job satisfaction. Second, the reserve components tend to self-select those who were not completely disdainful of active service but had a mitigating reason to leave active service. For many it was family separation which can be softened by an agreement to be activated for a predictable and finite period of time. This recalled cohort is comprised traditionally of those aviators who love tactical flying but decided to leave active service due to personal, not professional reasons. While these generalizations might not align completely with intuition, there is ample statistical evidence to support acknowledging a means difference between active duty and reserve USMC aviators. It is interesting to point out that this difference also exists among USMC enlisted personnel but not among USN personnel. It might stand to reason that activation as a tactical pilot plausibly provides similar job satisfaction (both professional and financial) compared to activation as an USMC enlisted maintenance expert.

Work center

The final demographic that yields significant safety climate assessment means differences is work center for the MCAS cohort as shown in Tables 6.3 and 6.4. The work center demographic is not applicable to the officer group. Maintenance Control has the highest means for both enlisted groups. Not surprisingly, this work center is the management and oversight center for all squadron maintenance operations and is consequently manned by the most senior enlisted maintainers in the squadron and run by the most senior enlisted personnel. These two factors explain the high level of safety climate perception since it is this organization that is evaluating its very own policies, programs and procedures.

The ordinance work center, responsible for the preparation, loading, arming and de-arming of all ordinance and ordinance related equipment has the next highest perception of the organizational safety climate. Besides being somewhat reassuring, this work center must have some organizational qualities that distinguish it from the other work centers. Perhaps it can be attributed to the nature of their job specialization. Working with ordinance requires safe guards, team confidence, technical competency and trust besides all the other qualities necessary to operate effectively in a high risk military organization. None of the previous demographic explanations apply such as rank, tenure, experience or authority. The fleet ordinance work center is manned with the same distribution of enlisted manning as any other maintenance work center (i.e. rank, authority, etc.). Potential explanations will be explored in Phase 2 but suffice it for now to acknowledge that there exists a quantifiable elevated safety climate in both USN and USMC ordinance work centers.

Finally, the Quality Assurance (QA) work center in USN units has an elevated safety climate while it does not in the USMC units. Formally, the QA work center works directly for the Maintenance DH and not the Maintenance Control supervisor or the Maintenance/Material Control Officer (MMCO) (OPNAVINST 4790.2J, 2005). Informally, the QA work center often answers directly to MC, mirroring the attitudes and perceptions of that work center (essentially becoming safety program advocates). This explains the distinction between USN and USMC units. In the Navy, the QA work center is typically manned by senior enlisted personnel who become the agents of the Maintenance/Material Control Chief (MMCPO). They look to the MMCPO for both operational guidance and professional advocacy and venerate his/her position because of organizational nepotism. This explains the similarity between MC and QA perceptions of safety climate.

In the Marine Corps, QA operates in a more traditional role embracing the value of impartial and unfettered monitoring of squadron maintenance and operations remaining uninfluenced by or protected from, senior maintenance department leaders. Therefore, USMC QA work centers have a lower safety climate assessment than their MC counterparts and their safety climate assessment mean is in line with the other departmental work centers.

Safety Program Best Practices and Safety Climate

Logistic regression analysis was performed on the four Phase 1 data sets using the variables described in Chapter 5. Logistic regression allows for regression modeling of the categorical (dummy) dependent and predictor variables described in Chapter 5. Statistical analysis was conducted to reveal significant predictors (independent variables) of safety climate (dependent variable) from the CSA and MCAS secondary data sources. The data tables in this chapter show abridged results presenting only those predictor variables with statistically significant marginal effects greater than 5%. The modeling technique was exploratory and methodical in nature meaning additional independent variables were added after subsequent iterations in an effort to improve the model's predictive power. With such a variable rich data set, the researcher endeavored to build a parsimonious model excluding variables that did not have policy relevance or did not add to the model's coefficient of determination, R^2.

Analyzing the Officer (Aviator) Cohort

Tables 6.5 and 6.6 show the regression results of the CSA data analysis using *safetyclimate_1* and *safetyclimate_11* as the dependent variable. Similar modeling was done for the *safetyclimate_2* and *safetyclimate_3* variable sets.

Table 6.5 Regression Results CSA Survey (USN/VFA)

	Model (1) safetyclimate_1	**Model (2)** safetyclimate_11	**Model (3)** safetyclimate_1	**Model (4)** safetyclimate_11
Independent Demographic variables				
FRS	0.003	-0.103	0.001	-0.091
	(0.394)	(0.033)*	(0.867)	(0.056)
Independent Organizational Variables				
reportviolations	0.003	0.241	-0.000	0.212
	(0.457)	(0.000)**	(0.915)	(0.001)**
humanfactorboard	0.003	0.218	0.002	0.216
	(0.371)	(0.000)**	(0.305)	(0.000)**
planning	0.008	0.537	0.002	0.536
	(0.036)*	(0.000)**	(0.424)	(0.000)**
communication_1	0.048	0.242	0.006	0.155
	(0.000)**	(0.015)*	(0.130)	(0.166)
leadership_1	0.013	0.146	0.003	0.099
	(0.004)**	(0.009)**	(0.250)	(0.082)
motivation_1	0.042	0.158	0.026	0.136
	(0.000)**	(0.000)**	(0.000)**	(0.003)**
# of variables	29	29	41	41
Respondents	1783	1783	1783	1783
Pseudo R2	.60	.37	.68	.38

n=1783. Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
safetyclimate_11: respondents ***strongly agreed*** to safety climate statement (CSA42)
Robust p-values, * significant at 5%; ** 1%. dprobit results. Coefficients indicate marginal effects.

Table 6.6 Regression Results CSA Survey (USMC/VMFA)

	Model (1) safetyclimate_1	**Model (2)** safetyclimate_11	**Model (3)** safetyclimate_1	**Model (4)** safetyclimate_11
Independent Organizational Variables				
reportviolations	0.011	0.160	0.000	0.113
	(0.159)	(0.013)*	(0.891)	(0.083)
motivation_1	0.031	0.250	0.003	0.220
	(0.001)**	(0.000)**	(0.269)	(0.000)**
consequence_1	-0.002	0.206	-0.001	0.205
	(0.649)	(0.000)**	(0.604)	(0.000)**
# of variables	29	29	41	41
Respondents	1160	1160	1160	1160
Pseudo R2	.60	.37	.68	.38

n=1783. Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
safetyclimate_11: respondents ***strongly agreed*** to safety climate statement (CSA42)
Robust p-values , * significant at 5%; ** 1%. dprobit results. Coefficients indicate marginal effects.

Tables 6.5 and 6.6 reveal those statistically significant predictor variables that were verified by the regression results of either *safetyclimate_2* or *safetyclimate_3*. Only those variables that had a similar modeling result using either the secondary or tertiary dependent variable are included in the tables above. This was done to give the researcher additional confidence in the results of the primary model. As can be seen from the data, only one demographic variable, Fleet Replacement Squadron (FRS) is a statistically significant predictor of safety climate assessment and that is only among the USN cohort (Table 6.5, Model 2). While the pseudo R^2 equals .37 in model (2) of each data set, care should be taken when interpreting this result. Contrary to Ordinary Least Squares (OLS) regression, which provides an R^2 value than can be interpreted as an estimate of explained variation, the same cannot be said in a maximum likelihood regression. STATA documentation warns against using pseudo R^2 in formal write-ups of results. The idea of a pseudo R^2 came from economists who wanted some rough measure of explanatory power of the model. Therefore, it is really just a guide for fitting models. A small pseudo R^2 should make a researcher question the model's explanatory ability, but a big pseudo R^2 should not be considered a research panacea. This is particularly true when using continuous *y* (dependent) variables although this is not the case with this data set (Hamilton, 2004).

Since the dprobit logistic regression routine yields marginal effects, this variable’s coefficient (-0.103) can be interpreted as follows. Officers in the FRS are 10.3 percent less likely to strongly agree with the safety climate assessment statement (CSA42) in the CSA survey than officers in other types of units (all else being equal). The remaining organizational variables can be interpreted the same way but rely on a review of the survey statement that generated them for clarity. For example, the dummy variable *reportviolations* was generated from CSA11, *"Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions."* From model (2) in Table 6.5, one could interpret the coefficient (.241) as, officers who agree or strongly agree with CSA11, are 24.1% more likely to strongly agree with the safety climate assessment statement (CSA42) than those officers who neither agree or strongly agree with CSA11. This suggests that if one believes their organizational cohorts are willing to report safety violations, they perceive their safety climate as higher (i.e. 25 percent more likely to either agree or strongly agree with CSA42) than those who think their organizational cohorts are not as willing to report this type of unsafe behavior.

The remaining variables can be interpreted in the same manner. It is interesting to note that the high percentage correlations occur among the "strongly agree" safety climate assessment variables (*safetyclimate_11*). One way to interpret this is that officers who have an extreme opinion about the independent variable (those who either strongly agree or strongly disagree as opposed to those who have either a moderate opinion about the statement or don't know), tend to have a similarly aligned opinion about the safety climate in their unit. However, safety climate seems to be one of those organizational dimensions that tends to get a mainstream (positive) assessment from the population majority and requires a careful examination of extremes (strongly agree or disagree) to analyze organizational predictors that might correlate with an atypical assessment.

For the Navy and Marine Corps officer/aviator cohort, 30 dummy variables were created as independent predictors of safety climate assessment while 16 of those dummies were used to model the specific policy interventions outlined in the Navy's mishap reduction strategy (FRP). Excluding the demographic predictors, only 6 organizational variables correlate with elevated safety climate assessment for the Navy data set and only 3 variables correlate for Marine Corps aviators. One of these variables, CSA8 is in the PA (Process Auditing) factor set; 2 variables, CSA11 and CSA17 are in the RA (Rewards System) factor set; one variable, CSA26 is in the RM (Risk Management) factor set; and 3 variables, CSA41, CSA47 and CSA50 are in the CC (Command and Control) factor set. Of the 16 prescribed "leadership best practices" outlined in the FRP, only 4 organizational variables positively correlate with elevated safety climate assessment in the Navy and only 2 correlate in the Marine Corps. Based upon a five-year sample of secondary data, it appears that only 25 percent of the prescribed mishap reduction interventions seem to have the desired policy outcome for the Navy and only 12.5 percent for the Marine Corps. Table 6.7 summarizes these results.

Table 6.7 Interventions Associated with Elevated Safety Climate (CSA)

Organizational Variable	CSA #	Service	Factor	Survey Statement
humanfactorboard	CSA8	USN	PA	*Human Factors Boards have been successful reducing chances of an aircraft mishap due to high-risk aviator.*
reportviolations	CSA11	USN USMC	RA	*Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions.*
consequences	CSA17	USMC	RA	*In this command, an aviator who persistently violates flight standards and rules will seriously jeopardize his/her career.*
communication_1	CSA41	USN	CC	*Command leadership is successful in communicating its safety goals to unit personnel.*
leadership_1	CSA47	USN	CC	*Command leadership reacts well to unexpected changes to its plans.*

CSA survey data
Factors: PA (Process Auditing), RA (Rewards System), RM (Risk Management), CC (Command & Control).

Using the leadership style assessment guidance outlined in Chapter 5, each organizational variable in Table 6.7 reveals a principal leadership style component. The variable *humanfactorboard* has a distinctly transformational component because this particular leadership intervention shows concern for an individual's welfare and professional development. While historically considered a primary attrition method, human factor boards are far from that today. These boards provide exceptional support to individuals in need of performance remediation, professional development advice, and personal advocacy. *Reportviolations,* albeit a factor grounded in concern for safety and individual welfare, also reflects a transactional arrangement between those who observe unsafe behavior and the reciprocity for reporting such an observance. Followers are generally rewarded for this type of individual effort and the focus of this intervention is the accomplishment of the immediate job at hand. *Consequences* follows a similar transactional arrangement between the follower who violates a known organizational procedure and the predictability (or certainty) of a substantial consequence. While follower concern is a factor, the leadership intervention that imposes consequences for violating flight standards is concerned primarily in unit objectives and short term goals. *Communication_1* and *leadership_1* are primarily transformational factors. Each focuses on individual consideration and attempts to expand the follower's needs by facilitating open communications and managing job and schedule uncertainties.

In an effort to validate these findings, logistic regression was conducted on the 11 factor variables derived for each CSA survey cohort described in Chapter 5 as predictors of safteyclimate_1. Tables 6.8 and 6.9 show the statistically significant results of this analysis for both the Navy and Marine Corps cohort.

Table 6.8 Regression Results, CSA Factor Analysis (USN)

Factor Analysis Variables	Model 1 safetyclimate_1
RM1 (Risk Management 1)	0.004
	(0.020)*
RM2 (Risk Management 2)	-0.009
	(0.000)**
CC1 (Command & Control 1)	0.009
	(0.000)**
# of Factors	11
Respondents	1783
Pseudo R^2	.53

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
Robust p values in parentheses
* significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 6.9 Regression Results, CSA Factor Analysis (USMC)

Factor Analysis Variables	Model 1 safetyclimate_1
PA1 (Process Auditing 1)	0.009
	(0.025)*
RM3 (Risk Management 3)	-0.020
	(0.000)**
CC1 (Command & Control 1)	0.016
	(0.000)**
# of Factors	11
Respondents	1160
Pseudo R^2	.39

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
Robust p values in parentheses
* significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

As described in Chapter 5, caution should be exercised when correlating certain factors to specific policies variables when using factor analysis in social science research. Attributing factor analysis results to organizational policies can be misleading and can present a slippery "analytical" slope. Value is gained by comparing factor analysis with the empirical results of regression techniques using policy specific variables and evaluating generalizations that either verify or contradict those results. Interpreting the results of logistic regression, when using factor variables, is equally difficult. Table 6 .8 shows, for example, that a 1 unit increase in the RM1 factor score will increase the likelihood of a respondent either agreeing or strongly agreeing to the safety climate assessment survey statement by .4 percent (a 1 vice a 0 dummy score). While the influence of this factor may not seem large, it was derived by creating a principle component that considers risk management across a broad spectrum of organizational actions. Additionally, this factor considers the interaction effect amongst a variety of variables, many which either enhance or diminish the combined influence of certain organizational actions that have a risk management component along with a multitude of other functional components. There is evidence that suggests the principle components RM1, PA1 and CC1 correlate positively with safety climate assessment among the CSA cohort. This is consistent with the "best practices" analysis that reveals 2 of the Navy's 5 highly correlative policy interventions came from the CC factor and that all three of the Marine Corps' came from the RM category.

The RM correlation for both the Navy and Marine Corps is negative however. This should not be interpreted directly, postulating that risk management causes a reduction in safety climate assessment. RM has several principal components and it is the second and third components that correlate negatively with safety climate assessment. In the CSA instrument, 4 of the 13 questions are negatively phrased, meaning a higher opinion choice correlates with a lower assessment of the organizational function or policy in question. For example, CSA23 states, "*Command leaders permit cutting corners to get a job done*." To agree or strongly agree with this survey statement would intuitively imply a lower safety climate assessment. The correlation in Tables 6.8 and 6.9 seem to reflect at least a portion of this negative relationship with the risk management principle component.

A second explanation will be further investigated in Phase 2. This explanation involves an investigation of the potentially negative influence that certain risk management policies may have on a unit member's assessment of the safety climate in his or her squadron. The risk management functions surveyed in the CSA instrument deal with broad matters of manning, budgeting, training, and equipping and the management challenge of risk identification and assessment. It is hypothesized that there are certain aspects of the latter component, risk identification and assessment that might retain a negatively correlative component when related to safety climate assessment. Certain risk management techniques have become highly intrusive and may potentially have a transition point where they become counter-productive and damaging to individual self-esteem and job satisfaction; two components that are presumed to be highly predictive of safety climate assessment.

Analyzing the Maintenance Cohort

Tables 6.10 and 6.11 show the regression results for the MCAS data sets using *safetyclimate_1* as the dependent variable. Similar modeling was done for the *safetyclimate_2* and *safetyclimate_3* variables.

Table 6.10 Regression Results MCAS Survey (USN/VFA)

	Model (1) safetyclimate_1	**Model (2)** safetyclimate_1	**Model (3)** safetyclimate_1	**Model (4)** safetyclimate_1
Independent Demographic Variables				
E4_to_E5	-0.024	-0.024	-0.028	-0.022
	(0.009)**	(0.006)**	(0.003)**	(0.012)*
nightcheck	-0.021	-0.020	-0.018	-0.018
	(0.004)**	(0.007)**	(0.013)*	(0.013)*
ashore	0.029	0.028	0.027	0.024
	(0.004)**	(0.006)**	(0.009)**	(0.016)*
avionics	-0.049	-0.055	-0.063	-0.057
	(0.003)**	(0.001)**	(0.000)**	(0.001)**
Independent Organizational Variables				
tolerance	0.095	0.082	0.075	0.070
(MCAS14)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
training	0.071	0.047	0.047	0.038
(MCAS35)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
planning_1	0.139	0.101	0.098	0.096
(MCAS1)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
respect_1	0.071	0.051	0.048	0.041
(MCAS16)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
leadership_1	0.076	0.043	0.033	0.033
(MCAS23)	(0.000)**	(0.000)**	(0.001)**	(0.001)**
# of variables	38	45	49	52
Respondents	14242	14242	14242	14242
Pseudo R2	.42	.44	.45	.45

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (MCAS7)
Robust p-values in parentheses; * significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 6.11 Regression Results MCAS Survey (USMC/VMFA)

	Model (1) safetyclimate_1	**Model (2)** safetyclimate_1	**Model (3)** safetyclimate_1	**Model (4)** safetyclimate_1
Independent Demographic Variables				
E4_to_E5	-0.040	-0.038	-0.038	-0.035
	(0.001)**	(0.002)**	(0.003)**	(0.005)**
E6_to_E7	-0.069	-0.062	-0.064	-0.057
	(0.000)**	(0.001)**	(0.001)**	(0.003)**
daycheck	0.022	0.028	0.027	0.026
	(0.057)	(0.015)*	(0.020)*	(0.026)*
MAW_4	0.052	0.040	0.040	0.042
	(0.026)*	(0.098)	(0.101)	(0.084)
ashore	0.113	0.067	0.067	0.067
	(0.004)**	(0.086)	(0.079)	(0.078)
overseas	0.078	0.043	0.042	0.041
	(0.014)*	(0.206)	(0.206)	(0.210)
Independent Organizational Variables				
tolerance	0.105	0.090	0.085	0.083
(MCAS14)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
planning_1	0.150	0.108	0.102	0.103
(MCAS1)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
respect_1	0.089	0.062	0.057	0.056
(MCAS16)	(0.000)**	(0.000)**	(0.000)**	(0.000)**
leadership_1	0.094	0.057	0.043	0.045
(MCAS23)	(0.000)**	(0.000)**	(0.005)**	(0.004)**
# of variables	36	43	47	50
Respondents	7117	7117	7117	7117
Pseudo R2	.40	.42	.43	.43

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (MCAS7)
Robust p-values in parentheses; * significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Tables 6.10 and 6.11 reveal those statistically significant predictor variables that were verified by the regression results of either *safetyclimate_2* or *safetyclimate_3*. Only those variables that had a similar modeling result using either the secondary or tertiary dependent variable are included in the tables above. Similar to the CSA cohort, this was done to give the researcher additional confidence in the results of the primary model. As can be seen from the data, there are several demographic variables that are statistically significant predictors of safety climate assessment among both the Navy and Marine Corps maintenance cohort. Demographic coefficients are interpreted relative to the categorical variable that was omitted from the model. Referencing the USN/MCAS model 1, the E-4 to E-5 enlisted cohort is 2.4 percent less likely than the E-1 to E-3 cohort (the rank dummy variable omitted from the model) to agree or strongly agree with the safety climate assessment survey statement (MCAS7). This is consistent with the Marine Corps model and in addition, the E-6 to E-7 cohort shows a similar trend and is consistent with the means analysis shown in Tables 6.3 and 6.4.

Navy night check maintenance technicians are almost 2 percent less likely to have a positive safety climate assessment compared to their day check counterparts while the Marine Corps disparity is almost 3 percent. This finding is also consistent with previous means analysis. Sailors serving in shore-based units are 3 percent more likely to have a positive safety climate assessment than their sea-based (afloat) counterparts while the Marine Corps difference between these two groups is over 11 percent. The difference between Marines serving overseas and those serving afloat is almost 8 percent.

Work center assignment is highly correlative with safety climate assessment among the Navy cohort while this is not necessarily the case among Marines. For Navy maintenance experts, assignment to a technical (production) work center predicts a lower assessment than those maintainers assigned to Maintenance Control. Table 6.10 shows that members of the avionics work center are about 5 percent less likely to have a positive safety climate assessment than their maintenance control counterparts. Although not included in Table 6.10, this correlation is similar for every production work center. The Quality Assurance branch does not correlate. Marines assigned to the reserve air wing, MAW4, are over 5 percent more likely to have a favorable safety climate assessment than their fellow Marines serving in MAW1.

The modeling results (coefficients) for the organizational variables can be interpreted like those in the CSA cohort. For example, Navy MCAS respondents who deem unprofessional behavior is not tolerated in their command (agree or strongly agree with MCAS14, the *tolerance* dummy) are almost 10 percent more likely to have a positive safety climate assessment than those respondents who have a neutral, negative or inconclusive response (all else being equal). This correlation might equate to organizational programs, policies or procedures that monitor and mitigate behavior at all levels that does not conform to some institutional standard. Bear in mind, the question refers to behavior in general, and is not specifically tied to behavior that has some safety related component. A survey participant may respond to this statement considering social, professional, ethical or financial behavior rather than behavior that might jeopardize the safety of a particular unit member.

The remaining variables can be interpreted in the same manner. It is interesting to note that contrary to the CSA cohort, high percentage correlations for the MCAS cohort occur with the "agree" or "strongly agree" safety climate assessment dependent variables (*safetyclimate_1)* as opposed to the "strongly agree" dependent variable, *(safetyclimate_11)*. One explanation may be that the MCAS cohort, comprised primarily of enlisted respondents, is more honest (or objective) in reporting their opinions on organizational attributes meaning the mainstream tendency is not to naturally align with an elevated (agree) climate assessment as is the baseline with the officer cohort. Perhaps officers feel obligated to report more positive unit evaluations than their maintenance counterparts because by organizational structure alone, they retain certain codified responsibilities for shaping the very attributes they are being asked to evaluate. It is clear from means analysis, that the MCAS cohort has significantly lower safety climate assessment means than the CSA cohort. Finally, it should be emphasized that both cohorts responded to different survey statements that were used to generate the safety climate variable. This discrepancy was resolved in the Phase 2 instrument and both cohorts responded to an identical safety climate assessment statement.

For the Navy and Marine Corps maintenance cohort, 29 dummy variables were created as independent predictors of safety climate assessment while 14 of those dummies were used to model the specific policy interventions outlined in the Navy's mishap reduction strategy (FRP). Excluding the demographic predictors, only 5 organizational variables correlate with elevated safety climate assessment for the Navy data set and 4 variables correlate for Marine Corps maintainers. One of these variables, MCAS1 is in the PA (Process Auditing) factor set; 1 variable, MCAS14 is in the RA (Rewards System) factor set: MCAS16 is in the QC (Quality Control) factor set; MCAS23 is in the RM (Risk Management) factor set and the fifth variable, MCAS35, is in the CC (Command and Control) factor set. Of the 14 prescribed "leadership best practices" outlined in the FRP, only 3 organizational variables positively correlate with elevated safety climate assessment in the Navy and only 2 correlate in the Marine Corps. Based upon this five-year sample of secondary climate data, it appears only 21 percent of the prescribed policy intervention measures are positively correlated with the policy objective (elevated safety climate) for the Navy and only 14 percent for the Marine Corps. Table 6.12 summarizes these results.

Table 6.12 Interventions Associated with Elevated Safety Climate (MCAS)

Organizational Variable	MCAS #	Service	Factor	Survey Statement
planning_1	MCAS1	USN USMC	PA	*The command adequately reviews and updates safety procedures.*
tolerance	MCAS14	USN USMC	RA	*Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions.*
training	MCAS35	USN	CC	*Safety education and training are comprehensive and effective.*

MCAS survey data
Factors: PA (Process Auditing), RA (Rewards System), CC (Command & Control).

Similar to the CSA cohort, the organizational factors in Table 6.12 have a specific leadership style focus. *Tolerance* (similar to *reportviolations* in the CSA cohort) reflects primarily a transactional arrangement between those who observe unsafe behavior and the reciprocity for reporting such an observance although follower well being is an important element. Followers are generally rewarded for this type of individual effort and the focus of this intervention is the accomplishment of the immediate job at hand. *Planning_1* and *training* are primarily transformational factors. Each focuses on individual consideration and worker well being. Each intervention attempts to expand the follower's needs by facilitating open communications and managing job and schedule uncertainties.

In an effort to validate these findings, logistic regression was conducted on the 6 factor variables derived for the Navy MCAS survey cohort and the 7 factor variables for the Marines as described in Chapter 5. Tables 6.13 and 6.14 show the statistically significant results of this analysis for both the Navy and Marine Corps cohort.

Table 6.13 Regression Results, MCAS Factor Analysis (USN)

Factor Analysis Variables	Model 1 safetyclimate_1
PA1 (Process Auditing 1)	0.081 (0.000)**
RA1 (Rewards System 1)	-0.015 (0.002)**
RA2 (Rewards System 2)	0.047 (0.000)**
QC1 (Quality Control 1)	0.054 (0.000)**
CC1 (Command & Control 1)	0.056 (0.000)**
Number of factors	6
Respondents	14,158
Pseudo R^2	.23

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (MCAS7))
Robust p values in parentheses;* significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 6.13, the Navy MCAS cohort, shows that a 1 unit increase in the Process Auditing factor (PA1) score will increase the likelihood of a respondent either agreeing or strongly agreeing to the safety climate assessment survey statement by over 8 percent (a 1 vice a 0 dummy score). The only principal component that does not correlate with elevated safety climate is Risk Management (RM). The

Rewards System (RA1) has a slightly negative correlation although it is close enough to zero to be considered neutral. Deferring further investigation until Phase 2, there is evidence to suggest that some award programs may have perceptible policy inequities and process flaws; possibly explaining the negative correlation for the RA1 factor.

Table 6.14 Regression Results, MCAS Factor Analysis (USMC)

Factor Analysis Variables	Model 1 safetyclimate_1
PA1 (Process Auditing 1)	0.076 (0.000)**
RA1 (Rewards System 1)	0.016 (0.020)*
RA2 (Rewards System 2)	0.044 (0.000)**
QC1 (Quality Control 1)	0.034 (0.000)**
RM1 (Risk Management 1)	0.025 (0.019)*
RM2 (Risk Management 2)	-0.049 (0.000)**
CC1 (Command & Control 1)	0.051 (0.000)**
# of Factors	7
Respondents	7017
Pseudo R^2	.21

Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (MCAS7)
Robust p values in parentheses;* significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

For the Marines (Table 6.14), all components positively correlate with the exception of Risk Management 2 (RM2). Similar to the explanation for the CSA cohort, risk management programs can interact with other command functions in ways that might actually reduce the perceived safety climate due to mismanagement, over supervision, and/or privacy intrusion. This will be further examined in Phase 2. Factor analysis is a powerful analysis tool, capable of providing utility in exploratory research. It is reemphasized here however, that factor analysis is not empirical proof of cause and effect relationships.

Pre versus post-Policy Analysis

This section analyzes survey data before and after the policy implementation date to evaluate the performance of the Navy's intervention strategy. If safety climate assessment increased after the implementation date, there would be substantial reason to believe the policy caused the desired outcome (controlling for other significant organizational influences). Pre and post-policy means comparison of the safety climate assessment variable was conducted for both cohorts. May 2003 was the date used for DOD policy implementation and April 2004 was when the FRP policy message was released.

Table 6.15 Safety Climate Assessment Means, Pre and Post Policy Comparison

Data Set	pre-May 2003	post-May 2003	pre-Apr 2004	post-April 2004
CSA/USN	4.35 (566)	4.38 (1,217)	4.38 (1,023)	4.36 (760)
CSA/USMC	4.26 (741)	4.46 (412)	4.30 (941)	4.48 (212)
MCAS/USN	3.92 (4,002)	3.94 (10,156)	3.94 (7,221)	3.94 (6,937)
MCAS/USMC	3.89 (2,977)	3.99 (4,040)	3.94 (3,987)	3.95 (3,030)

Means calculated using response to CSA42 or MCAS7
Total respondents in parentheses (n)
May 2003:DOD mandate; April 2004: FRP message release

Table 6.15 shows there was no discernable elevation in safety climate assessment after either the DOD mandate or the Navy's Fleet Response Plan (FRP) and the results are unremarkable for both the aviator and maintenance Navy cohort. The Marine Corps aviator cohort experienced a 0.2 rise in the safety climate assessment means following the DOD policy mandate in 2003 and an almost identical rise following the FRP implementation plan. While both services were subject to DOD's policy mandate, only the Navy cohort was subject to the FRP implementation plan. The maintenance cohort in the Marine Corps experienced a slight means increase following May 2003 but the rise topped out for the remainder of the study.

In addition to means comparison, this researcher conducted logistic regression analysis on the Navy survey data comparing the correlation of predictor variables before and after the DOD policy implementation date. Tables 6.16 and 6.17 compare those significant predictor variables before and after the FRP implementation date for the Navy CSA and MCAS cohort.

Table 6.16 Pre versus Post-Policy Regression Results CSA, USN

	safetyclimate1 pre-policy	safetyclimate1 post-policy	safetyclimate11 pre-policy	safetyclimate11 post-policy
Independent Organizational Variables				
reportviolations	0.000	0.004	0.302	0.218
(CSA11)	(0.981)	(0.185)	(0.005)**	(0.004)**
humanfactorboard	0.003	-0.001	0.231	0.215
(CSA8)	(0.022)*	(0.505)	(0.000)**	(0.000)**
planning	0.001	0.006	0.517	0.553
(CSA26)	(0.618)	(0.013)*	(0.000)**	(0.000)**
communication_1	0.006	0.054	0.323	0.203
(CSA41)	(0.034)*	(0.000)**	(0.034)*	(0.104)
leadership_1	0.008	0.006	0.257	0.090
(CSA47)	(0.028)*	(0.025)*	(0.012)*	(0.159)
motivation_1	0.007	0.045	0.158	0.175
(CSA50)	(0.011)*	(0.000)**	(0.029)*	(0.002)**
# of variables	29	29	29	29
Respondents	566	1217	566	1217
Pseudo R2	.65	.65	.37	.39

n=1783. Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
safetyclimate_11: respondents ***strongly agreed*** to safety climate statement (CSA42)
Robust p-values in parentheses; * significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects

Table 6.17 Pre versus Post-Policy Regression Results MCAS, USN

	safetyclimate1 pre-policy	safetyclimate1 post-policy	safetyclimate11 pre-policy	safetyclimate11 post-policy
Independent Organizational Variables				
planning_1	0.075	0.104	0.025	0.038
(MCAS1)	(0.000)**	(0.000)**	(0.231)	(0.006)**
tolerance	0.063	0.075	0.041	0.067
(MCAS14)	(0.000)**	(0.000)**	(0.019)*	(0.000)**
respect_1	0.056	0.037	0.034	0.055
(MCAS16)	(0.000)**	(0.001)**	(0.087)	(0.000)**
leadership_1	0.061	0.022	0.025	0.001
(MCAS23)	(0.001)**	(0.070)	(0.289)	(0.939)
training	0.038	0.037	0.062	0.037
(MCAS35)	(0.021)*	(0.001)**	(0.001)**	(0.003)**
# of variables	51	51	51	51
Respondents	4007	10212	4007	10235
Pseudo R2	.4057	.4753	.1658	.1645

n=14,242. Survey conducted between November 2000 and June 2005.
safetyclimate_1: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (CSA42)
safetyclimate_11: respondents ***strongly agreed*** to safety climate statement (CSA42)
Robust p-values in parentheses; * significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects

None of the predictor organizational variables emerged as statistically significant among the post-policy cohort that was not significant in the pre-policy cohort. This means that those leadership interventions that elevated safety climate prior to the policy implementation date remained essentially unchanged following FRP implementation.

For the officer cohort, none of the organizational variable coefficients increased (in fact, some decreased) among the post-policy group with the exception of communication_1 which increased its influence on the survey respondent group by 5%. This means that officers who agree or strongly agree that command leadership is successful in communicating its safety goals to unit personnel are 5% more likely to agree their unit's safety climate is high compared to officers who have a lesser assessment of safety communications. This factor was insignificant among the pre-policy cohort. Although a relatively small increase, this could be interpreted as improvement in safety communications, a leadership best practice outlined in the FRP.

Post-policy analysis for the Navy enlisted cohort remains equally unimpressive. None of the organizational factors outlined in the FRP significantly increased their correlative relationship with safety climate assessment while several coefficients (marginal effects) actually decreased. The only organizational variable that showed significant increase among the post-policy cohort is *respect_1*. Enlisted personnel in this group, who agree quality assurance and safety personnel are well respected and are seen as essential to mission accomplishment, are almost 6 percent more likely to strongly agree that their safety climate is very high compared to those members who have a lower assessment of the respect shown for these Sailors. This could be attributed to an increased focus on empowering quality assurance and safety personnel in the post-policy group. Unfortunately, this organizational factor was not included as a best practice in the Navy's FRP.

In general, the leadership best practices outlined in the Navy's FRP plan to reduce preventable accidents and mishaps had minimal statistical influence on elevating safety climate among the officers and Sailors studied using Phase 1 safety climate data. Of the organizational factors that did show positive correlation, few seemed to increase their marginal effect on safety climate assessment when comparing the pre and post-policy cohorts.

Chapter 7: Phase 2 Analysis: Safety Climate and Leadership Interventions

Three specific questions were proposed in Chapter 4 for Phase 2 research that will be investigated using a primary data set designed to collect safety climate data within several high-risk units of interest. Phase 2 of this research plan investigates the relationship between certain organizational variables (both within and outside the scope of an institutionalized safety program) and safety climate. Specifically, do these variables influence members' assessment of safety climate? Second, does leadership style influence a worker's safety climate assessment and finally, is there a measurable relationship between safety climate assessment and organizational performance?

While Phase 1 data analysis focused specifically on traditional policies, programs, and procedures within the formal construct of the Naval Aviation Safety Program, Phase 2 reaches beyond these traditional programs and searches for organizational level influences that might positively influence the safety climate assessment of unit workers. Equally important is assessing the relationship between safety climate perceptions and individual behavior. This phase also focuses on evaluating supervisory practices commonly associated with a specific leadership style and searches for empirical proof of a causal link between safety climate and worker performance.

Squadron Demographics and Safety Climate

The Phase 2 instrument was designed to collect broad demographic information in comparison to the Phase 1 instrument. Therefore, Phase 2 analysis will start with an assessment of both the officer and enlisted cohort evaluating correlations between demographic categories and a respondent's perception of safety climate. As was done in Phase 1, the first step in demographic analysis is to compare the means of variable *y* across categories of variables *x* investigating the null hypothesis that there is no statistical difference between means. In this case, *y* represents the unit's safety climate assessment mean as measured by question #33 in both the officer and enlisted survey and *x* represents the demographic questions asked of each survey respondent in section 1. Because the Phase 2 data set is much smaller than Phase 1, many of the analytical routines (ANOVA) employed to compare means failed Bartlett's test for equal variance. A low Bartlett's χ^2 probability implies that ANOVA's equal-variance assumption is implausible, in which case, ANOVA's *F* test results should not be trusted (Hamilton, 2004).

Means comparison gives a researcher clues about potential correlations and possible cause and effect relationships. This researcher exercises extreme caution when analyzing these associations because of the extremely complicated and interconnected nature of organizations. Tables 7.1 and 7.2 summarize the statistically significant means differences for both cohorts. Complete tables are included in Appendix J. In Table 7.1, the dummy variable name was included in the variable column to help explain the focus of the survey question subjected to means comparison. The numeric correlates with the Likert grading scale (1 equals a respondent who "strongly disagrees" with the survey statement, 2 "disagrees", 3 "neutral", 4 "agrees", and 5 "strongly agrees". Table 7.2 shows there were four demographic, but no organizational variables that had statistically significant means differences because all ANOVA tests failed Bartlett's test for equal variance.

Table 7.1 Safety Climate, ANOVA means comparison (NAS Oceana Officers)

Respondent's assessment of safety climate in unit (Q33) (1-5 Likert scale)						
Demographic Variables	n	Mean	SD	means comparison/statistical significance[1]		
Unit				**a**	**b**	**c**
a. Squadron 1	12	4.5	.52	-		
b. Squadron 2	12	4.25	.45	.25	-	
c. Squadron 3	13	4.8	.44	.27	**.52***	-
d. Squadron 4	15	4.33	.49	.17	.08	.44
Served in Safety Dept				a		
a. Yes	13	4.69	.48	-		
b. No	39	4.38	.49	**.31***		
Organizational Variables						
q38 "rec to friend"				a	b	c
a. 2	1	4.00	0.00	-	-	-
b. 3	5	4.20	.45	.20	-	-
c. 4	16	4.19	.40	.19	.01	-
d. 5	30	4.67	.48	.67	.47	**.48****
q39 "morale"				a	b	c
a. 2	5	4.00	0.00	-	-	-
b. 3	4	4.25	.50	.25	-	-
c. 4	22	4.41	.50	.41	.16	-
d. 5	21	4.67	.48	**.67***	.42	.26
q40 "myopinion"				a	b	c
a. 2	4	4.50	.58	-	-	-
b. 3	7	4.29	.49	.21	-	-
c. 4	26	4.31	.47	.19	.02	-
d. 5	15	4.86	.36	.36	.57	**.55****
q46 "orm"				a	b	c
a. 2	1	4.00	0.00	-	-	-
b. 3	3	4.00	0.00	0.00	-	-
c. 4	27	4.30	.47	.30	.30	-
d. 5	21	4.80	.41	.80	.80	**.50****
q53 "safetyawards"				a	b	c
a. 2	6	4.17	.41	-	-	-
b. 3	15	4.13	.35	.03	-	-
c. 4	22	4.68	.48	.51	**.55****	-
d. 5	9	4.71	.49	.55	.58	.21
q56 "bestpeoplesafety"				a	b	c
a. 2	9	4.00	0.00	-	-	-
b. 3	20	4.50	.51	.50	-	-
c. 4	12	4.33	.48	.33	.17	-
d. 5	11	4.88	.35	**.88****	.38	.55

q63 “prodevplan”				a	b	c
a. 2	7	4.11	.33	-	-	-
b. 3	9	4.42	.51	.31	-	-
c. 4	12	4.41	.50	.28	.01	-
d. 5	24	5.00	0.00	**.89***	.58	.59
q79 “leaderdecide” [2]				a	b	c
a. 1	23	4.74	.45	-	-	-
b. 2	18	4.28	.46	.46*	-	-
c. 3	8	4.25	.46	.49	.03	-
d. 4	3	4.00	0.00	**.74***	.26	.25

[1] absolute value of means difference
[2] negative question, *= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 (ANOVA), Scheffe’s multiple comparison test, Bartlett’s test for equal variance

Table 7.2 Safety Climate, ANOVA means comparison (NAS Oceana Enlisted)

Respondent’s assessment of safety climate in unit (Q33) (1-5 Likert scale)								
Demographic Variables	n	Mean	SD	means comparison/statistical significance[1]				
Unit				a	b	c		
a. Squadron 1	68	4.09	.82	-	-	-		
b. Squadron 2	122	4.05	.88	.04	-	-		
c. Squadron 3	70	4.10	.76	.01	.05	-		
d. Squadron 4	284	3.55	.84	**.53*****	**.50*****	**.55*****		
Work Shift				**a**	**b**			
a. Day check	290	3.83	.91	-	-			
b. Night check	177	3.90	.83	.07	-			
c. Mid check	77	3.48	.75	**.35****	**.42****			
Sleep (Avg. hrs per night)				**a**	**b**	**c**	**d**	**e**
a. <5	74	3.42	.94	-	-	-	-	-
b. 5-6	197	3.77	.90	.35	-	-	-	-
c. 6-7	164	3.85	.83	**.43***	.08	-	-	-
d. 7-8	86	4.09	.78	**.67*****	.32	.24	-	-
e. 8-9	18	3.72	.57	.30	.03	.13	.27	-
f. >9	5	4.20	.84	.78	.43	.35	.11	.48
Job satisfaction				**a**	**b**	**c**	**d**	**e**
a. 1	41	3.44	.95	-	-	-	-	-
b. 2	49	3.35	.80	.09	-	-	-	-
c. 3	99	3.44	.91	.01	.10	-	-	-
d. 4	124	3.82	.74	.38	**.48***	**.38***	-	-
e. 5	151	4.08	.74	**.64****	**.73*****	**.64*****	.26	-
f. 6	80	4.15	.92	**.71*****	**.80*****	**.71*****	.33	.07

[1] absolute value of means difference, *= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 (ANOVA), Scheffe’s multiple comparison test, Bartlett’s test for equal variance

An alternative way to compare means is to abandon the equal variances assumption and conduct a one-way ANOVA with a dichotomous x variable (dummy variable) which is equivalent to a two-sample *t* test. Dummy variables were created for all demographic and organizational predictor variables for both the officer and enlisted cohort. One-way ANOVA testing was completed on each data set to test for differences among safety climate assessment (q33) means and each dichotomous variable. The statistically significant results are presented in Tables 7.3 and 7.4.

Table 7.3 One-way Analysis of Variance (Officer Cohort)

Respondent's assessment of safety climate in unit (Q33) (1-5 Likert scale)				
Demographic Variables	Dummy coefficient	n	mean	SD
unit 3	0	39	4.36	.49
	1	13	4.77	.44
ne	0	37	4.35	.48
	1	15	4.73	.46
safetydept	0	39	4.38	.49
	1	13	4.69	.48
Organizational Variables				
morale	0	9	4.11	.33
	1	43	4.53	.50
orm	0	5	4.00	0.00
	1	47	4.51	.51
safetydata	0	20	4.30	.47
	1	32	4.56	.50
safetyawards	0	23	4.17	.39
	1	29	4.69	.47
mentoring	0	26	4.35	.49
	1	26	4.58	.50
perfjobassignment	0	12	4.25	.45
	1	40	4.53	.51
*leaderdecide**	0	41	4.54	.50
	1	11	4.18	.40

n=52, data collected August 2006
* negative question, Analysis of variance (ANOVA); $p \leq 0.05$

Table 7.4 One-way Analysis of Variance (Enlisted Cohort)

Respondent's assessment of safety climate in unit (Q33) (1-5 Likert scale)				
Demographic Variables	Dummy coefficient	n	mean	SD
Unit 1	0	476	3.76	.87
	1	68	4.09	.83
Unit 4	0	260	4.07	.83
	1	284	3.55	.84
E-3	0	392	3.76	.90
	1	152	3.92	.77
E-4	0	432	3.84	.86
	1	112	3.65	.92
mid check	0	467	3.86	.88
	1	77	3.48	.75
married	0	298	3.74	.89
	1	246	3.88	.84
LPO	0	513	3.79	.87
	1	31	4.06	.89
rural	0	369	3.85	.89
	1	175	3.70	.82
suburban	0	419	3.76	.88
	1	125	3.95	.83
tenure1to2	0	351	3.85	.87
	1	193	3.71	.87
Organizational Variables				
expectedaccidents	0	396	3.93	.83
	1	148	3.47	.90
bestpeoplesafety	0	397	3.69	.88
	1	147	4.11	.77
mentoring	0	292	3.54	.86
	1	252	4.10	.78
leaderpride	0	272	3.60	.89
	1	272	4.00	.80
*leaderdecide**	0	436	3.85	.85
	1	108	3.60	.94

n=544, data collected August 2006
* negative question, Analysis of variance (ANOVA); $p \leq 0.05$

In general, very few of the 32 demographic questions that comprise section 1 of the Oceana survey generate means of *y* that vary significantly across categories of *x* where *y* is the safety climate assessment value (q33) and *x* is a specific demographic category. This is true for both the officer and enlisted cohort.

The first analytical step will be to compare the safety climate assessment means results of Phase 2 with Phase 1. The rank distinction (i.e. senior officers have a higher safety climate assessment than junior officers) among the Phase 1 officer cohort does not bear out in the Phase 2 data although this can probably be explained by the small data set. However, the rank distinction is verified in the Phase 2 data among the enlisted cohort. E-3 personnel have a higher safety climate assessment means when compared to all other enlisted categories while the E-4 cohort is significantly lower than all other ranks. Because Phase 2 data was parsed by each pay-grade as opposed to Phase 1 which combined pay-grades (e.g. E-1 to E-3 or E-4 to E-5), a more specific pay-grade comparison could be conducted. There appears to be much lower perception of the unit's safety climate by Junior Petty Officers (E-4) compared to the other rank cohorts (all else being equal).

For the officer respondents, safety climate assessment in Unit 3 was higher than the other three units and statistically higher than Unit 2. The enlisted data shows Unit 1 with a statistically higher safety climate mean than the other units while Unit 4 has a statistically lower climate means. In compliance with the researcher's agreement to keep any unit identifiable data out of this report, these unit findings are consistent with the data analyzed in Phase1 when referencing unit type (i.e. training unit vs. operational unit). It appears members of training units have a lower (statistically significant) safety climate assessment means than their operational counterparts.

These statistical findings were in fact corroborated during the personnel interviews. Based upon a subjective evaluation of all interview sessions, interviewees in Unit 4 (training unit) had a lower perception of their unit's safety climate compared to Units 2, 3 and 4 (operational units). Referencing the data gathered during the Phase 2 interview process (see Table 5.37), session #4 and #16 were with groups of E-1 to E-3 Sailors from two different units (Units 1 and 4) and interviews #8 and #20 were with E-4 and E-5 personnel also from two different units (Units 2 and 4). Groups #16 and #20 were both from Unit 4. The junior Sailors, E-1 to E-3 were discernibly more upbeat and positive about the safety climate in their units describing the atmosphere as "helpful", "focused", "professional", "tough, but fair", and "much better than the training unit I was previously in". The interviewees were mostly excited about being a part of a real combat unit and were eager to learn more about their technical ratings; in essence, contribute more to the overall productivity of the unit. It was clear from the interviews, that the junior enlisted cohort was all eyes and ears and did not seem to resent the fact that the majority of their work effort was closely monitored and highly supervised. This close supervision was not only expected, but actually appreciated by the new technicians. They seemed to be a very close group, laughing and kidding and referring to each other by their first names during the discussion. There was no tendency for participants to get off topic during the interviews or steer the conversation towards discussing alternative topics (there seems to be a tendency for disgruntled employees to vent to anyone who is willing to listen). In general, this junior cohort (E-1 to E-3) was positive about their current situation and optimistic about their potential (growth, performance, and opportunity) within the organization.

This description above can be starkly contrasted with the 2 interviews conducted with the Third and Second Class Petty Officers (E-4 and E-5) in Unit's 2 and 4. This cohort seemed perceptibly down about their station within the organization responding much more negatively about their assessment of the organization's safety climate. 15 of the 19 Sailors in this cohort were on their second enlistment and 12 of the 19 were in their second duty assignment. This possibly explains why the *tenure1to2* cohort (respondents who have been in the unit, 1 to 2 years) has an assessment mean lower than respondents with higher or lower unit tenure (3.71 vs. 3.85).

When the E-4's and E-5's were asked about their organization's safety climate, some of the responses included "challenging', dangerous", "they care more about airplanes than people", "we're not people, we're machines", "I know more than my supervisor", and "I'm surprised we don't have more accidents". Many seemed frustrated with a perceived inconsistency between their high technical knowledge (proficiency) and their lack of decision-making authority. Many commented they felt as if their supervisor was more interested in his/her own career than the careers' of their workers. This researcher sensed a general lack of camaraderie and company during the group sessions. The interview participants were not very friendly with each other nor did any of them refer to each other by their first names. The discussion about safety climate focused squarely on supervisory priorities. Many considered their supervisor's priorities to be incorrectly aligned with operational performance, productivity and supervisory aggrandizement rather than worker safety and a follower's professional development. The optimism and excitement exuded by the junior Sailors (E-1 to E-3) was replaced among the junior Petty Officers (E-4 to E-5) with a palpable bitterness and indolence. This researcher sensed a general apathy among the interviewees towards their supervisors; a bitterness that seemed to stem from a perceived lack of advocacy and individual sponsorship. Personnel in this pay grade seemed to lack an acceptable level of individual choice or self-determination (agency), with many expressing an inability to capitalize on their individual talents or capabilities (Sen, 2000).

Officers who hail from the northeast (U.S.) have a statistically higher assessment of safety climate (4.73 vs. 4.35) than those officers from other parts of the U.S. In addition, officers who have served in the safety department have a higher mean (4.69 vs. 4.38). The safety department finding is consistent with Phase 1 results. Further research is required to adequately explain the geographic correlation. One possible explanation might be the location of the survey site (east coast, mid-Atlantic), meaning there might be a correlation between unit location and overall job satisfaction. The job satisfaction and safety climate assessment correlation will be further investigated later in this Chapter.

Mid-check enlisted workers have a lower safety climate assessment than their day check and night check counterparts (3.48 vs. 3.86) which is consistent with Phase 1 findings. Night check and day check workers have a similar mean which is counter to Phase 1 findings. This may be attributed to sample size. Mid-check is a transition work shift that starts earlier than night check and ends earlier than night check (every unit has slightly different work shift times). Based upon unit interviews, respondents' generally agreed there was a much lower perception of safety climate during the evening shifts as opposed to the day shifts. In summary, this can be attributed to:

a. Less manning/supervision at night (both external and internal to a work center)
b. The general perception that "less favored" technicians/managers get relegated to night work.
c. Less senior leadership/officer involvement at night
d. Less senior leadership observation opportunity for a night shift worker
e. Less administrative/support services at night
f. Increased environmental hazards (temperature, lighting, fatigue, etc.)
g. The general perception that "no matter what we do, day check will consider it inadequate."

Safety climate assessment means comparison yields several other interesting results regarding the enlisted cohort. Married Sailors have a statistically higher safety climate assessment than their non-married (single, separated, divorced) counterparts (3.88 vs. 3.74). Perhaps the external socio-emotional support married personnel receive from their spouses has a positive influence on organizational perceptions. Also, there is a defined correlation between age and the decision to marry and have children and this family satisfaction is a determinant for retention (Segal & Segal, 2004). Marriage therefore serves as a predictor of positive retention choice, correlating positively with increased age and higher enlisted pay grade. Despite the same work associations and professional relationships as their married colleagues, data suggests a spouse offers a statistically significant (positive) influence on an individual's safety climate assessment.

Sleep rate correlates positively with safety climate assessment for the enlisted work force with a fairly linear increase in assessment as cumulative sleep averages increase per night. There is a significant means difference between workers getting less than 5 hours per night compared to the 6-7 and 7-8 hours per night cohorts (3.42 vs. 3.85/4.09). Sleep values have been studied as a predictor of work attitude, with drowsiness correlating positively with lower attitude assessments towards shift-work (Isra-Golec, 1993). By a relatively non-scientific show of hands, 11 of the 13 First Class Petty Officers, (E-6's) in interview group # 5, and all five Airman (E-1 thru E-3's) in interview group #16 responded in the affirmative when asked if they **did not** get enough sleep at night to accomplish their job safely. Several interview participants commented they were often conflicted having to prioritize sleep ahead of personal commitments because they were cognizant of the dangers of their work environment. Many mid-grade Petty Officers, (E-4 to E-5) held their supervisors accountable for their lack of sleep arguing long shift work and unplanned weekend work forced them to place their personal safety ahead of their personal life (i.e. choosing sleep over recreation, relationships, etc.).

Consistent with Phase 1 findings, Leading Petty Officers (LPOs) have a significantly higher safety climate assessment means than non-LPOs (4.06 vs. 3.79). "Worker", the lowest category on the demographic authority scale, has the lowest means while safety climate assessment increases as authority increases (see Appendix J, Table J.2). This is an extremely significant finding for policy formulation because it reveals that climate perceptions are correlated with individual authority. Therefore, organizational interventions designed to elevate climate must consider the differential nature of baseline climate perceptions and carefully evaluate how leader choice will influence the attitudes and behavior of respective authority groups. Many interviews with junior enlisted seemed to verify this condition. One junior E-3 commented her "supervisor was out of touch and had no clue what her needs were." Another more senior Petty Officer (E-6) said, "…pilots think everything is fine while we're down here barely holding things together."

Enlisted respondents from suburban settings had a significantly higher safety climate assessment than those Sailors from other settings (3.95 vs. 3.76) while Sailors from rural settings had a lower assessment than respondents from other settings (3.70 vs. 3.85). While this correlation requires further research to explain, this researcher suspects there may be a potential association between a respondent's domestic setting and their socio-economic status, a variable that was not sampled in the Phase 2 survey design. Several other demographic variables such as flight experience for officers and work center for maintenance personnel showed comparable trends with Phase 1 findings however the test results were not statistically significant (see Appendix J).

Tables 7.5 and 7.6 display the logistic regression modeling conducted using the demographic predictor variables of section 1 of the Phase 2 instrument and safety climate assessment. Both *safetyclimate* and *safetyclimate1* were used as dependent dummy variables. Only the statistically significant coefficients are displayed. A complete set of regression tables for Phase 2 are included in Appendix K.

Table 7.5 Demographic Regression Results, Oceana Officer (USN/VFA)

	Model (1) safetyclimate1
Independent Demographic Variables*	
unit3 (unit 4)	0.795
	(0.000)**
brancho (co/xo)	-0.585
	(0.003)**
departhd (co/xo)	-0.529
	(0.013)*
single (married)	0.553
	(0.027)*
se (ne)	-0.691
	(0.006)**
midwest (ne)	-0.647
	(0.001)**
urban (rural)	-0.599
	(0.000)**
suburban (rural)	-0.555
	(0.004)**
# of variables	20
Respondents	52
Pseudo R2	.47

Survey conducted August 2006.
* the variable in parentheses is the comparison dummy variable (i.e., the variable left out of the model)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 7.6 Demographic Regression Results, Enlisted (USN/VFA)

	Model (1) safetyclimate	Model (2) safetyclimate1
Independent Demographic Variables*		
noncitizen (citizen)	0.216	0.444
	(0.215)	(0.014)*
africanamerican (cauc)	0.014	0.102
	(0.833)	(0.035)*
corrosion (mc)	-0.391	0.039
	(0.009)**	(0.715)
daycheck (mid)	0.198	0.185
	(0.002)**	(0.003)**
nightcheck (mid)	0.212	0.254
	(0.001)**	(0.001)**
worker (lpo)	-0.280	-0.050
	(0.009)**	(0.518)
rural (sub)	-0.121	-0.077
	(0.049)*	(0.042)*
urban (sub)	-0.150	-0.039
	(0.011)*	(0.300)
# of variables	54	54
Respondents	544	544
Pseudo R2	.11	.11

Survey conducted August 2006.
* the variable in parentheses is the comparison dummy variable (i.e., the variable left out of the model)
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Officers in Unit 3 are almost 80 percent more likely to strongly agree with the safety climate assessment statement (Q33) than their Unit 4 counterparts (all else being equal). Branch Officers and Department Heads are less likely (over 50 percent) to strongly agree with Q33 than their CO/XO's while single officers are over 50 percent more likely to have the highest safety climate assessment when compared with their married colleagues. Officers from the southeast and midwest have lower safety climate assessment when compared with officers from the northeast while officers raised in urban or suburban environments have a lower safety climate assessment than officers raised in a rural setting (60 percent and 56 percent respectively). All of these regression results are consistent with the means results presented in Appendix J for the Oceana officer cohort. Caution should be placed on the conclusiveness of these results given the small size of the officer cohort. In addition, these correlations were not investigated during officer interview sessions.

The single versus married distinction is an interesting finding. Since married officers tend to be more senior (both in rank and time in service), the marital status finding seems counter-intuitive to Phase 1 results. Upon closer inspection of the Phase 2 data, significant climate influences such as rank, flight experience and authority can be ruled out as potential biases. This finding is consistent however, with the results of some of the officer interviews. As will be investigated in the next section, it was primarily the married officers who had strong opinions about organizational processes and policies that influence their safety climate assessment. Perhaps the social arrangement of marriage introduces an organizational variable that correlates with an individual's safety climate assessment.

Non-citizen enlisted members are more than 44 percent more likely to strongly agree with the safety climate assessment survey statement (Q33) than their citizen counterparts (all else being equal) while African American Sailors are 10 percent more likely than their Caucasian counterparts to assign the highest assessment grade. Sailors who work in corrosion control have a lower climate opinion than members working in maintenance control while mid-check workers have the lowest opinion of their safety climate (compared to day and night check workers). Interestingly, urban and rural enlisted personnel have a lower safety climate assessment than their suburban counterparts which is counter to the officer results. The enlisted results are consistent with the means comparison tables in Appendix J.

Race and safety climate assessment is an important area of analysis when considering the depth, applicability and fairness of organizational processes and programs designed to influence employee behavior. While the distinction between the safety climate assessment of African American and Caucasian sailors is a statistically significant finding, neither the survey nor the interviews provided adequate information to explain the difference. What remains important at this point is the realization that race is a demographic variable that must be considered when designing policies intended to shape or improve an organization's safety climate.

Leadership Best Practices and Safety Climate

Sections 2 through 4 of the Phase 2 survey instrument assess a respondent's opinion of the safety, management and leadership programs within their respective commands. Logistic regression analysis was conducted on the survey data base. An explanatory model was built that attempts to determine significant predictor variables of safety climate assessment. Since safety programs were queried in the Phase 1 survey instrument, the Phase 2 model will be used to verify Phase 1 findings. Organizational management and leadership programs are surveyed for the first time in Phase 2. Table 7.7 and 7.8 show the principal factors that statistically predict the dependent variable, *safetyclimate* or *safetyclimate1*.

Table 7.7 Principal Factor Regression Results, Oceana Officers (USN/VFA)

Principal Factor Variables	Model (1) safetyclimate1
SC1 (Safety Climate1)	0.730
	(0.005)**
LS4 (Leadership Style4)	0.330
	(0.020)*
# of variables	16
Respondents	52
Pseudo R2	.51

Survey conducted August 2006.
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 7.8 Principal Factor Regression Results, Oceana Enlisted (USN/VFA)

Principal Factor Var	Model (1) safetyclimate	Model (2) safetyclimate1
SC1 (Safety Climate1)	0.207	0.104
	(0.000)**	(0.000)**
SC2 (Safety Climate2)	-0.160	-0.044
	(0.000)**	(0.003)**
SP1 (Safety Programs1)	0.104	0.068
	(0.000)**	(0.001)**
UP1 (Unit Programs1)	-0.052	-0.056
	(0.100)	(0.007)**
UP2 (Unit Programs2))	0.049	0.042
	(0.066)	(0.041)*
# of variables	9	9
Respondents	544	544
Pseudo R2	.27	.23

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Two principal factors reveal statistically significant correlation among the officer cohort while five factors correlate among the enlisted cohort. As was the case in Phase 1, caution is exercised when trying to quantitatively express or put into operation these findings. Care must be given when using factor analysis as anything other than an exploratory tool. Since the officer data yields very little safety climate assessment variation, it is not surprising that only two factors show significant correlation. SC1 seems to be a predictable outcome due to the existence of a common climate thread that runs through questions 33-42 of the Oceana survey. What is curious to this researcher is the lack of principal factor correlation among the other categories with the exception of LS4. One explanation may be the small data set and the lack of safety climate assessment variation among the survey group. Perhaps however, there is a significant component of leadership style that can be identified through further research that contributes as a significant predictor of safety climate assessment.

For the enlisted cohort, the justification for SC1 remains the same as the officer group. Of the remaining four factors, two correlate positively (SP1 and UP2) and two have a negative correlation with safety climate assessment (SC2 and UP1). This statistical result seems to verify a basic premise of this research, that is, certain organizational policies and programs (safety and non-safety) related, have implications for influencing climate perception. Quantifying this influence is the focus of the multi-variable regression analysis conducted on both survey groups and substantiated through personnel interviews.

Tables 7.9 and 7.10 display the regression results for both safety and unit leadership and management programs as predictors of safety climate assessment.

Table 7.9 Unit Program Regression Results, Oceana Officer (USN/VFA)

Safety and Unit Programs Variables	Model (1) safetyclimate1
orm	predicts failure perfectly
(Q45)	4 observations dropped
safetyawards	0.981
(Q53)	(0.015)*
mentoring	0.973
(Q60)	(0.036)*
# of variables	25
Respondents	46
Pseudo R2	.48

Survey conducted August 2006.
Safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 7.10 Unit Program Regression Results, Oceana Enlisted (USN/VFA)

Safety and Unit Programs	Model (1) safetyclimate	Model (2) safetyclimate1
standdowns	0.166	0.038
(Q43)	(0.001)**	(0.119)
handleschange	0.105	0.055
(Q49)	(0.062)	(0.048)*
counselingguidlines	0.035	-0.128
(Q57)	(0.577)	(0.001)**
counselinghelpful	0.103	0.182
(Q58)	(0.099)	(0.000)**
mentoring	0.079	0.084
(Q60)	(0.152)	(0.001)**
meaningfulreward	0.001	-0.058
(Q61)	(0.986)	(0.018)*
racebias	0.119	0.022
(Q65)	(0.029)*	(0.364)
# of variables	25	25
Respondents	544	544
Pseudo R2	.39	.33

Survey conducted August 2006.
Safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Of the 25 variables used to build an explanatory model for the officer study group, one safety program variable (*orm*) predicted failure perfectly and those observations were dropped. Two variables showed significant correlation with safety climate assessment; one is a safety program (*safetyawards*) and the other is a unit program, (*mentoring*).

The dummy variable *orm* was dropped because of the four total observations coded as a 0 (neither agreed nor strongly agreed with Q45, “leadership considers safety issues during the formation of operational and training plans”). None of the respondents strongly agreed with the safety climate assessment statement Q33. The dummy variable *orm* predicts failure perfectly and is interpreted as being highly predictive of safety climate assessment. Essentially, those officers who think leadership does not consider safety issues in planning, are highly likely to consider the safety climate in their organization to be unfavorable. This finding is consistent with many of the opinions voiced during the officer interview sessions. Particularly among the mid-grade junior officers, (O-3’s), interview participants lauded those planners who considered safety as an important component of operational planning as opposed to those who considered it an obstacle, nuisance or an item to just simply ignore. One Lieutenant in Unit 4 said, “I feel much better about a training detachment when I know the folks who planned it gave due consideration to balancing risk versus reward, that is, they are not going to let the training requirements dictate how much we fly!” Another Lieutenant in Unit 4 said, “Sometimes we pretend bad weather doesn’t exist…we are going to fly no matter what…it makes everyone very uncomfortable.”

The second safety program, *safetyawards,* is positively correlated with safety climate assessment. According to the Oceana data, those officers who agree or strongly agree that safety awards in their squadron are meaningful and highly coveted are 98 percent more likely to strongly agree with the safety climate assessment dummy (Q33) than those respondents who respond less favorably to their safety award program. Based upon interviews, it seems the credibility of an awards program has a significant influence on command climate. While a strong program that recognizes and rewards deserving individuals can maintain or elevate safety climate, it seems the opposite influence of a failing program can have a more dramatic effect on climate. The majority of interviewees that voiced an opinion on the subject discussed how negatively they reacted when a less-than-deserving individual received an award for some safety related act. Recognizing the difficulty in judging differences in perceptions regarding award choices, there remains a substantiated problem with consistency in many safety award programs. This inconsistency can be very problematic and presents a difficult challenge for managers and leaders trying to improve organizational climate. This finding is consistent with Schneider's model that depicts the human resource management practice of rewarding as being directly related to the climate dimension of reward orientation. While the prominence and emphasis of rewards may vary from unit to unit, the degree to which rewards are commensurate with merit and achievement is an important climate modifier.

The dummy variable *mentoring* is highly predictive of safety climate assessment. This is the only squadron (non-safety) program that reveals statistical significance. Those respondents who either agreed or strongly agreed they had someone in their organization that took them under their wing and mentored them were 98 percent more likely to strongly agree with the safety climate assessment statement then those respondents who did not have a similar mentoring association (all else being equal). This finding was consistently corroborated during the interview sessions and applied equally to both the junior and senior personnel. The Commanding Officer of Unit 1 said, "… I am so fortunate to have an Airwing Commander (superior officer) that takes time to help me figure things out…" This particular officer said it was this mentoring relationship that not only fostered his positive attitude, but also motivated him to establish similar arrangements with his Department Heads. Those officers who did not have a positive mentor relationship expressed their envy of those colleagues who did, and also described how the lack of a mentor negatively influenced their perception about the organization's climate. Again referring to Schneider's model, the mentoring correlation is consistent with his notion that climate is modified to the extent to which a worker feels like their best interests and personal welfare is valued by management.

For the enlisted cohort, one of the two safety program predictor variables, *standdowns*, showed significant correlation with the dependent variable, *safetyclimate* or *safetyclimate1*. While this may be an encouraging finding given the amount of time, effort and energy given to safety stand downs as an intervention method for all military services, the data is viewed with caution. Interviewees were fairly split on the efficacy of safety stand downs based upon the quality of the event and the value of the training component. While the data shows the positive correlation between mandatory safety stand downs and safety climate, many interviewees said a poorly run stand down can have a negative influence on safety climate. The survey statement asked respondents to express their opinion in reference to mandatory stand downs (irrespective of quality) relying upon the respondent's stand down experience to determine their response. This ambiguity introduces a variation that was highlighted during the interview sessions; reducing to a fairly polarized opinion on the subject of mandatory stand downs as a predictor of elevated safety climate. Good stand downs elevate safety climate and poor stand downs either seem to moderate or lower safety climate. Schneider's model considers the degree to which management places emphasis on the proper techniques, processes and procedures needed for workers to get the job done. This "means emphasis" is an important climate dimension and one that can be effectively (and positively) influenced through well planned and well executed human resource practices such as safety stand downs.

The second safety program variable, *handleschange*, showed that those respondents, who either agreed or strongly agreed that their squadron reacts well to planning changes, are 6 percent more likely to strongly agree with the safety climate assessment statement than their counterparts who think less favorably of change management (all else being equal). It was clear in the group interviews that change is the "great equalizer" when it comes to organizational safety perceptions. Organizations that handle change calmly and professionally have higher safety climate assessment. One particular Sailor in the group interview said, "…when my supervisor starts freaking out because the deployment date was moved up, we all start freaking out." Another more experienced Chief Petty Officer said, "How can we be expected to get things done safely when everything keeps changing. My guys run for fear every time I walk into their work center and tell them the plan has changed!"

The counseling and mentoring coefficients in Table 7.10 are highly indicative of a common theme that emerged from the enlisted interview sessions. Counseling and mentoring programs are both non-traditional safety program interventions that show statistical correlation with safety climate perceptions. Sailors who are actively and professionally counseled and who are personally engaged through a viable and effective mentoring program are statistically more likely to have a more favorable safety climate perception than their unengaged counterparts. The negative coefficient on the *counselinguidlines* variable is curious and may reflect a general apathy towards the current counseling system. Interviewees reported a strong desire for effective counseling but expressed an equally strong dislike for the current system which is calendar based, overly structured, highly supervised and lacks an effective training component for counseling administrators (NAVADMIN 146/95). Mentoring is criticized by many of the same program indictments voiced by the officer cohort. Three common disparagements emerged from the interview sessions.

1. A formal mentor program only exists because it is mandated by higher authority. "It exists in name only."
2. Mentors are assigned, not chosen, therefore the mentor/protégé relationship is flawed. "I should be allowed to choose my own mentor."
3. Good mentors are not recognized or rewarded in their performance appraisals. "It seems the worst mentors always get promoted because they put production ahead of people."

Consistent with the officer interviews, many enlisted participants lauded the value of being the protégé of an effective mentor and verified the correlation between a positive mentoring experience and elevated safety climate perceptions. Again, this correlation is consistent with the Schneider model that places significant value on the socio-emotional support component of leader action and how this dimension can positively influence the work environment.

Although not verified statistically, there was a strong emphasis placed on awards program inconsistencies during the enlisted interview sessions. While the *safetyaward* variable was not statistically significant, the *meaningfulaward* variable showed a negative correlation (-6%). This finding runs counter to interview opinions and may be attributed to several factors including statement wording and the small number of respondents who actually strongly agreed with this survey statement (less than 5 percent of the survey population). In every group interview session, there was a discussion regarding award inconsistencies and how this organizational flaw degraded safety climate perceptions. Not one interview cohort in any unit was able to unanimously agree the award program in that organization was well managed and equitably implemented. It is not surprising to this researcher that awards (and associated award programs) were the source of much organizational discontent. This stands to reason for in volunteer organizations like the ones under study in this research program, there are very few formal incentives available to supervisors and leaders when compared to similar organizations across the public/private divide. Financial incentives, time-off and promotion, the grand rewards of private sector managers are virtually unavailable to military supervisors. While time-off is still a controllable incentive to the military leader, its cost/benefit structure is different than private sector managers and presents a significantly different “bottom-line” cost to the organization. Therefore, awards present a potentially critical policy lever for organizational safety climate control. While awards remain an important incentive device to military supervisors, they are subject to the following institutional ailments:

1. Approval level continually creeps up the chain
2. Approval process too long
3. Awards become time/rank relevant (expectation of receipt at specific times, only certain ranks can get certain awards)
4. Submission process complicated, burdensome
5. Approval process flawed (subject to favoritism)
6. Awards become diluted

Finally, the demographic characteristic of race that showed statistical significance in Table 7.6 (African Americans having a higher safety climate assessment than their Caucasian counterparts), emerges in this section as a significant predictor of safety climate assessment when considering the existence of racial bias. Unit members, who agree or strongly agree that there is no racial bias in their command, are 12 percent more likely to favorably assess their safety climate than their counterparts who have a less favorable opinion on the existence of racial bias. Considered long to be outside the realm of the formal organizational safety program, human relations and equal opportunity programs have a correlative influence on an individual’s perception of the safety climate within their organization.

Section 6 of the Oceana survey asked both officer and enlisted participants to consider possible ways to improve their unit's safety climate. They were asked to rank their top three choices of a list of possible interventions considering how each option would improve how people perceive their work environment and/or improve safety performance. Respondents were given the opportunity to add their own choice(s) if they were not satisfied with the preset list. Referencing Figure 5.2, almost 50 percent of the officer cohort selected three options as their first choice: establish a functional mentoring program (19 percent), get rid of poor performers (19 percent), and improve squadron resources (17 percent). While none of these are considered typical actions or responsibilities associated with managing the squadron's safety program, they are in large measure embedded in programs under the control of unit leaders.

For the enlisted cohort, the top three interventions accounted for 44 percent of the first choice variation: increase my pay and benefits (17 percent), get rid of poor performers (16 percent), and establish a functional mentor program (11 percent). These findings were verified with both interview cohorts and both groups had two of the same top three choices. What <u>made</u> the top three choices is not as surprising to this researcher as is what did not spike as a top priority. It was expected that choices like reducing operational tempo or better hardware (aircraft, tools parts) would emerge at the top of a safety climate improvement list however those choices received less than 2 percent and 8 percent respectively for the officer group and less than 2 percent and 5 percent respectively for the enlisted survey group.

Leadership Style and Safety Climate

The Phase 2 survey instrument presented 18 supervisory assessment statements in section 5 designed to measure the leadership style of the respondent's direct supervisor. Each statement, if acknowledged in the affirmative, is designed to place the supervisor of the respondent in a general leadership style category as described in Chapter 5. Section 5 responses were modeled as independent predictors of the dependent variable, safety climate assessment. The results of this modeling effort are presented in Tables 7.11 and 7.12. Only the statistically significant results are shown with the full model results included in Appendix K.

Table 7.11 Leadership Style Regression Results, Oceana Officer (USN/VFA)

Leadership Style Variables	**Model (1)** **safetyclimate1**
leadermoralstand	0.532
	(0.039)*
leadergetsit	0.603
	(0.016)*
# of variables	25
Respondents	46
Pseudo R2	.48

Survey conducted August 2006.
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, * significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table 7.12 Leadership Style Regression Results, Oceana Enlisted (USN/VFA)

Leadership Style Variables	Model (1) safetyclimate	Model (2) safetyclimate1
leaderinspiration	0.065	0.097
	(0.316)	(0.002)**
goalsknown	0.140	0.067
	(0.008)**	(0.012)*
# of variables	36	36
Respondents	544	544
Pseudo R2	.39	.33

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, *significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Two leadership style survey statements show significant correlation for each cohort. For officer respondents, *leadermoralstand* and *leadergetsit* predict over 50 percent and 60 percent respectively a "strongly agree" safety climate assessment response compared to respondents who have a less agreeable evaluation of their supervisor relative to these two categories. The variable *leadermoralstand is* a dummy variable created from Q73, "my supervisor takes a stand on controversial issues, considering the moral consequences of decisions" while *leadergetsit* was created from Q84, "my supervisor really knows what is going on." The variable *leadermoralstand* is designed to categorize a transformational leader if answered in the affirmative. Transformational leaders develop beyond the immediate concern for their own personal agenda to higher levels of values and obligations (Kuhnert & Lewis, 1987). At their highest level, transformational leaders endorse universal ethical principles of justice, the equality of human rights, and the respect for human dignity. According to Bass (1990), there is a belief in and a commitment to these principles becoming almost unto themselves an objective for action. It is this quality that differentiates transformational leaders from transactional leaders.

The variable *leadergetsit* is designed to assess the envisioning and intuitive qualities of a respondent's supervisor with a notably affirmative evaluation categorizing a leader as transformational. Tichy & Devanna (1986) describe envisioning as a charismatic's leader's ability to predict and show a follower how to achieve a future state. Its success involves paying close attention to the organizational change agents, determining with great clarity the key issues, prioritizing strategies and decisions, and communicating the vision in a way that will move followers forward to the envisioned state (Bennis & Nanus, 1985). Intuition augments interpretations of events and data that illuminate the image of the future state. With their ability to provide images of the future state, inspiring leaders provide the path that must be taken that gives clear direction to the followers (Tucker, 1981).

Referring back to the leadership style models presented in Chapter 3, these two style factors are consistent with the layer of individual consideration added to the transformational model as depicted in Figure 3.3. L*eadermoralstand* and *leadergetsit* define a specific developmental orientation for a leader that manifests in the individualization of followers. Regarding l*eadermoralstand*, this individualization means a leader considers how his or her actions would impact follower differences resulting in the fulfillment of unique needs. Similarly, *leadergetsit* fosters individual attention on the part of the leader which results in a follower's fulfillment of personal desires for information and fate control.

Officer interviews verified the importance of serving for seniors who place priority on ethical decision making. In general, officers placed the majority of their current supervisors in the transformational style category and emphasized the importance of serving for superiors who placed a high premium on conduct and decision-making grounded in high moral and ethical principles. While none of the interviewees would acknowledge currently serving for a transactional leader, they did express a notable degradation in safety climate when serving for a supervisor that was focused primarily on exchange relationships and productivity. The discussion regarding leaders who "really know what is going on" was less about tacit knowledge and more about a leader's ability to assess the organization's "social architecture" and transform it into equitably beneficial action. This, in its truest sense, is what is meant by a leader who really "gets it". Despite the participants ability to describe these qualities, most acknowledged these leaders were rare; many only having served for one or two during their careers.

For the enlisted cohort, two different but equally important leadership variables emerged as significant predictors of positive safety climate assessment. The variable *leaderinspiration* is a classic transformational quality being derived from Q69, "my supervisor is inspirational". As was described in Chapter 3, inspirational leaders express goals that followers want to attain (McClelland, 1975). Such leaders "conceive and articulate goals that lift people out of their petty preoccupations, carry them above the conflicts that tear a society apart, and unite them in the pursuit of objectives worthy of their best efforts" (Gardner, 1965). Inspirational leaders stimulate enthusiasm among subordinates garnering individual support to accomplish group objectives. Enlisted interview participants expressed a strong desire for this quality in their leaders while noting a significant lack of this quality among contemporary supervisors. Like the officer group, this quality was independent of rank, i.e. Chief Petty Officers were equally desirous of inspirational leadership in comparison with junior Sailors. The enlisted group described an overall dearth of inspirational leaders within their units although the most junior group (E-1 to E-3's) said they had some pretty inspirational junior Petty Officers supervising their training and job performance. Mid-grade and senior Petty Officers revealed the most significant lack of inspirational leadership. After a discussion of leadership qualities among each enlisted interview group, participants were asked through a show of hands, how many of them were currently working for a supervisor they considered inspirational. This was not done during the individual interviews or during the group officer interviews. Table 7.13 shows the result of the survey.

Table 7.13 Participants Who Work for Inspirational Leaders, by Unit

Unit	Number of participants	Officer/Enlisted	General description	Work for Inspirational Leader
1	15	Enlisted	E-1 to E-3	13/15 (87%)
1	13	Enlisted	E-6	4/13 (31%)
2	4	Enlisted	E-4	1/4 (25%)
3	3	Enlisted	E-7	3/3 (100%)
4	5	Enlisted	E-1 to E-3	4/5 (80%)
4	15	Enlisted	E-4 to E-5	0/15 (0%)

Numbers based upon interviews conducted August 2006. Data generated by an affirmative show of hands to the question, *"How many of you work for an inspirational leader?"*

Recognizing the potential bias introduced during a public vote regarding an individual's supervisor, the tallies very closely mirror the opinions derived during the group discussions. In general, very junior and more senior enlisted have the highest assessment of their current supervisor's inspirational leadership attributes while mid-grade enlisted have a very low assessment. Clearly there are organizational influences causing this phenomenon. Additionally, interviewees verified the positive correlation between inspirational leadership and safety climate assessment. One Sailor raised a significant point in reference to the topic of inspirational leadership when she said, "I feel worse about my squadron when my supervisor gets replaced by someone who can't lead themselves out of a paper bag." Her point was the absence of inspiration has a more damaging consequence on climate perhaps more than the positive influence of an actively inspirational leader. When asked if participants were more likely to do their job safely and effectively when working for an inspirational leader, the result was overwhelmingly positive. This finding has been verified statistically using a variety of methods and a variety of cohorts (Bass and Aviolo, 1989; Colby and Zak, 1988; Waldman, Bass and Einstein, 1986).

The final variable correlating positively with safety climate assessment for the enlisted cohort is *goalsknown*, derived from Q74, "the goals of this command are known (updated, shared and published)". This element of leadership is critical to the transformational paradigm which relies on organizational awareness for followers to transcend their own self-interests for the good of the group. "Ordinarily, open, easy, ready communications contribute not only to the extent to which the leader and the group can influence each other but to the extent to which they will be effective" (Bass, 1990, p. 674). Leadership is directly responsible for the ease and accuracy of communications within a group and the extent to which subordinates can use superiors as sources of information. Several military studies have verified the positive correlation between effective organizational communications and unit performance (Dyer and Lambert, 1953; O'Reilly, 1977; and Weschler and Shepard, 1954). Perhaps the number one complaint voiced during all the interview sessions was the follower's lack of accurate and/or timely information regarding the unit's schedule and goals. This communication failure contributed to a significant degradation in morale, job satisfaction and overall climate. Referring back to the transformational leadership style model (Individualized Consideration by Leader and Follower Effort) depicted in Figure 3.3, *goalsknown* fosters one-on-one contact and two-way communications resulting in the fulfillment of unique needs and the desire for information.

Leadership Style Distinctions

Caution must be exercised when placing certain leadership best practices exclusively with the domain of one distinct leadership paradigm. It is not uncommon for a leader's actions to have a variety of components that might be perceived as both transformational and transactional. The purpose of identifying a leader's style is not to ideologically judge one leadership theory as superior to another, rather the purpose of this research is to understand why certain leadership actions produce the results they do (given a variety of followers within a variety of contexts). For example, the intervention evaluated in section 6 of the Phase 2 survey instrument, "get rid of poor performers", might (and probably would) require a predominantly transactional leadership approach for effective implementation. Despite its highly correlative relationship with safety climate assessment, any leader action designed to identify and attrite poor performers is a management function (see Table 3.2) and relies on the transactional arrangement of a leader supporting a worker if it is merited by worker performance. In the case of eliminating poor performers, worker support would not be warranted and managerial action should be taken to remove the employee. If however the leader action is focused on behavior remediation or performance improvement, then the intervention takes on a distinctly transformational quality (helping workers achieve their full potential). Regardless of the leadership alignment (transformational or transactional), any leader action to eliminate poor performers (attrite or remediate) would be viewed as a positive organizational intervention.

Bass (1985) recognized that leadership is not a neat and tidy concept. Leaders often need to exercise organizational influence that varies dramatically across the leadership landscape. Given organizational necessity and certain operational contexts, leader action is influenced by personality, interpretation and choice and can become a composite of many leadership theories. An example might be the "*goalsknown*" variable discussed in the previous section. There is an inherently transactional dimension to a leader action that endeavors to make sure command goals are updated, shared, and published. Referring to the transactional leadership model in Figure 3.1, this practice is based upon a leader recognizing what the follower needs (information on command goals) and clarifying how the worker's needs will be fulfilled in facilitating this outcome. Within this transactional arrangement, the follower has high confidence in achieving his or her role requirements (because goals are known) and is motivated to attain the desired outcome.

Leader action designed to ensure command goals are known, updated and shared also has a unique transformational dimension that focuses specifically on transcending the follower's self interests as depicted in Figure 3.2. A follower is transformed when they tend to place the interests of the group above their own. Sharing macro-level unit information regarding a command's goals (e.g. schedule, production, personnel, advancement, transition, etc.), can serve to elevate the value of the unit outcome over the value of the individual outcome. This is particularly true if the unit objectives are immediate and short term. In summary, a leader's actions may have disparate motivational components (i.e. aligned with a specific leadership theory), and yet these components can interact in seemingly complimentary ways to achieve a desirable worker behavior.

Safety Climate and Performance

Linking safety climate assessment to organizational performance is a critical second step in evaluating leadership interventions designed to elevate safety climate. Because Phase 1 data did not include performance data, this researcher designed a method to obtain this type of data in Phase 2 although it has some methodological weaknesses. Unit safety data was not made directly available to this researcher. Specifically, unit identifiable data regarding mishap and injury statistics is considered by Navy instruction to be privileged safety data and is not releasable in unit identifiable form. Permission was granted to this researcher to include performance related questions in the instrument survey which could not be attributed to individuals and only reflected the opinions of survey respondents, i.e. not a part of the official safety record.

Section 1 of the Phase 2 survey included 5 questions regarding safety performance as outlined in Chapter 5. Each respondent was asked to estimate their recollection of certain accident and mishap occurrences they have either been a part of or observed over the past year. The researcher evaluated empirical correlations between the safety climate assessment variable and this self-reported performance data. The first approach was to compare safety climate assessment means between performance categories. There is an inherent weakness in analyzing climate and performance. As discussed in Chapter 3, climate is a varying condition and it may be inaccurate to compare a very recent sample of safety climate assessment with historical performance data. To adjust for this situation, two types of performance measurements were gathered. Respondents were asked for their recollection of safety incidents which occurred over the past year, and to also offer their performance assessment of their particular organization today. The accuracy of this data and the validity of means comparisons rely on a respondent's fair and unbiased perception of their organization and the presumption that there is a positive correlation between a respondent's assessment of their organization's performance and actual performance.

Officer Safety Climate Assessment and Performance

ANOVA was conducted on the officer database testing whether the means of safety climate assessment (Q33) differ across different categories of performance. For each of the five injury and mishap variables (*injury1, injury2, injury3, mishap1 and mishap2*), the null hypothesis of equal means fails to be rejected. While the null hypothesis of equal means cannot be rejected for the operational performance variable (*opperf)*, the safety performance variable (*saperf)* showed significant means differences. Table 7.14 shows the ANOVA results.

Table 7.14 Safety Climate, ANOVA means comparison (NAS Oceana Officers)

Respondent's assessment of safety climate in unit (Q33) (1-5 Likert scale)							
Performance Variables	**n**	**Mean**	**SD**	**means comparison/statistical significance[1]**			
Assessment of command's safety performance (Q29)				**a**	**b**	**c**	**d**
a. 1	1	5.00	0.0	-	-	-	-
b. 3	1	4.00	0.0	1.00	-	-	-
c. 4	4	4.25	.50	.75	.25	-	-
d. 5	25	4.24	.44	.76	.24	.01	-
e. 6	21	4.76	.44	.24	.76	.51	**.52****

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 (ANOVA), Scheffe's multiple comparison test, Bartlett's test for equal variance

For the safety performance variable (Q29), we can reject the hypothesis of equal means (P=.0022), but not the hypothesis of equal variance (P=.948) which indicates high confidence regarding ANOVA's validity. Two sample paired-difference tests (t-tests) were conducted using the same performance variables and the categorical climate variable (*safetyclimate1*) to adjust for unequal variances. Following these tests, the basic conclusion remains that there does not appear to be significant means differences among historical performance measures and safety climate assessment among the officer cohort. However, there is a significant means difference among safety performance ratings across the safety climate assessment category. Essentially, those officers who strongly agree the safety climate in their unit is very high also have a higher assessment of their unit's safety performance. Since the majority of officers (88 percent) rate their unit's safety performance as either a 5 or 6 on the performance scale, a rating of 5 might be interpreted as an indicator of some performance weaknesses while a 6 reflects optimum performance. It is not unusual for these performance marks to be skewed very high and to the right of the assessment scale.

While this finding implies a correlation between climate and safety performance, it does not imply causality, i.e. high climate assessment does not predict high safety performance. To measure safety climate as a predictor of safety performance, regression analysis was conducted using performance measures as the dependent variable with a model comprised of organizational independent predictors including safety climate.

Table 7.15 Performance Regression Results (Oceana Officer)

Climate Variables	Model (1) safetyperf5	Model (2) safetyperf6
safetyclimate1	-0.369	0.414
	(0.034)*	(0.018)*
safetypriority1	0.092	-0.081
	(0.550)	(0.577)
recommendtofriend1	-0.101	0.312
	(0.590)	(0.078)
morale1	-0.126	0.188
	(0.511)	(0.331)
myopinion1	-0.176	-0.057
	(0.449)	(0.802)
standdowns1	0.146	-0.165
	(0.526)	(0.431)
expectedaccidents	#	0.529
	#	(0.123)
# of variables	6	7
Respondents	50	52
Pseudo R2	.21	.28

Survey conducted August 2006.
safetyperf5: respondents assessed their unit's safety performance as a 5 (Q29)
safetyperf6: respondents assessed their unit's safety performance as a 6 (Q29)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.
predicts failure perfectly, 2 obs. dropped.

Table 7.15 shows a model comprised of all the independent safety climate predictors of performance from section 2 of the Phase 2 survey. Officers who strongly agree their unit's safety climate is very high are 37 percent less likely to rate their unit's safety performance a 5 on the 1-6 scale. Conversely, officers who strongly agree their unit's safety climate is very high are 41 percent more likely to assign a safety performance rating of 6. The regression results of all other modeling attempts using different dependent performance variables were inconclusive. Given this limited sample size, there is evidence to suggest that there is a cause and effect relationship between safety climate assessment and safety performance assessment as measured using self-reported perceptions of both variables. However, there is no empirical safety data to substantiate this conclusion. Additionally, safety performance is more closely linked with a respondent's recent assessment of safety climate as opposed to the other performance measurement variables that assess safety performance over the last year.

Based upon officer interviews, this claim was substantiated. Many officers commented their behavior (e.g. judgment and decision-making) is influenced by the safety climate within the organization. Officers in Unit 4 had a much lower climate assessment as expressed during interviews and commented they were certain the unit's safety performance, as measured by injuries and mishaps, was much worse than other units they had been in. Several stated that climate influenced an officer's propensity to accept (tolerate) lower standards for maintenance quality and degraded aircraft material conditions. One group of experienced aviators claimed that climate plays havoc on risk tolerance, often quietly reducing the overall standard of acceptable risk within an organization. As safety climate diminishes, risk tolerance increases causing an ever increasing chance of an avoidable injury or mishap.

Enlisted Safety Climate Assessment and Performance

Similar analysis was conducted on the enlisted cohort, searching for correlations between performance measures and safety climate assessment. Table 7.16 shows the statistically significant results of the ANOVA testing.

Table 7.16 Safety Climate, ANOVA means comparison (NAS Oceana Enlisted)

Respondent's assessment of safety climate (Q33) (0-5 Likert scale)								
Performance Variables	**n**	**Mean**	**SD**	**means comparison / statistical significance[1]**				
Command mishaps over the past year				**a**	**b**	**c**	**d**	
a. None	324	3.88	.89	-	-	-	-	
b. 1 time	127	3.87	.76	.01	-	-	-	
c. 2 times	59	3.52	.95	.35*	.34	-	-	
d. 3 times	27	3.33	.62	.54*	.53*	.19	-	
e. > 3 times	7	3.14	1.07	.73	.72	.38	.19	
Assessment of command's operational performance				a	b	c	d	e
a. 1	9	3.11	1.05	-	-	-	-	-
b. 2	26	3.23	.91	.12	-	-	-	-
c. 3	94	3.29	.96	.18	.06	-	-	-
d. 4	178	3.72	.75	.61	.49	.44**	-	-
e. 5	167	4.07	.62	.95*	.83***	.78***	.34**	-
f. 6	70	4.35	.96	1.25**	1.12***	1.07***	.63***	.29
Assessment of command's safety performance				a	b	c	d	e
a. 1	6	2.50	1.22	-	-	-	-	-
b. 2	21	2.71	.95	.21	-	-	-	-
c. 3	84	3.26	.78	.76	.55	-	-	-
d. 4	148	3.61	.78	1.11*	.90***	.35**	-	-
e. 5	193	4.04	.60	1.54***	1.33***	.78***	.43***	-
f. 6	92	4.41	.88	1.9***	1.70***	1.15***	.80***	.37*

[1] absolute value of means difference, *= $p \le 0.05$, **= $p \le 0.01$, ***= $p \le 0.001$
STATA 8.2 (ANOVA), Scheffe's multiple comparison test, Bartlett's test for equal variance

The previous results show a positive correlation between a respondent's recollection of unit mishaps over the past year and safety climate assessment. Those respondents with the highest safety climate assessment mean (3.88) recollect a mishap-free year while those respondents who report higher mishap rates, perceive a progressively lower safety climate assessment mean within their units. Similar trends exist for both safety performance assessment and operational performance assessment. The lowest assessment rates for each category of performance attribute the lowest safety climate assessment means. The safety climate assessment means get progressively higher as the performance assessment measures increase.

Many of the performance variables not included in Table 7.16 failed Bartlett's test for equal variance during ANOVA testing making means comparison relatively unreliable. To remedy this, two sample t-tests were conducted using the categorical safety climate variable across performance measures adjusted for unequal variances. Conclusions were checked by conducting a nonparametric Mann-Whitney U test, also known as a Wilcoxon rank sum test.

Table 7.17 Two Sample Performance t-Tests, (Oceana Enlisted)

safetyclimate	Observations	Performance Category(Mean)	SD	p-value
0	187	*mishap1* (.13)	.53	.05
1	357	*mishap1* (.05)	.27	
0	187	*mishap2* (.85)	1.09	.001
1	357	*mishap2* (.55)	.85	
0	187	*injury3* (2.01)	.95	.01
1	357	*injury3* (1.80)	.86	
0	187	*saperf* (3.65)	1.09	.000
1	357	*saperf* (4.84)	.89	
0	187	*opperf* (3.60)	1.07	.000
1	357	*opperf* (4.58)	1.01	

STATA 8.2 t-test, Wilcoxon rank-sum test

The null hypothesis of equal population means can be rejected for *mishap1*, *mishap2*, *injury3*, *opperf* and *saperf* as depicted in Table 7.17. Five performance variables have significant means differences when compared across the categorical variable, *safetyclimate*. In each case, the performance measure (mean) is more favorable for higher categories of safety climate assessment supporting the conclusion that safety climate correlates positively with a variety of performance measures for the enlisted cohort.

Regression modeling was conducted to assess climate as a predictor of safety performance measures. Table 7.18 summarizes the modeling results.

Table 7.18 Performance Regression Results (Oceana Enlisted)

Climate Variables	Model (1) mishap0	Model (2) opperf6	Model (3) safetyperf6
safetyclimate	0.052	0.064	0.131
	(0.023)*	(0.027)*	(0.000)**
safetypriority	0.016	0.020	0.040
	(0.384)	(0.464)	(0.228)
recommendtofriend	0.026	-0.118	-0.104
	(0.229)	(0.000)**	(0.001)**
morale	0.014	0.289	0.119
	(0.569)	(0.000)**	(0.005)**
myopinion	-0.053	-0.014	0.021
	(0.028)*	(0.622)	(0.561)
expectedaccidents	0.020	-0.005	-0.048
	(0.312)	(0.873)	(0.183)
standdowns	-0.025	0.024	0.061
	(0.162)	(0.365)	(0.063)
# of variables	7	7	7
Respondents	544	544	544
Pseudo R2	.02	.21	.12

Survey conducted August 2006.
mishap0: respondents assessed zero mishaps in their unit over the past year (Q25)
opperf6: respondents assessed their unit's operational performance as a 6 (Q28)
safetyperf6: respondents assessed their unit's safety performance as a 6 (Q29)
Robust p values in parentheses, *significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Similar to the officer cohort, high safety climate assessment predicts the highest performance assessment mark from a respondent when compared to respondents who have a lower opinion of the unit's safety climate (6 percent and 13 percent respectively). Respondents who have a high safety climate assessment are 5 percent more likely to report zero mishaps over the past year when compared to their counterparts who have a lower safety climate assessment. Again, while these factors are not based upon reported measures of empirical safety statistics, there is ample evidence to conclude under these circumstances, elevated safety climate predicts higher levels of safety and operational performance.

Chapter 8: Discussion

Summary of Results

The 2003 policy mandate of the Secretary of Defense to reduce preventable mishaps by 50 percent over a two-year period was not achieved by any of the military services directed to comply. This research effort focused specifically on the Department of the Navy's aviation component with the highest propensity for operational mishaps and highest mishap cost factor, the F/A-18 strike fighter community, and evaluated why the policy failed. The Naval Aviation strategy to reduce preventable accidents and mishaps was based upon the fundamental notion that improving organizational safety climate would influence personal decision-making in a positive and generally prudent way. At the heart of the Navy's safety climate improvement initiative was a directive to implement specific leadership best-practices that were designed to elevate safety climate by targeting three specific areas of concern: complacency, change and uncertainty, and taking care of Sailors. The military commander in charge of all tactical aviation units formulated a policy designed to target these specific areas of weakness. He directed all unit leaders to implement a series of best practices intended to improve safety climate by targeting these three areas (referred to operationally as the Fleet Response Plan). This is the policy at the heart of this dissertation's research focus.

In Phase 1 of the research, five years of safety climate data (over 20,000 respondents) compiled by the Naval Post-Graduate School, was used to statistically evaluate the efficacy of the leadership best practices outlined in the Navy's policy directive. Although the Marine Corps was not targeted by the FRP, their data was also evaluated for comparison. Since the data collection survey was not designed specifically for this purpose (secondary analysis), proxy variables were designed to most closely model the leadership interventions under study.

The safety climate survey administered by the Naval Post-Graduate School did not query many demographic factors because the instrument was designed to ensure Sailors and Marines it was impossible for the data to be attributed to a specific member. This compromise theoretically assured honest and accurate participation. Of the limited demographic data generated by the survey, several variables correlated both positively and negatively with safety climate assessment. For example, junior officers have a lower safety climate assessment than senior officers while mid-grade enlisted personnel have a lower assessment when compared with both their most junior colleagues and more senior Sailors. <u>This finding suggests that a fundamental requirement for an effective mishap reduction policy would be to customize the policy lever to a specific unit demographic or organizational peer group that shows statistical correlation with safety climate assessment.</u> A significant policy planning and execution flaw might occur if organizational interventions are unilaterally targeted at a unit, and not specific cohorts within the unit.

For the officer cohort evaluated in both research phases (Navy and Marine Corps in Phase 1), a total of 16 FRP best practices were modeled using survey statements in the climate assessment questionnaire. Additional leadership intervention proxies were modeled that fell outside the focus of the FRP. A variety of statistical analysis techniques revealed a positive correlation between six Navy and three Marine Corps leadership best practices and safety climate. Of those, only four

Navy and two Marine Corps factors that were included in the FRP directive, positively correlated with elevated safety climate. For the Navy, these factors include:

1) Using Human Factors Boards to effectively reducing chances of an aircraft mishap due to high-risk aviator.
2) Leadership that encourages, facilitates, or enables individuals in a command to willingly report safety violations, unsafe behaviors or hazardous conditions.
3) Command leadership that successfully communicates its safety goals to unit personnel.
4) Command leadership that reacts well to unexpected changes to its plans.

For the Marine Corps, these factors include:

1) Leadership that encourages, facilitates, or enables individuals in a command to willingly report safety violations, unsafe behaviors or hazardous conditions.
2) Command leadership that imposes sanctions/career consequences on an aviator who persistently violates flight standards and rules.

While these factors are important organizational leadership interventions in an active effort to improve safety climate, <u>they comprised only 25 percent (4 of 16) of the prescribed mishap reduction policy methods in the FRP</u>. Phase 1 study analysis revealed two best practices that emerged as significant predictors of elevated safety climate that were not included in the FRP. The first regards leaders who consider safety issues during the formation and execution of operational and training plans. This organizational practice correlates highly with elevated safety climate assessment among the five-year officer cohort analyzed in Phase 1. The second best practice that emerged from the Phase 1 study that was not included in the FRP mishap reduction policy was leadership interventions designed to increase morale and motivation. Of the almost 1800 officers among the Phase 1 Navy cohort, those officers who assessed their command's morale and motivation as high, also considered the safety climate very high. This factor also correlated among the almost 1200 Marine Corps officers who completed the Phase 1 safety climate survey.

For the enlisted cohort (both Navy and Marine Corps), a total of 14 FRP best practices were modeled using survey statements in the climate assessment questionnaire. Like the officer study, additional leadership intervention proxies were modeled that fell outside the focus of the FRP. This was based in large measure on the types of survey statements that were included in the research questionnaire. A positive correlation was found to exist between five Navy and four Marine Corps leadership best practices and safety climate. Of those, only three Navy and two Marine Corps factors included in the FRP directive, positively correlated with elevated safety climate. For the Navy, these factors include:

1) Leadership that adequately reviews and updates safety procedures.
2) Organizational practices that demonstrate intolerance for unprofessional behavior.
3) Comprehensive and effective safety education and training programs.

Like the officer study, a low percentage of leadership best practices outlined in the FRP actually show statistical correlation with elevated safety climate among a large data base of enlisted respondents in both the Navy and Marine Corps. For the Navy, only 3 of 14 (21 percent) correlate and only 2 of 14 (14 percent) correlate for the Marine Corps. Two organizational variables, not included in the FRP, were found to show significant correlation with elevated safety climate. Sailors who agree quality assurance and safety members are well respected and are seen as essential to mission accomplishment within their organizations are much more likely to assess their unit's safety climate as high compared to those Sailors who have a lower perception of the respect given these specific unit members. Also, enlisted personnel who have supervisors who recognize unsafe conditions and manage hazards associated with maintenance and the flight-line are more likely to perceive their unit's safety climate as very high compared to those Sailors who work for less diligent supervisors.

Since the Phase 1 data included surveys completed between 2001 and 2005, the data actually bracketed the policy implementation period. Statistical analysis was conducted comparing pre and post-policy implementation cohorts to assess the efficacy of the Navy's plan to elevate command safety climate. While the pre and post-policy cohorts were different survey respondents, it was presumed that the groups were similar enough in demographics to attribute any significant change in safety climate attitudes to the policy treatment and not some socio-economic, cultural or political influence outside the control of the experiment. Analysis of safety climate assessment means among enlisted personnel and officers in the pre and post-policy study groups reveals statistically insignificant differences. Comparison dates included both pre and post-May 2003, the date of SECDEF's mishap reduction policy mandate, and April 2004, the date of the FRP message release. There was essentially no change in means among three of the four study groups with the exception of the Marine Corps officer cohort. Their safety climate assessment mean rose from 4.26 to

4.46 following May 2003 and rose from 4.30 to 4.48 following April 2004. For the Navy policy study group, the FRP policy had no measurable influence on elevating safety climate as measured by the by the Phase 1 survey instrument.

Besides the fact that the preponderance of leadership best practices outlined in the Navy's mishap reduction policy show little correlation with elevated safety climate, additional scrutiny must be given to the policy implementation methodology. First, the FRP did not prioritize which best practices might be most effective for units given certain circumstances such as operational schedule, mishap history, status of equipment and infrastructure, manning level, etc. Given this lack of priority, some unit commanders may have completely ignored some or all of the practices outlined in the FRP. The implementation plan did not make the guidance actionable in either timeframe or comprehensiveness, i.e. there was no requirement to have any or all interventions in place by a specific deadline, nor was there a mechanism to measure policy effectiveness.

Phase 2 surveyed 32 specific demographic factors along with a variety of unit performance factors, climate factors and leadership variables at four different F/A-18 squadrons located at NAS Oceana in Virginia. Surprisingly few demographic factors correlated positively with a respondent's assessment of the safety climate within their organization although Phase 2 seemed to corroborate Phase 1 demographic results. For the officer cohort, authority, marital status and geographic region/setting correlated positively with elevated safety climate while for the enlisted group, citizenship, race, work center, work shift and geographic setting demonstrated positive correlation.

Of the 25 organizational variables, three displayed positive safety climate correlation for the officer cohort and 6 for the enlisted group. Those variables for the officer group are:

1) Leadership that considers safety issues during the formation of operational and training plans.
2) Safety awards programs that are meaningful and produce highly coveted awards.
3) Organizations that effectively mentor junior personnel.

For the enlisted cohort:

1) Units that conduct mandatory safety stand downs that are effective in improving safety climate.
2) Commands that measure safety statistics and publish the results.
3) Supervisors that conduct helpful counseling sessions.
4) Organizations that effectively mentor junior personnel.
5) Leadership that rewards people for meritorious work, not just for doing their job.
6) Units that create an environment free of race/gender bias.

Respondents to the Phase 2 survey were asked to answer statements designed to place the leadership style of their supervisors in either the transformational or transactional category. Statistical analysis was conducted to determine correlation between certain measures of leadership style and safety climate assessment. Two leadership style survey statements show significant correlation for each cohort. <u>For officer respondents, two transformational qualities of their leaders emerge as positive predictors of safety climate assessment:</u>

1. Leaders who take a stand on controversial issues, considering the moral consequences of their decisions.
2. Leaders who seem to know what is "really going on".

<u>For the enlisted group two different yet equally transformational qualities emerge:</u>

1. Supervisors who are inspirational.
2. Leaders who ensure command goals are known (i.e. updated, shared and published).

Of the two factors identified as being significant for each cohort, only the command goals factor could potentially be considered a leadership best practice defined in the FRP policy message. In the FRP, Commanding Officers were charged with articulating command expectations and mission although this FRP policy is different from the Phase 2 survey statement. The survey statement specifically asks a respondent to evaluate whether his or her supervisor (not just his or her commanding officer) ensures command goals are known. In either case, this specific leader behavior correlates highly with a follower's safety climate assessment.

Phase 2 also endeavored to conduct an investigation into the causality link between safety climate and performance. Performance in this regard refers specifically to individual safety behavior (i.e. mishap, accident and injury avoidance). Notwithstanding the limited empirical performance data generated by the survey, <u>a preliminary causal relationship was identified between safety climate assessment and certain safety performance indicators such as a respondent's assessment of organizational safety performance, operational performance and mishap frequency.</u>

The Phase 2 survey instrument provided the researcher with data on policy preferences for cohorts regarding elevated safety climate. For both the officer and enlisted cohorts, policy measures designed to eliminate poor performers along with effective mentoring programs were identified as the top two measures that would potentially improve safety climate in a respondent's unit. These findings are important because they are intuitive, practical, and economical and can be easily operationalized and implemented at the unit level. Many of the safest and most productive strike-fighter squadrons in the Navy today have implemented these policy measures with significant results.

Theoretical Analysis

Returning to the organizing framework detailed in Chapter 2, Schneider's model (Figure 2.1) predicted a linear relationship between the five organizational components evaluated in this study (i.e. human resource management practices, organizational climate, cognitive and affective states, salient organizational behaviors, and organizational productivity). Despite the simplicity of his framework, the results seem to be consistent with the theoretical design. More specifically, Phase 1 research revealed a highly correlative relationship between several leadership best practices and safety climate. In general, the results reveal a positive relationship between rewarding, monitoring and developing practices and the resultant climate dimensions influenced by goals and means emphasis, reward orientations, and task support. A Phase 1 example would be the finding that a comprehensive and effective safety education and training programs positively correlates with elevated safety climate assessment (Table 6.10). This particular leadership best practice is a “developing” practice given Schneider’s rubric and influences the “means emphasis” and “task support” climate dimensions.

Phase 2 results are similar however they predominantly include climate dimensions that emphasis socio-emotional support. For example, a helpful counseling sessions was seen as a leadership practice that was highly predictive of elevated safety climate assessment for the Phase 2 enlisted cohort (see Table 7.10). Effective counseling can be seen as a “monitoring” and “developing” practice that influences “task support” but also provides a significant amount of influence on the socio-emotional dimension of a worker’s climate perceptions (i.e. the feeling that their best interests and personal welfare are valued). Counseling sessions are typically one of the few leader-follower arrangements where personal matters can be openly and candidly discussed. As might be predicted, the data confirms that it is these “effective” counseling sessions that predict higher climate perceptions. Schneider emphasized that his model was not all-inclusive and acknowledged that there are potentially many factors (leadership practices) outside of his model that might influence an individual’s assessment of their workplace climate. Though not comprehensive, the first two components of the climate explanatory model seem to be verified by the statistical analysis of Phase 1 and 2 data.

Schneider’s framework suggests that climate is the psychological process that mediates the relationship between what leaders do (best practices) and the resultant attitudes and behaviors of followers. Based upon this theoretical concept, best practices that effectively elevate safety climate should predict higher levels of worker motivation and job satisfaction. These elevated cognitive and affective states would correlate with improved safety performance. While these components were not assessed in the Phase 1 data, Phase 2 did survey respondents regarding their job satisfaction. Although the officer cohort did not show any correlation (probably due to sample size), the enlisted cohort showed a statistically significant positive correlation between a respondent's assessment of their safety climate and their job satisfaction (see Table 7.2). As safety climate scores increased, so too increased a worker's evaluation of their job satisfaction. Again acknowledging the limitations of this simple relationship, worker motivation is influenced by a variety of cognitive factors to include worker potential, self-efficacy, reward incentives, and how an individual generally feels about their work environment (affective state).

The final theoretical arrangement evaluated in this research plan was the relationship between these two sources of follower influence (cognitive and affective state) and a worker's behavior. For example, does higher motivation (or any other of a variety of metrics used to measure an employee's cognitive or affective state) predict distinctive behavior in three salient organizational contexts (attachment, performance, or citizenship)? Regarding safety performance, quantitative analysis preliminarily reveals a positive correlation between elevated safety climate and positive safety performance parameters. Given the limitations of the safety performance data, Table 7.18 for example reveals that enlisted members who have a positive safety climate assessment are 13 percent more likely to assess their unit's safety performance as a 6 (on a 1 to 6 scale), and 5 percent more likely to report zero mishaps in their unit over the past year, than their counterparts who have a lower safety climate assessment (all else being equal).

While focusing on just the safety element of leadership, climate and performance, it appears there is ample empirical evidence to demonstrate that Schneider's climate and culture model provided an accurate and relevant theoretical framework upon which to design and conduct this policy evaluation research experiment.

Evaluation of Hypotheses

I. For Phase 1, the first research question focuses on the demographics that determine differences in how Navy and Marine Corps strike fighter squadron members assess the safety climate of their organization. **Hypothesis One** states that because of these differences, *individual safety climate assessment for both officers and maintenance personnel will vary with rank, authority, and experience; will vary for maintenance personnel by organizational work center and workday shift; and will vary based upon command location and type.*

Hypothesis One is confirmed.

Senior officers, senior maintenance personnel, and persons in positions of authority were found to have a higher assessment of organizational safety climate while aviators with higher flight experience correlated directly with a higher assessment of command safety climate. Mid-grade Petty Officers (E-4 to E-5) had a lower climate assessment mean compared to junior and senior enlisted categories. Maintenance personnel assigned to the Maintenance Control (MC) and Quality Assurance (QA) work centers had a higher climate assessment than the production work centers while day check personnel revealed a higher climate assessment than night check personnel. Training organizations like the Fleet Replacement Squadron

(FRS) had a lower assessment of squadron climate than their operational counterparts and units assigned overseas showed a lower assessment of climate than their embarked or ashore based counterparts.

II. The second Phase 1 research question investigated if there were certain organizational variables (leadership best practices) that correlated with an individual's assessment of unit safety climate. **Hypothesis Two** states that individuals who favorably view the efficacy of certain leadership best practices will also give a higher rating to their organization's safety climate, *leadership practices that facilitate or encourage open communication regarding operational schedule, organizational mission, safety concerns, personnel management policies, and daily job performance will predict higher levels of individual safety climate assessment; leadership practices that express concern for subordinate development and individual welfare will predict higher levels of individual safety climate assessment*; *and leadership practices based primarily on exchange relationships, will predict lower levels of safety climate assessment.*

Hypothesis Two is confirmed.

Statistical analysis revealed several leadership best practices for both the Navy and Marine Corps officer cohort that correlated positively with elevated safety climate assessment. Two dealt directly with personnel management policy and subordinate welfare (human factor boards and flight violations), three were communication specific (safety violations, safety goals, and operational schedule), one dealt with concern for subordinates (unexpected changes), one dealt with leaders who consider safety issues during the formation and execution of operational and training plans, and the final best practice dealt with methods designed to increase morale and motivation.

The enlisted cohort (both Navy and Marine Corps) revealed similar results dealing primarily with subordinate care and safety concerns (review and update of safety procedures, intolerance for unprofessional behavior, and effective safety education and training programs, well respected quality assurance and safety members, and supervisors who recognize unsafe conditions and manage hazards associated with maintenance and the flight-line). Unfortunately, the FRP did not stress these leadership best practices and therefore the safety climate in the units under study did not change.

Hypothesis Two predicted that the components of an effective leadership best practice (i.e. elevate safety climate) would be grounded in one of the transformational leadership principles outlined by Bernard Bass in Chapter 3 (e.g. concern for subordinate development and individual welfare). When considering the results, it is clear that several of the organizational variables that correlated with elevated safety climate assessment for both the officer and enlisted cohort have both transformational and transactional elements. Specifically, best practices designed to encourage the reporting of safety violations, although clearly designed to protect worker safety and well being, are based primarily on transactional exchange relationships. Workers who report violations expect to be rewarded for their efforts and the focus is typically on maintaining the daily status quo. Programs designed to identify poor or unsafe performers are also based upon a quid pro quo arrangement between the general workforce and management. Despite the altruistic motivations of a concerned follower, often the impetus to report an unsafe worker is the potential for supervisory acknowledgement or reward.

This is not inconsistent with the leadership models introduced in Chapter 3. The transactional model depicted in Figure 3.1 is actually a component of the larger transformational model that predicts extra follower effort (Figure 3.2). While certain elements of a leader action may contribute to the transactional component, other transformational elements may be contributed simultaneously by the same or other leaders. Ultimately, all leader influence is processed and the resultant follower behavior either: fails to meet, meets, or exceeds performance expectations.

Assessing how the Secretary of the Navy's leadership best practices initiative improved safety climate was the focus of research question three. **Hypothesis Three** states that *those leadership best practice designed to emphasize goals and/or means, orient effective rewards, support individuals in their tasks or provide socio-emotional support to unit's members will elevate safety climate.*

Hypothesis Three is partially confirmed

Pre and post-policy analysis of Phase 1 data reveals no increase in safety climate assessment among the survey group because none of the cohorts targeted by the FRP policy demonstrated a measurable climate increase. Only the Marine Corps officer group, a survey cohort not under the FRP directive, showed a significant increase in climate assessment means.

Hypothesis 3 design measures represent the five climate dimensions that Schneider (1990) suggests can be influenced by leader action (human resource management practices) as outlined in his model in Figure 2.1. These six practices (hiring, placing, rewarding, monitoring, developing, and promoting) primarily shape what workers perceive (climate) and according to his model, can ultimately influence employee decision-making. Theoretically, elevating one of the aforementioned climate dimensions (goal emphasis, means emphasis, reward orientation, task support and socio-emotional support) could elevate (positively shape) worker behavior and ultimately improve safety output.

Unfortunately, only four of the sixteen FRP best practices for the Navy and only two of the sixteen for the Marine Corps showed any statistically significant correlation with safety climate assessment. Of those Navy and Marine Corps FRP factors that did correlate, only one factor seems to target the above mentioned climate dimensions. *Communication_1* (Navy only) identifies those respondents who think their leaders are successful in communicating their safety goals to unit personnel (goal emphasis). Despite the significance, this one factor was probably not enough to elevate safety climate perception for the entire cohort.

For the MCAS cohort, the results were similar. Of the fourteen FRP policy intervention modeled, only 3 correlated for the Navy and two for the Marine Corps. *Planning_1* and *training* could both be considered leader actions designed to target the means emphasis climate dimension. Each intervention strives to improve the means (updated procedures, education, and training) workers have to accomplish their jobs safely and effectively. Perhaps these FRP best practices were not enough to cause a detectable increase in safety climate assessment during the policy implementation period.

The first Phase 2 research question focused on determining if certain leadership best practices that are commonly considered outside the scope of the organizational safety program might improve an individual's assessment of unit safety climate. **Hypothesis Four** states that *certain personal and professional development programs will predict higher levels of safety climate assessment.* **Hypothesis Four is confirmed**.

Several safety programs were statistically shown to correlate positively with safety climate assessment including effective safety award programs, operational risk management, effective safety stand downs, and the measurement and publication of safety statistics. Phase 2 analyses revealed certain programs that are typically considered to be outside the construct of traditional safety improvement programs, positively correlated with safety climate assessment. Both the officer and enlisted cohort revealed a highly positive and statistically significant correlation between an effective personnel mentor program and safety climate assessment. This correlation was validated through both individual and group interviews. For the enlisted cohort, respondent's who received helpful counseling sessions from their supervisors predicted higher safety climate assessment along with reward programs (non-safety specific) that acknowledged meritorious effort, vice routine performance. Finally, members who reported being assigned to a unit that created an environment free of race/gender bias positively predicted an elevated individual safety climate assessment.

The Phase 2 survey instrument also provided the researcher with data on other policy preferences regarding elevated safety climate. For both Navy cohorts (officers and enlisted personnel), policy measures designed to eliminate poor performers along with effective mentoring programs were identified as the top two measures that would potentially improve safety climate in a respondent's unit. Neither of these interventions were a part of the FRP policy.

III. The second Phase 2 research question investigated the correlation between the leadership style of a respondent's supervisor and safety climate assessment and whether safety priority influences this assessment**.** **Hypothesis Five** stated that *transformational leadership will predict the highest level of safety climate assessment followed by transactional leaders; laissez-faire leadership will predict the lowest level of safety climate assessment; safety climate assessment will increase under transformational leadership during high safety priority conditions; safety climate assessment will remain unchanged for transactional and laissez-faire leaders during high safety priority conditions.*

Hypothesis Five is confirmed.

Of the 18 survey statements used to place the leadership style of each survey respondent, two factors positively correlated for each of the cohorts. For officer respondents, two transformational qualities of their leaders emerged as positive predictors of safety climate assessment to include leaders who take a stand on controversial issues and consider the moral consequences of their decisions, and leaders who seem to know what is "really going on". For the enlisted group, two different yet equally transformational qualities emerged which are supervisors who are inspirational, and leaders who ensure command goals are known (i.e. updated, shared and published). None of the transactional qualities predicted an elevated level of safety climate assessment with any level of statistical significance. There were an insignificant number of respondents who identified their leaders as laissez-faire, making that leadership style hypothesis unverifiable. This finding means that respondents, who identify their leaders as having either of the two transformational qualities identified above, are more likely to assess their safety climate as higher than those respondents who do not place their leaders in this transformational style category.

None of the factors in the survey that were designed to measure safety priority under certain operational conditions (i.e. combat, stand down, work-ups, schedule change, etc.) revealed any statistical correlation between leadership style and safety climate assessment.

IV. The third Phase 2 research question endeavored to determine if an individual's safety climate assessment mediates behavior-dependent injury and accidents.

Hypothesis Six states *that higher levels of safety climate assessment will predict lower injury and accident rates.*

Hypothesis Six is confirmed.

Given the research limitations on collecting performance data, certain performance measures were included in the survey instrument that indicated a respondent's assessment of a variety of operational and safety performance parameters. A preliminary causal relationship was identified between safety climate assessment and certain safety performance indicators such as a respondent's assessment of organizational safety performance, operational performance, and mishap frequency.

Limitations of Research

Several limitations to this research effort exist which are outlined in no particular order below:

1. Use of secondary data for Phase 1 research: Phase 1 relied on a secondary use data base that was not designed to model the particular organizational policies, practices and procedures under evaluation. Because of this fact, proxies were used to most closely model the factors under investigation for statistical analysis. This methodology introduces potential analytical errors because the survey statements were not specifically framed for policy analysis. Also, because this was a secondary data source, this researcher was unable to interview Phase 1 participants to refine conclusions regarding organizational practices and safety climate assessment.

2. The use of aggregated data for safety climate assessment: Measuring safety climate is a challenge for social science researchers. Evaluating unit climate relies on the aggregation of individual climate perceptions which may not always be an accurate reflection of the safety climate in place at the time of organizational data collection. Despite this potential inaccuracy, this method has garnered broad support among scholars as an approved method for analysis.

3. Lack of longitudinal data: Policy evaluation relied on data collected from different units and different respondents in the pre and post-policy cohorts. This introduces many variables outside the control of the researcher. A longitudinal study would have been more effective. Again however, the secondary data was the only source available for analysis.

4. Survey bias: Regardless of the survey measures in place to ensure participation anonymity, the CSCAS process still retains a certain survey bias that most likely inflates some organizational assessment scores. This is probably most profound for the officer cohort. Participants are never completely assured their personal scores could not, or would not, be attributed to them and are therefore sometimes influenced to moderate their assessment scores.

5. Difficulty of modeling cause and effect relationships in human systems: Policy making and analysis would be easier if cause and effect could always be clearly linked and understood in human systems. Small changes would have small effects, large changes would have large effects, what worked in the past would work in the future, and so on (Gulden, 2006). This researcher recognizes organizations are much more complicated than the linear model that underlies the majority of the policy analysis in this dissertation. This study lacks: the quantification of strategic behavior, the assessment of non-linear feedback systems, and the observation of heterogeneous actors in these high risk organizations.

6. The size of the Phase 2 cohort. The size of the Phase 2 cohort is small, particularly among officer respondents. In light of this fact, conditions are placed on Phase 2 findings although the interview sessions add confidence to Phase 2 conclusions.

7. The limitations of Phase 2 performance data: Establishing confidence in the cause and effect relationship between safety climate and performance remains questionable due to the lack of empirical and respondent attributable performance data although some preliminary progress was made. Two significant obstacles faced

the researcher in Phase 2. First, specific performance data for each unit (i.e. safety data, mishap rates, injury data, lost workdays, etc.) was not made available due to the privileged nature of this data. The researcher had a general sense of the unit's performance based upon community reputation. This information was purely anecdotal however, and could not be used for statistical modeling purposes.

The second obstacle was designing a survey instrument that could collect self-reported safety performance data that would be accurate enough to be used in statistical modeling. There is a certain institutional reluctance for survey respondents to accurately report accident or injury data due to some common biases or misperceptions such as: surveys are never anonymous, the non-attribution policy is deceptive, fear of reprisal, surveys present an opportunity to voice discontent, and/or surveys never lead to affirmative action or organizational change. The validity of the performance data used in Phase 2 must be viewed cautiously while considering it an investigative first step in a more robust and comprehensive research effort.

Contribution to Current Practice

Despite tremendous supervisory involvement at all levels within the military services, uniformed personnel continue to injure themselves at alarming rates. The majority of these incidences occur during non-operational events such as driving to and from work or during recreational events such as boating or skiing. For example, four times as many Navy Sailors are killed annually in private motor vehicle crashes than are fatally injured during operational training events. Simply, the most dangerous time for a member of the military is "off-duty" time. Limitations to duty, lost work days, and medical costs are just some of the metrics used to document the impact non-operational accidents are having on the readiness of our military operating forces. While managing risk "on-the-job" remains a viable and appropriate mishap reduction strategy, the fact remains that the majority of injuries and fatalities sustained by U.S. military members occur during non-operational events.

This dissertation contributes to the current practice of mishap reduction (policy formulation and implementation) in a way not initially envisioned in the research design. While this research project interviewed participants and collected opinion data during the operational workday, the findings reveal some insights relevant to non-operational worker behavior. A worker's attitude regarding safety climate within the workplace environment undoubtedly influences non-workplace attitudes. How a member feels when they leave work inevitably shapes in some measure how they act and feel the rest of the day. While the magnitude, direction, and duration of this influence was not determined in this study, participant interviews revealed that certain workplace attitudes can remain with individuals long after they leave the job. For example, an elated worker might feel happy the rest of the day while a disgruntled member might continue to be distraught or bitter at home. This correlation offers exciting potential. A Sailor with a careless or reckless attitude while working on an airplane at the squadron might fail to wear safety goggles while repairing a neighbor's lawnmower at home. Conversely, a soldier in a transportation battalion known for his or her safety acumen might drive with due diligence on the freeway home. Recognizing this relationship, the potential exists for positive organizational interventions to elevate non-operational safety attitudes. Positive leader influence at work could quite possibly improve safety behavior outside of the workplace. In essence, the interventions suggested in this report for improving workplace safety attitudes and workplace safety performance during the workday might additionally enhance a worker's attitude and behavior during the most hazardous phase of the day, "off-duty" time.

As military organizations modernize and transform, care must be taken to assess and retain those leadership best practices that can be empirically proven to improve organizational safety productivity and efficiency. Unknowingly, several of these best practices might be critical contributors to elevating safety climate and serve as moderators of individual decision-making and safety behavior. Recognizing that accident prevention and mishap mitigation requires creative intervention, this dissertation research suggests certain leadership interventions could improve both operational and non-operational safety performance. Several organizational practices and programs traditionally considered outside the realm of mishap and accident mitigation correlate positively with safety climate assessment and therefore present an area for safety improvement.

In addition to the challenge of reducing non-operational accidents and injuries, the operational military environment remains inherently high-risk. Some high level policy-makers within the uniformed military services and the Department of Defense might conclude that preventable accident and mishap rates have bottomed out and that further reductions would take an unreasonable and cost-ineffective commitment of resources to achieve modest improvements. Two mishaps per 100,000 flight hours remains the annual Class A mishap rate that seems almost impossible for military aviation safety managers and unit leaders to break.

Safety data is over analyzed and often misunderstood, particularly at the strategic level of assessment. Like mishap investigations, safety analysts (particularly at the senior staffs) evaluate performance data at the macro level and attribute success or failure to macro level intervention strategies. Without dismissing the importance of this analysis, this research highlights the potential advantage that might be gained by training and placing either a full-time or collateral duty safety analyst at the unit level of operation. Mishap reduction is all about infinitesimal corrections over an infinite amount of time and the environment may be ready to acknowledge that a "unit-level" professional analyst is needed to assist command leadership in not only recognizing, but also developing and measuring, appropriate interventions to mitigate today's safety trends. This recommendation recognizes the lack of highly skilled safety analysts in the uniformed services. Perhaps there exists an outsourcing opportunity for these services.

More specifically, this research confirms that adequate data existed prior to the FRP implementation date of April 2004 to enable safety policy makers to accomplish several very important objectives. First, a preliminary analysis of historical safety climate data would have shown that certain demographic cohorts have a higher propensity to assess their organizational safety climate as higher compared to their unit colleagues (all else being equal). Also, there are specific leadership interventions that can be empirically shown to elevate safety climate assessment and others that show no correlation with a member's perception of their organizational safety climate. These findings could have been helpful in developing the FRP. Finally, and perhaps most important, the policy presumption upon which the entire mishap reduction strategy was based (i.e. elevated safety climate will predict improved safety performance), was verifiable given the historical safety climate data available from NPS Monterey. Given this rich source of historical climate data, the FRP could have been crafted along the following guidelines:

1. The FRP should have identified specific intervention policies for specific treatment groups rather than the unilateral application of a mishap reduction plan to an entire unit. For example, it is clear that the mid-grade enlisted cohort requires a different policy treatment than the senior officer cohort. This dissertation shows that there are several identifiable demographics (rank, marital status, work shift, etc.) that predict comparatively lower safety climate assessment scores and that it is within these organizational sub-groups that a targeted intervention strategy might be most effective in reducing preventable mishaps.
2. The FRP should have been more specific regarding the efficacy of certain intervention best practices so that policy implementers (COs, leaders, supervisors) could have been more selective (and efficient) in customizing a mishap reduction strategy for their unit. The list of leadership best practices promulgated in the FRP should have been prioritized based upon statistical analysis so that unit leaders had a way of evaluating the cost and benefit of each intervention given their operational schedule and unit needs. Because certain leadership best practices did not correlate statistically with elevated safety climate assessment does not mean they are unimportant practices, rather it means they were less likely to accomplish the policy objective which was to elevate the safety climate in these high-risk units. Undoubtedly these best practices serve a variety of

valuable organizational purposes despite their lack of correlation with the policy objective.

3. The FRP should have included a mechanism for unit leaders to baseline their own unit's organizational safety climate and a method for monitoring the progress of their intervention strategy. A mishap reduction strategy should not be based upon the single accident metric (pass or fail based upon one catastrophic event); rather a leader should be most concerned with small attitudinal changes and subtle degradations or improvements in individual and group perceptions. This should be done incrementally during the course of the treatment phase and not deferred until the end of the two year period. Random samples (both written polls and interviews) taken periodically can be extremely accurate and highly predictive of even small shifts in attitudes and behavior. It seems this tool would have been a valuable addition to the FRP and would have empowered unit leaders to be more in control of their efforts to reduce preventable accidents and mishaps.
4. In addition to base lining and measuring safety attitudes, the FRP should have included a method for obtaining and evaluating safety performance data. This data should have included both operational and non-operational safety performance metrics. The non-operational component should be emphasized because it continues to contribute the highest percentage of preventable accidents and injuries.

Beyond the operational implications, this dissertation represents one practical extension of the military leadership education that is taught in the classroom for example at the three U.S. military service academies. Building upon a core classroom pedagogy, each academy endeavors to synthesize the entire experience of student activity into a leadership component that prepares the young adult for subsequent service as a commissioned military officer. The experience of officer formation is different for each student although each academy endeavors to control this variation through standardized training and adherence to strict performance requirements. Variance occurs due to differences in student background, culture, trait personalities, intelligence, motivation, interests, activities and a whole host of other variables that cannot be controlled for in the officer development model. Simply, students have different traits and experiences that may profoundly effect how they ultimately lead. What does remain constant for each cohort group, however, are the core academic courses taught on the subject of military leadership. Understanding this one constant is an important first step in a broader research investigation into how leadership manifests in individuals in the operational service components of the U.S. Army, Navy and Marine Corps.

This dissertation research has the potential to feed into the organizing concept of leader development systems such as the Cadet Leader Development System (CLDS) at West Point. The CLDS lays out the concept for cadet development in several broad domains of growth. "The central idea is that we intend to educate and train cadets to be effective professional officers. The CLDS can be thought of as a conceptual framework—a theory, if you will—of professional development that provides the basis for the design and implementation of the curriculum and the assessment of students and programs. All cadet development programs, including our undergraduate academic curriculum, flow from this broad framework of student growth" (Forsyth 2004). The core military leadership course (PL300) includes a content area on leadership systems (leader-follower interactions as well as situational factors) and organizational systems (macro-level factors including climate and culture). Mission relating the classroom academic theory to practical field application relies not just on instructor anecdote, but also on the introduction of innovative and current applied scientific research. This doctoral research potentially represents a direct link between the theories of leadership taught in the classroom, and the understandable and measurable implications of leadership applied in the field.

This research on safety climate reveals the potential of crafting leadership intervention strategies designed to influence organizational perceptions or to improve or elevate other (non safety related) climate parameters. While designing a preliminary methodology for assessing these leadership–safety climate–behavior relationships, this dissertation unveils the potential of understanding (and empowering) leaders to improve other climate dimensions within their organizations such as a climate for service, character, honesty, cordiality or profit. While reiterating the difficulty of modeling perceptions and behavior in human systems, this dissertation reveals a methodology designed to evaluate: how certain leader actions might influence follower perceptions, and how changes in perceptions might predict subsequent follower behavior. While the military's recent focus has been on reducing preventable mishaps, there is ample evidence to suggest that many of the best practices modeled in this research (and undoubtedly others) might favorably influence a member's climate perception of other important organizational parameters such as a climate for fairness, equity or justice. Making leaders aware of these connections could improve organizational quality and performance and could represent a significant advance in leader development and leadership education.

This dissertation identifies two significant organizational programs that are extremely correlative with elevated safety climate and highly predictive of positive safety performance. Recognizing that formal mentor programs and sophisticated performance appraisal programs are integral to today's military management rubric, this research indicates that these programs are not optimized to deliver a critical service. Equally important is the fact that with an appropriate level of improvement to these two programs, military leaders have an almost immediate opportunity to improve the safety performance of their units. Although evaluating these programs is beyond the scope of this research project, the discovery that two very specific personnel management programs have the potential to improve organizational safety performance should be valued as an important opportunity for leadership to implement timely and effective change.

These two programs have the potential to legitimately "transform" personnel in very salient ways. A robust mentor program can extract individual potential and turn it into commendable military performance, while a sophisticated performance appraisal program can shape the most efficient fighting force. In addition to improving military operational performance, these programs have the added benefit of elevating workers' attitudes outside of the work environment resulting in potentially fewer non-operational accidents and injuries.

Recommendations for Future Research

To confidently validate the preliminary conclusions of this dissertation, a longitudinal study of a naval aviation unit could be conducted with a policy treatment group and a study control group. The policy treatment would be designed specifically to assess if certain leadership best practices influence safety climate and safety behavior in positive and predictable ways. Ethnographic research augmented with time sequenced surveys and interviews could potentially quantify the behavioral influence of specific leadership best practices on safety climate assessment. In addition, collecting specific performance data (both on and off the job) over time would be required to establish confidence in the climate/performance, cause and effect relationship. Most importantly, observing and collecting data on the antecedents to accident-prone decision-making and behavior would add enormous clarification and insight to understanding how leaders influence the behavior of followers in these high-risk organizations.

The current CSCAS safety climate survey process should collect more demographic data in their survey instrument. While recognizing the purpose of the process is to provide unit leaders with important organizational insight for safety decision-making purposes, there is potentially more leaders can do to customize interventions for specific cohorts (given they are made aware of the data). Also, this researcher understands how demographic questions can bias participants. Care should be given to introduce demographic survey measures in an ordered or systematic way so that this new collection focus is transparent to new and repeat respondents.

More specifically, two important programs emerge in this study that give this researcher optimism that that opportunity to significantly reduce preventable mishaps is well within our reach. Navy leadership must consider forming a blue-ribbon study group to evaluate the content, consistency and efficacy of current performance evaluation programs for both officers and enlisted personnel. This study should include an unbiased assessment of performance appraisal programs and promotion programs currently in effect, with a significant focus on assessing institutional competence in identifying, improving and/or eliminating poor performers. This dissertation verifies the proposition that working with a poor performer (or the perception of working with a poor performer) significantly reduces a member's safety climate assessment and is subsequently highly predictive of accident or mishap propensity. This is a change in paradigm for program evaluators as the historical focus of most performance reviews has been on ensuring the best performers are retained, not the worst performers are separated.

Mentoring programs should be subject to the same formal and objective scrutiny. There is ample statistical and anecdotal evidence to suggest that despite a high-level of focus, program formality, and implementation urgency, the current mentor program is letting many protégés down. Like formal mentoring programs, poor professional development programs, particularly for junior officers and junior enlisted personnel are highly correlated with low safety climate assessment and are predictive of elevated accident or injury propensity. The information, resources and talent to improve these programs exists today. This researcher concludes that it is in these above mentioned areas where leaders can have the greatest impact on elevating safety climate in high-risk military units.

Researchers in other HROs like the Federal Aviation Administration (FAA) or NASA might consider collecting and analyzing safety climate data for the purposes of evaluating leadership effectiveness and to validate or discover other leadership interventions (safety or non-safety related) that might have an influence on worker's organizational attitudes and perceptions.

Appendix A

Command Safety Assessment (CSA) Survey

Part I. Demographic Information

Your rank:
Your designation:
Your current model aircraft:
Your total flight hours:
Your total hours in model:
Are you currently a department head?
Your status:
Your service:
Your parent command:
Your unit's location

Part II. Take Survey
Select one of the following choices:
Strongly Disagree--Disagree--Neutral--Agree--Strongly Agree--N/A--Don't Know

1. My command conducts adequate reviews and updates of safety standards and operating procedures. (PA)

2. My command uses an internal audit and hazard reporting system to catch any problems that may lead to a mishap. (PA)

3. My command has a defined process to set training goals and to review performance. (PA)

4. My command closely monitors proficiency and currency standards to ensure aircrew are qualified to fly. (PA)

5. Command leadership is actively involved in the safety program and management of safety matters. (PA)

6. My command has a defined process to effectively manage the high-risk aviator. (PA)

7. Human Factors Councils have been successful in identifying aircrew members who pose a risk to safety. (PA)

8. Human Factors Boards have been successful reducing chances of an aircraft mishap due to high-risk aviator. (PA)

9. My command makes effective use of the flight surgeon to help identify and manage high-risk personnel. (PA)

10. Command leadership encourages reporting safety discrepancies without the fear of negative repercussions. (RS/SC)

11. Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions. (RS/SC)

12. In my command, peer influence is effective at discouraging violations of standard operating procedures, or safety rules. (RS/SC)

13. In my command, we believe safety is an integral part of all flight operations. (RS/SC)

14. In my command, anyone who intentionally violates standard procedures, or safety rules, is swiftly corrected. (RS/SC)

15. In my command, violations of operating procedures, flying regulations, or general flight discipline are rare. (RS/SC)

16. Leaders in my command encourage everyone to be safety conscious and to follow the rules. (RS/SC)

17. In this command, an aviator who persistently violates flight standards and rules will seriously jeopardize his/her career. (RS/SC)

18. I am not comfortable reporting a safety violation, because people in my command would react negatively toward me. (RS/SC)

19. My command has a reputation for high-quality performance. (QA)

20. My command sets high quality standards and strives to maintain quality control. (QA)

21. My command closely monitors quality and corrects any deviations from established quality standards. (QA)

22. Quality standards in my command are clearly stated in formal publications and procedural guides. (QA)

23. Command leaders permit cutting corners to get a job done. (RM)

24. Lack of experienced personnel has adversely affected my command's ability to operate safely. (RM)

25. Safety decisions are made at the proper levels, by the most qualified people in my command. (RM)

26. Command leaders consider safety issues during the formation and execution of operational and training plans. (RM)

27. Command leadership has a clear picture of the risks associated with its flight operations. (RM)

28. My command takes the time to identify and assess risks associated with its flight operations. (RM)

29. My command does a good job managing risks associated with its flight operations. (RM)

30. My command has increased the chances of a mishap due to inadequate or incorrect risk assessment. (RM)

31. I am provided adequate resources (time, staffing, budget, and equipment) to accomplish my job. (RM)

32. My command provides the right number of flight hours per month for me to fly safely. (RM)

33. I have adequate time to prepare for and brief my flights. (RM)

34. Based upon my command's personnel and other assets, the command is over-committed. (RM)

35. My command has incorporated Operational Risk Management processes in decision-making at all levels. (RM)

36. My supervisor can be relied on to keep his/her word. (CC)

37. Our command leaders and supervisors can be trusted. (CC)

38. My command's Safety Officer is highly regarded. (CC)

39. Our Safety Officer is influential in promoting safety. (CC)

40. My command is genuinely concerned about safety. (CC)

41. Command leadership is successful in communicating its safety goals to unit personnel. (CC)

42. My command provides a positive command climate that promotes safe flight operations. (CC)

43. Command leadership is actively involved in the safety program and management of safety matters. (CC)

44. Command leadership sets the example for compliance with flight standards. (CC)

45. My command ensures that all unit members are responsible and accountable for safe flight operations. (CC)

46. Command leadership willingly assists in providing advice concerning safety matters. (CC)

47. Command leadership reacts well to unexpected changes to its plans. (CC)

48. My command does not hesitate to temporarily restrict from flying individuals who are under high personal stress. (CC)

49. I am adequately trained to safely conduct all of my flights. (CC)

50. Morale and motivation in my command are high. (CC)

51. My command ensures the uniform enforcement of all operating standards among unit members. (CC)

52. Crew rest standards are enforced in my command. (CC)

53. In my command, NATOPS tests and check rides are conducted as intended, to candidly assess aircrew qualifications. (CC)

54. My command provides adequate safety backups to catch possible human errors during high-risk missions. (CC)

55. Within my command, good communications flow exists up and down the chain of command. (CC)

56. My command has good two-way communication with external commands. (CC)

57. Safety education and training are adequate in my command. (CC)

58. The Safety Department is a well-respected element of my command. (CC)

59. The Aviation Safety Officer position is a sought after billet in my command. (CC)

60. My command's Safety Department keeps me well informed regarding important safety information. (CC)

61. My command's Crew Resource Management (CRM) program is helping to improve mission performance and safety. (CC)

62. The most hazardous activity I perform is... (200 words max.)

63. The most significant action(s) my unit can take to improve safety is/are... (200 words max.)

Code:

PA: Process Auditing

RA: Reward System

QC: Quality Control

RM: Risk Management

CC Command and Control

Appendix B

Maintenance Climate Assessment Survey (MCAS)

Part I. Demographic Information

Your rank:
Total years aviation maintenance experience:
Your work center:
Your primary shift:
Your current model aircraft:
Your status:
Your service:
Your parent command:
Your unit's location

Part II. Take Survey
Select one of the following choices:
Strongly Disagree--Disagree--Neutral--Agree--Strongly Agree--N/A--Don't Know

1. The command adequately reviews and updates safety procedures. (PA)

2. The command monitors maintainer qualifications and has a program that targets training deficiencies. (PA)

3. The command uses safety and medical staff to identify/manage personnel at risk. (PA)

4. CDIs/QARs routinely monitor maintenance evolutions. (PA)

5. Tool Control and support equipment licensing are closely monitored. (PA)

6. Signing off personnel qualifications is taken seriously. (PA)

7. Our command climate promotes safe maintenance. (RS/SC)

8. Supervisors discourage SOP, NAMP or other procedure violations and encourage reporting safety concerns. (RS/SC)

9. Peer influence discourages SOP, NAMP or other violations and individuals feel free to report them. (RS/SC)

10. Procedural violations of SOP, NAMP or other procedures are not common in this command. (RS/SC)

11. The command recognizes individual safety achievement through rewards and incentives. (RS/SC)

12. Personnel are comfortable approaching supervisors about personal problems/illness. (RS/SC)

13. Safety NCO, QAR and CDI are sought after billets. (RS/SC)

14. Unprofessional behavior is not tolerated in the command. (RS/SC)

15. The command has a reputation for quality maintenance and set standards to maintain quality control. (QA)

16. QA and Safety are well respected and are seen as essential to mission accomplishment. (QA)

17. QARs/CDIs sign-off after required actions are complete and are not pressured by supervisors to sign-off. (QA)

18. Maintenance on detachments is of the same quality as that at home station. (QA)

19. Required publications/tools/equipment are available, current/serviceable, and used. (QA)

20. QARs are helpful, and QA is not 'feared' in my unit. (QA)

21. Multiple job assignments and collateral duties adversely affect maintenance. (RM)

22. Safety is part of maintenance planning, and additional training/support is provided as needed. (RM)

23. Supervisors recognize unsafe conditions and manage hazards associated with maintenance and the flight-line. (RM)

24. I am provided adequate resources, time, and personnel to accomplish my job. (RM)

25. Personnel turnover does not currently impact the command's ability to operate safely. (RM)

26. Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners. (RM)

27. Day/Night Check has equal workloads. Staffing is sufficient on each shift. (RM)

28. Supervisors shield personnel from outside pressures and are aware of individual workload. (RM)

29. Based upon my command's current assets/manning it is not over-committed. (RM)

30. My command temporarily restricts maintainers who are having problems. (CC)

31. Safety decisions are made at the proper levels and work center supervisor decisions are respected. (CC)

32. Supervisors communicate command safety goals and are actively engaged in the safety program. (CC)

33. Supervisors set the example for following maintenance standards and ensure compliance. (CC)

34. In my command, safety is a key part of all maintenance operations and all are responsible/accountable for safety. (CC)

35. Safety education and training are comprehensive and effective. (CC)

36. All maintenance evolutions are properly briefed, supervised and staffed by qualified personnel. (CC)

37. Maintenance Control is effective in managing all maintenance activities. (CC)

38. Effective communication exists up/down the chain of command. (C/FR)

39. I get all the information I need to do my job safely. (C/FR)

40. Work center supervisors coordinate their actions with other work centers and Maintenance. (C/FR)

41. My command has effective pass-down between shifts. (C/FR)

42. Maintenance Control troubleshoots/resolves gripes before flight. (C/FR)

43. Maintainers are briefed on potential hazards associated with maintenance activities. (C/FR)

44. The next quality defect will be caused by... (200 words max.)

45. The next quality defect can be prevented by... (200 words max.)

<u>Code</u>:

PA: Process Auditing

RS: Reward System

QA: Quality Control

RM: Risk Management

CC: Command and Control

C/FR: Communications

Appendix C

*Leadership and Safety Climate Research Project (**Officer Survey**)*

My name is Mark Adamshick and I am conducting a research project at the University of Maryland, College Park. I am inviting you to participate in this research because you are at least 18 years of age and a member of a U.S. Navy or Marine Corps Strike Fighter squadron. The purpose of this research is to determine if certain leadership interventions influence safety climate in high-risk military aviation units. I am asking you to complete a confidential survey. The questions in the survey will require you to assess the current safety climate of your unit. I ask for your truthful responses to questions asking you to assess how certain command policies, programs and procedures influence safety climate. To help protect your confidentiality, your name will not be included on the survey and no person or unit identifiable data will be collected. **The study is voluntary and anonymous.**

This research is not designed to help you personally, but the results may help me learn more about how certain command policies and procedures might improve a command's safety performance. I hope that in the future, other people might benefit from this study through improved understanding of how specific leadership interventions might positively influence the safety climate of similar military organizations. Your participation in this research is voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you have any questions about the research study itself, please contact Mark Adamshick at the University of Maryland, 2101 Van Munching Hall at (301) 405-6226 or madamshi@umd.edu.

This research has been reviewed and approved according to the University of Maryland, College Park IRB procedures for research involving human subjects and complies with DOD regulations regarding the same.

Circle all choices that apply (Pen or pencil is fine):

1. Demographic Data

1. My rank is..	O-1	O-2	O-3	O-4	O-5	CWO	
2. My service is.......................................	USN	USMC					
3. My status is……………...…………….	Active Duty	Active Reserve	Drilling Reserve	Other			
4. I am..	Male	Female					
5. I am	U.S. born	U.S Naturalized	Foreign Exchange				
6. I consider myself.................................	Caucasian	African American	Hispanic	Asian	Pacific Islander	Native American	Other
7. My designation is................................	Pilot	NFO	Admin	Maint	Intel	Medical	Other
8. Flight experience (total hrs/all models).	< 500	500-1000	1001-1500	1501-2000	2001-2500	>2500	N/A
9. I am a...	Branch Officer	Division Officer	Phase Head	Department Head	XO/CO	Other	
10. I am..	Single	Married	Separated	Divorced			
11. My spouse..	Resides w/me	Resides elsewhere	N/A				
12. My spouse..	Is not employed	Works part time	Works full time	N/A			

13. My spouse is in the military…………	Yes	No	N/A			
14. I live in base housing………………..	Yes	No				
15. I have...	0 children	1-2 children	3-4 children	5 or more	N/A	
16. My highest level of education is..........	2 yr college	4 yr college	Master’s	Other		
17. My commissioning source was...........	USNA	ROTC	OCS	ECP	PLC	Other
18. I am from the following geographic region (U.S.)...	N.E.	S.E.	N.W.	S.W.	Midwest	N/A
19. My home setting was primarily..........	Urban	Rural	Suburban	Other		
20. My parents served in the military........	One	Both	None			
21. I have been in this command………...	< 1 yr	1-2 yrs	2-3 yrs	3-4 yrs	> 4 yrs	
22. Over the **past year**, I have been injured on the job (mild to serious)……...	None	1 time	2 times	3 times	> 3 times	
23. Over the **past year**, I have been injured during leisure time (mild to serious)..	None	1 time	2 times	3 times	> 3 times	
24. Over the **past year**, I have been involved in a workplace mishap...............	None	1 time	2 times	3 times	> 3 times	
25. Over the **past year**, this command has had a Class A, B, or C aircraft mishap......	None	1 time	2 times	3 times	> 3 times	
26. Number of people I have seen injured at work over the **past year** (mild to serious)…………………………………..	0	1-2	3-4	5-6	> 6	
27. On average, I get the following amount of sleep each 24 hr cycle.............	< 5 hrs	5-6 hrs	6-7 hrs	7-8 hrs	8-9 hrs	> 9 hrs
28. My assessment of this command’s **operational** performance (Scale: 1=poor, 6=exceptional).................	1	2	3	4	5	6
29. My assessment of this command’s **safety** performance (Scale: 1=poor, 6=exceptional)…………	1	2	3	4	5	6
30. My job satisfaction is: (Scale; 1=low, 6=high)............................	1	2	3	4	5	6
31. The promotion recommendation on my last FITREP was (for US Navy)..........	P	MP	EP	Don’t know		

31a. The promotion recommendation on my last FITREP was (for USMC).............	Rec	Not-Rec	Don't know
32. I have served in the Safety Department this tour.................................	Yes	No	

2. Safety Climate

This section addresses your perception of the safety climate in your unit. Safety climate is how you interpret the safety conditions of your work environment and how it guides your behavior.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
33. I consider the safety climate in this command to be very high..	1	2	3	4	5	6	0
34. The safety climate in this command rarely changes…………………………………………….	1	2	3	4	5	6	0
35. Most people share my assessment of this unit's safety climate..	1	2	3	4	5	6	0
36. Safe operations are more important than fixing airplanes and meeting the flight schedule................	1	2	3	4	5	6	0
37. Safety climate improves as the operational demand increases (e.g. workups, deployment or combat)...	1	2	3	4	5	6	0
38. I would recommend this command to a friend..	1	2	3	4	5	6	0
39. Morale in this command is high.......................	1	2	3	4	5	6	0
40. People care about my opinion…………………	1	2	3	4	5	6	0
41. I am surprised we do not have more accidents or injuries than we do..	1	2	3	4	5	6	0
42. People are willing to take unsafe risks when the operational tempo increases (e.g. work-ups, deployment, or combat)...................................	1	2	3	4	5	6	0
43. Mandatory safety stand downs are effective in improving safety climate………………………….	1	2	3	4	5	6	0

3. Safety Program

Your assessment of the safety programs in your command.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
44. Individuals in my command are willing to report safety violations, unsafe behaviors or hazardous conditions...	1	2	3	4	5	6	0
45. Human Factors Boards have been successful in identifying the high-risk aviators............................	1	2	3	4	5	6	0
46. Leadership considers safety issues during the formation of operational and training plans (ORM)	1	2	3	4	5	6	0

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
47. People who intentionally violate standard procedures or safety rules are swiftly corrected......	1	2	3	4	5	6	0
48. Leaders communicate safety goals in relevant terms..	1	2	3	4	5	6	0

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
49. My command reacts well to unexpected changes to its plans..	1	2	3	4	5	6	0
50. My command measures safety statistics and publishes the results..	1	2	3	4	5	6	0
51. My command uses safety data to implement important organizational changes...........................	1	2	3	4	5	6	0
52. My fitness report includes a fair assessment of my contribution to command safety.......................	1	2	3	4	5	6	0
53. Safety awards are meaningful and highly coveted..	1	2	3	4	5	6	0
54. I am empowered to stop squadron operations if safety is being compromised..................................	1	2	3	4	5	6	0
55. I am allotted sufficient time to get my job done safely..	1	2	3	4	5	6	0
56. The best people in this command are assigned to the Safety Department..	1	2	3	4	5	6	0

4. Squadron Programs

Your perception of squadron management and leadership programs.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
57. My boss counsels me according to published guidelines.…………………………………...........	1	2	3	4	5	6	0
58. My counseling sessions are very helpful….......	1	2	3	4	5	6	0
59. My FITREP is an accurate reflection of my performance...	1	2	3	4	5	6	0
60. Someone in my organization has taken me under their wing and mentors me...........................	1	2	3	4	5	6	0
61. People are rewarded for meritorious work, not just for doing their job..	1	2	3	4	5	6	0
62. My command considers the impact on my family when making organizational decisions.........	1	2	3	4	5	6	0
63. My boss helped me form a personal plan for professional development and advancement...........	1	2	3	4	5	6	0

64. People are assigned jobs based upon performance, not tenure, favor or friendship...........	1	2	3	4	5	6	0
65. There is no racial/gender bias in this command	1	2	3	4	5	6	0
66. I will be a better leader because of this tour….	1	2	3	4	5	6	0

5. Leadership Style

Your assessment of the leader (C.O., D.H., or immediate supervisor), who most closely influences your daily behavior.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
67. My supervisor instills pride in me and others....	1	2	3	4	5	6	0
68. My supervisor promotes a collective sense of mission...	1	2	3	4	5	6	0
69. My supervisor is inspirational...........................	1	2	3	4	5	6	0
70. My supervisor makes personal sacrifices..........	1	2	3	4	5	6	0
71. My supervisor champions new possibilities......	1	2	3	4	5	6	0
72. My supervisor challenges me intellectually to understand the problems I face...............................	1	2	3	4	5	6	0
73. My supervisor takes a stand on controversial issues, considering the moral consequences of decisions..	1	2	3	4	5	6	0
74. The goals of this command are known (updated, shared and published).............................	1	2	3	4	5	6	0
75. My supervisor endorses rewards/awards based upon performance..	1	2	3	4	5	6	0
76. This command closely monitors individual performance and keeps track of mistakes...............	1	2	3	4	5	6	0
77. My supervisor is always aware of performance problems...	1	2	3	4	5	6	0
78. My supervisor leads by fear and intimidation…...	1	2	3	4	5	6	0
79. People in my chain of command avoid responsibility and/or fail to make decisions............	1	2	3	4	5	6	0
80. My chain of command always follows up on my requests..	1	2	3	4	5	6	0
81. My supervisor's leadership style changes as operational demand increases (e.g. work-ups, deployment, combat)..	1	2	3	4	5	6	0
82. My boss micro manages everything I do……..	1	2	3	4	5	6	0

83. My boss micro-manages more when operational tempo increases....................................	1	2	3	4	5	6	0
84. My boss really knows what is going on………	1	2	3	4	5	6	0

6. Program Assessment

85. Consider the following options as potential ways to improve your unit's **safety climate**. What interventions would improve how people perceive their work environment and/or improve safety performance? Choose the three options you think would improve safety climate the most and rank them by placing a 1, 2 and 3 next to those choices. Please comment on these choices in section 7.

___ Establish a functional mentor program

___ Publish safety statistics

___ Improve squadron resources ($$$$$)

___ Reduce operational tempo

___ Give out more awards

___ Take better care of my family

___ More objective and concrete feedback

___ Better hardware (aircraft, tools, parts)

___ Improve base housing

___ Increase unit diversity (race, gender

___ More medical personnel (e.g. flight surgeon)

___ Better professional growth programs

___ Institute a merit-based ranking system

___ Improve squadron communications

___ Increase my pay and benefits

___ Increase tour length/reduce turnover

___ Improve technical training

___ Make decision-making more participatory

___ More individual autonomy, less micromanagement

___ Improve workspaces (equipment, habitability)

___ Improved medical care for my family

___ Improve family advocacy programs

___ Get rid of poor performers (officer and enlisted)

___ (fill-in)_____________________________________

7. Free response

86. Comment on any dimension of safety climate you consider important or relevant. Of particular interest to this researcher might be any supervisory policy, organizational program or leadership dimension that might influence safety climate that you consider to be overlooked or ignored. These observations or comments could be either positive or negative. Please comment on behavioral influences that might have potential safety implications. What are the things leaders do that improve the safety environment and make you want to perform your job safely?

Appendix D

*Leadership and Safety Climate Research Project (**Enlisted Survey**)*

My name is Mark Adamshick and I am conducting a research project at the University of Maryland, College Park. I am inviting you to participate in this research because you are at least 18 years of age and a member of a U.S. Navy or Marine Corps Strike Fighter squadron. The purpose of this research is to determine if certain leadership interventions influence safety climate in high-risk military aviation units. I am asking you to complete a confidential survey. The questions in the survey will require you to assess the current safety climate of your unit. I ask for your truthful responses. To help protect your confidentiality, your name will not be included on the survey and no person or unit identifiable data will be collected. **The study is voluntary and anonymous.**

This research is not designed to help you personally, but the results may help me learn more about how certain command policies and procedures might improve a command's safety performance. I hope that in the future, other people might benefit from this study through improved understanding of how specific leadership interventions might positively influence the safety climate of similar military organizations. Your participation in this research is voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you have any questions about the research study itself, please contact Mark Adamshick at the University of Maryland, 2101 Van Munching Hall at (301) 405-6226 or madamshi@umd.edu.

This research has been reviewed and approved according to the University of Maryland, College Park IRB procedures for research involving human subjects and complies with DOD regulations regarding the same.

Circle all choices that apply (pen or pencil is fine):
1. Demographic Data

1. My rank is..	E-1/2	E-3	E-4	E-5	E-6	E-7	E-8/9
2. My service is..	USN	USMC					
3. My status is..	Active Duty	Active Reserve	Drilling Reserve	Other			
4. I am………...	Male	Female					
5. I am..	U.S. born	U.S. naturalized	Non U.S. citizen				
6. I consider myself......................................	Caucasian	African American	Hispanic	Asian	Pacific Islander	Native American	Other
7. My specialization is..................................	Maintenance	Admin	Intel	Medical	Services	Disbursing	Other
8. If a maintainer, my work center is...........	Maintenance Control	QA	PP	A/F	Avionics	Ordnance	Line
………………………………………………	Corrosion	Survival/PR	Other	N/A			
9. My primary work shift is..........................	Day check	Night check	Mid-check				
10. I am..	Single	Married	Separated	Divorced			
11. My spouse...	Resides w/me	Resides elsewhere	N/A				

12. My spouse...	Is not employed	Works part-time	Works full-time	N/A			
13. My spouse is in the military…………….	Yes	No	N/A				
14. I live in base housing…………………......	Yes	No					
15. I have..	0 children	1-2 children	3-4 children	5 or more	N/A		
16. My highest level of education is.............	some HS	HS diploma	GED	some college	college degree	Master's degree	Other
17. I am a..	LPO	Shift Sup	W/C Sup	Br CPO	Div CPO	Other	N/A
18. I grew up in the U.S…………………….	N.E.	S.E.	N.W.	S.W.	Midwest	Pac island	N/A
19. I grew up in the following setting...........	City	Country	Suburban	Other			
20. My parents served in the military...........	One	Both	None				
21. I have been in this command…………...	< 1 yr	1-2 yrs	2-3 yrs	3-4 yrs	> 4 yrs		
22. Over the **past year**, I have been injured on the job (mild to serious)……...................	None	1 time	2 times	3 times	> 3 times		
23. Over the **past year**, I have been injured during leisure time (mild to serious).............	None	1 time	2 times	3 times	> 3 times		
24. Over the **past year**, I have been involved in a workplace mishap..................................	None	1 time	2 times	3 times	> 3 times		
25. Over the **past year**, this command has had a Class A, B, or C aircraft mishap….......	None	1 time	2 times	3 times	> 3 times		
26. On average, I get the following amount of sleep each 24 hr cycle...............................	< 5 hrs	5-6 hrs	6-7 hrs	7-8 hrs	8-9 hrs	> 9 hrs	
27. Number of people I have seen injured at work over the **past year** (mild to serious)….	0	1-2	3-4	5-6	> 6		
28. My assessment of this command's **operational** performance (Scale: 1=poor, 6=exceptional).....................	1	2	3	4	5	6	
29. My assessment of this command's **safety** performance (Scale: 1=poor, 6=exceptional)………..……	1	2	3	4	5	6	
30. My job satisfaction is: (Scale: 1=low, 6=high)................................	1	2	3	4	5	6	
31. The promotion recommendation on my last evaluation was (USN)............................	P	MP	EP	Don't know			

31a. The promotion recommendation on my last evaluation was (USMC).........................	Rec	Not-Rec	Don't know
32. I have served in the Safety Department or have been a Safety PO this tour................	Yes	No	

2. Safety Climate

Your perception of the safety climate in your unit. Safety climate is how you interpret the safety conditions of your work environment and how it guides your behavior.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
33. I consider the safety climate in this command to be very high..	1	2	3	4	5	6	0
34. The safety climate in this command rarely changes…………………………………………….	1	2	3	4	5	6	0
35. Most people share my assessment of this unit's safety climate...	1	2	3	4	5	6	0
36. Safe operations are more important than fixing airplanes and meeting the flight schedule...............	1	2	3	4	5	6	0
37. Safety climate improves as the operational demand increases (e.g. deployment or combat)......	1	2	3	4	5	6	0
38. I would recommend this command to a friend..	1	2	3	4	5	6	0
39. Morale in this command is high…………..........	1	2	3	4	5	6	0
40. People care about my opinion…………………	1	2	3	4	5	6	0
41. I am surprised we do not have more accidents or injuries than we do..	1	2	3	4	5	6	0
42. People are willing to take unsafe risks when the operational tempo increases.....................	1	2	3	4	5	6	0
43. Mandatory safety stand downs are effective in improving safety climate………………………….	1	2	3	4	5	6	0

3. Safety Programs

Your assessment of the safety program in your command.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
44. Individuals in my command are willing to report safety violations or unsafe behavior.............	1	2	3	4	5	6	0
45. Leadership considers safety issues during the formation of operational and training plans (ORM)	1	2	3	4	5	6	0
46. Anyone who intentionally violates standard procedures or safety rules is swiftly corrected.........	1	2	3	4	5	6	0

47. Safety goals are clear and relevant..................	1	2	3	4	5	6	0
48. My command reacts well to unexpected changes to its plans..	1	2	3	4	5	6	0
49. My command measures safety statistics and publishes the results...	1	2	3	4	5	6	0
50. My command uses safety data to implement important organizational changes...........................	1	2	3	4	5	6	0
51. My performance evaluation fairly assesses my contribution to command safety.......................	1	2	3	4	5	6	0
52. Safety awards are meaningful and highly coveted...	1	2	3	4	5	6	0
53. I am empowered to stop squadron operations if safety is being compromised..................................	1	2	3	4	5	6	0
54. I have sufficient time to do my job done safely.	1	2	3	4	5	6	0
55. The best people in this command are assigned to the Safety Department.......................................	1	2	3	4	5	6	0
56. Injuries and/or accidents are always reported....	1	2	3	4	5	6	0

4. Squadron Programs

Your perception of squadron management and leadership programs.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
57. My boss counsels me according to published guidelines.…………………………………...........	1	2	3	4	5	6	0
58. My counseling sessions are very helpful….......	1	2	3	4	5	6	0
59. My evaluation is an accurate reflection of my performance...	1	2	3	4	5	6	0
60. Someone in my organization has taken me under their wing and mentors me...........................	1	2	3	4	5	6	0
61. People are rewarded for meritorious work, not just for doing their job...	1	2	3	4	5	6	0
62. My command considers the impact on my family when making organizational decisions.........	1	2	3	4	5	6	0
63. This command helped me form a personal plan for professional development and advancement......	1	2	3	4	5	6	0
64. People are assigned jobs based upon performance, not tenure, favor or friendship...........	1	2	3	4	5	6	0
65. There is no racial/gender bias in this command	1	2	3	4	5	6	0

66. I will be a better leader because of this tour….	1	2	3	4	5	6	0

5. Leadership Style

Your assessment of the supervisor, who most closely influences your daily behavior.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know	N/A
67. My supervisor instills pride in me and others....	1	2	3	4	5	6	0
68. My supervisor promotes a collective sense of mission..	1	2	3	4	5	6	0
69. My supervisor is inspirational...........................	1	2	3	4	5	6	0
70. My supervisor makes personal sacrifices..........	1	2	3	4	5	6	0
71. My supervisor champions new possibilities......	1	2	3	4	5	6	0
72. My supervisor challenges me intellectually to understand the problems I face...............................	1	2	3	4	5	6	0
73. My supervisor takes a stand on controversial issues, considering the moral consequences of decisions..	1	2	3	4	5	6	0
74. The goals of this command are known (updated, shared and published).............................	1	2	3	4	5	6	0
75. My supervisor endorses rewards/awards based upon performance..	1	2	3	4	5	6	0
76. This command closely monitors individual performance and keeps track of mistakes...............	1	2	3	4	5	6	0
77. My supervisor is always aware of performance problems...	1	2	3	4	5	6	0
78. My supervisor leads by fear and intimidation…...	1	2	3	4	5	6	0
79. People in my chain of command avoid responsibility and/or fail to make decisions............	1	2	3	4	5	6	0
80. My chain of command always follows up on my requests..	1	2	3	4	5	6	0
81. My supervisor's leadership style changes as operational demand increases (e.g. work-ups, deployment, combat)...	1	2	3	4	5	6	0
82. My supervisor micro manages everything I do	1	2	3	4	5	6	0
83. My supervisor micro-manages more when operational tempo increases....................................	1	2	3	4	5	6	0
84. My supervisor really knows what is going on...	1	2	3	4	5	6	0

6. Program Assessment

85. Consider the following options as potential ways to improve your unit's **safety climate**. What interventions would improve how people perceive their work environment and/or improve safety performance? Choose the three options you think would improve safety climate the most and rank them by placing a 1, 2 and 3 next to those choices. Please comment on these choices in section 7.

___ Establish a functional mentor program

___ Publish safety statistics

___ Improve squadron resources ($$$$$)

___ Reduce operational tempo

___ Give out more awards

___ Take better care of my family

___ More objective and concrete feedback

___ Better hardware (aircraft, tools, parts)

___ Improve base housing

___ Increase unit diversity (race, gender

___ More medical personnel (e.g. flight surgeon)

___ Better professional growth programs

___ Institute a merit-based ranking system

___ Improve squadron communications

___ Increase my pay and benefits

___ Increase tour length/reduce turnover

___ Improve technical training

___ Make decision-making more participatory

___ More individual autonomy, less micromanagement

___ Improve workspaces (equipment, habitability)

___ Improved medical care for my family

___ Improve family advocacy programs

___ Get rid of poor performers (officer and enlisted)

___ (fill-in)____________________________________

7. Free response

86. Comment on any dimension of safety climate you consider important or relevant. Of particular interest to this researcher might be any supervisory policy, organizational program or leadership dimension that might influence safety climate that you consider to be overlooked or ignored. These observations or comments could be either positive or negative. Please comment on behavioral influences that might have potential safety implications. What are the things leaders do that improve the safety environment and make you want to perform your job safely?

Appendix E

<u>*Mishap/Injury Summary Data, Unit Distribution (Oceana Survey)*</u>

Figure E.1 *injury1* Summary by Unit (Officer)

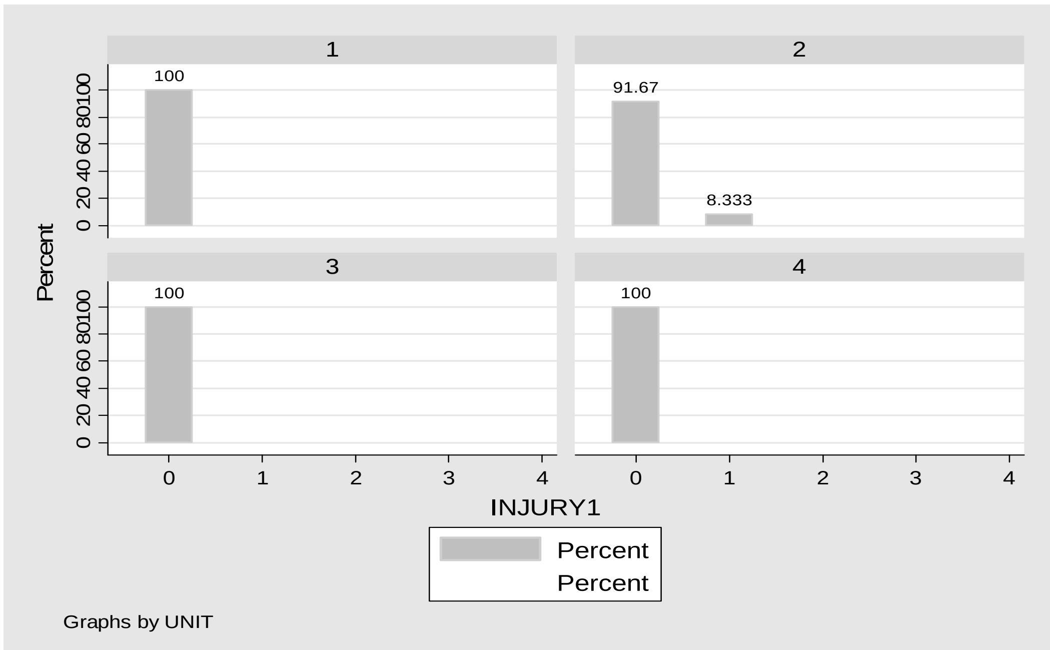


Figure E.2 *injury2* Summary by Unit (Officer)

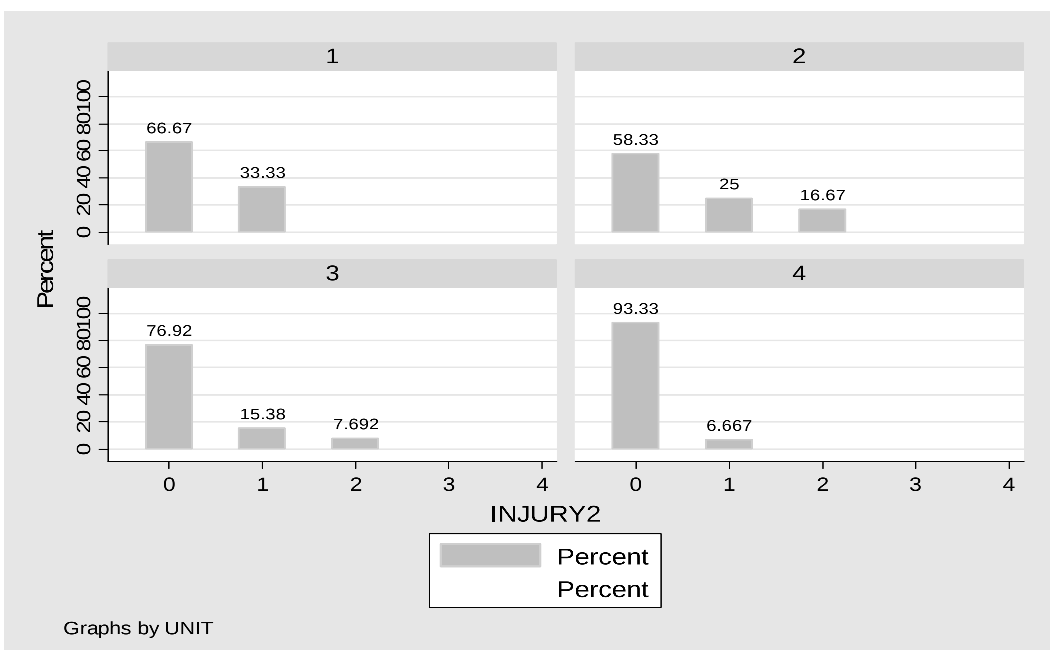


Figure E.3 *injury3* Summary by Unit (Officer)

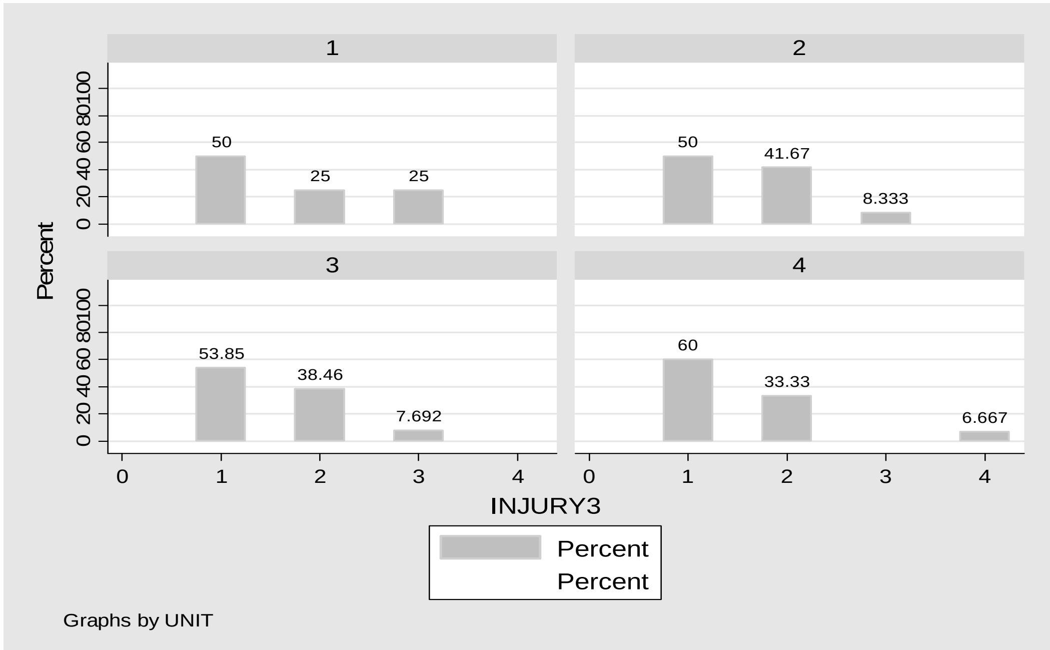


Figure E.4 *mishap1* Summary by Unit (Officer)

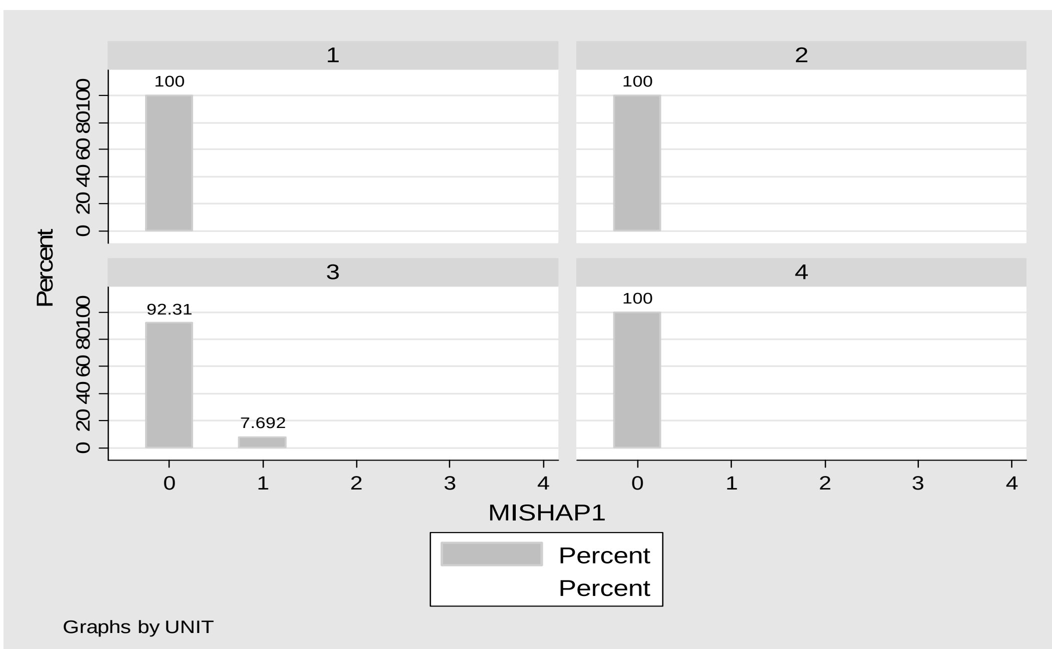


Figure E.5 *mishap2* Summary by Unit (Officer)

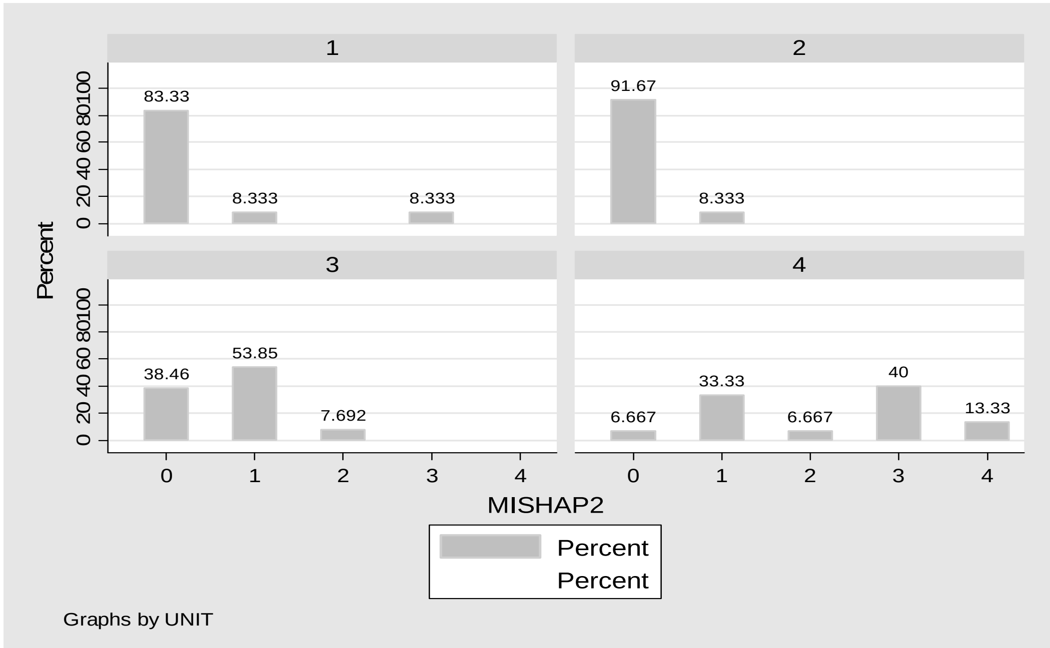


Figure E.6 *injury1* Summary by Unit (Enlisted)

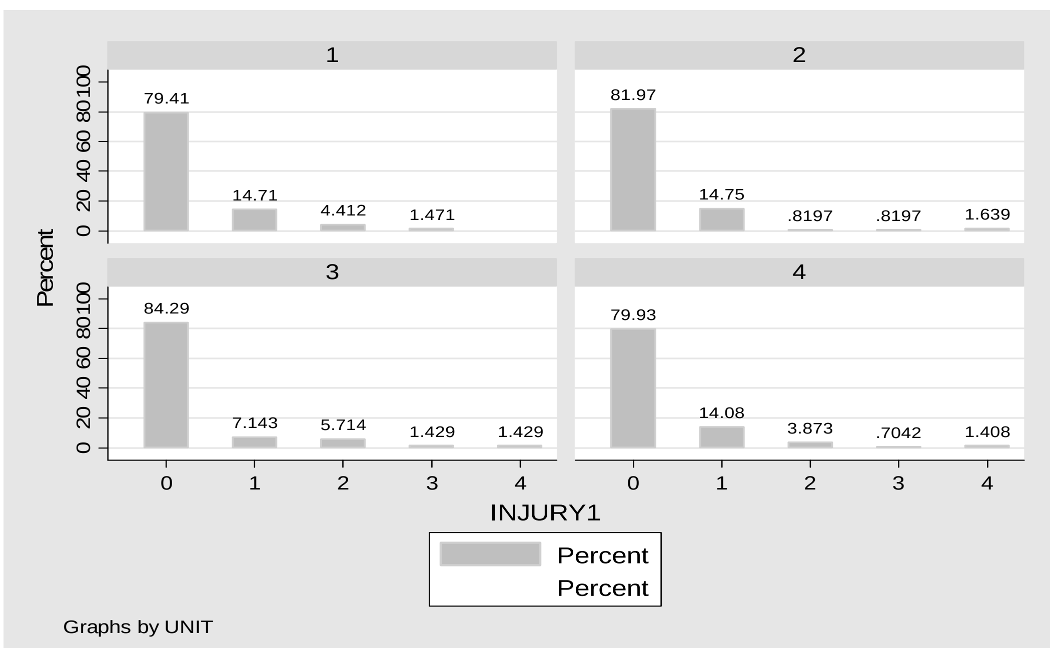


Figure E.7 *injury2* Summary by Unit (Enlisted)

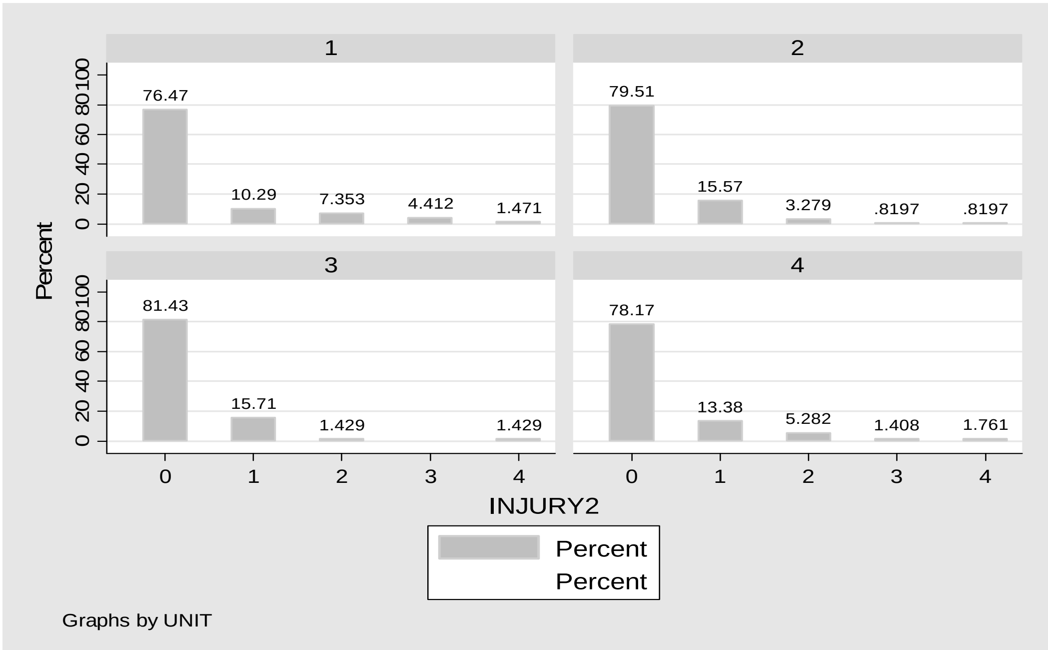


Figure E.8 *injury3* Summary by Unit (Enlisted)

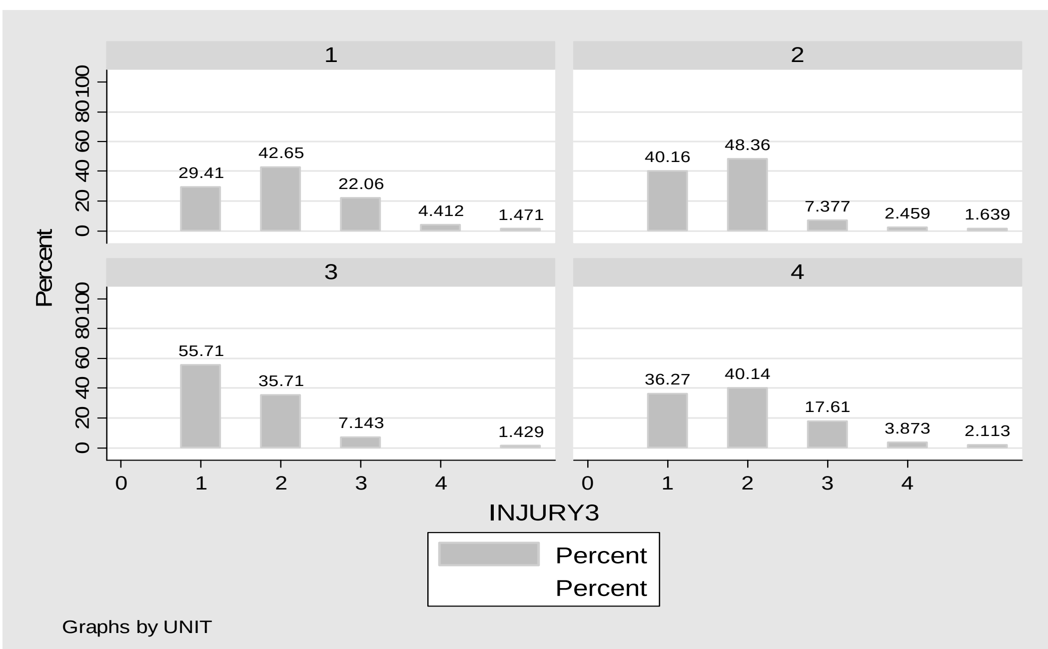


Figure E.9 *mishap1* Summary by Unit (Enlisted)

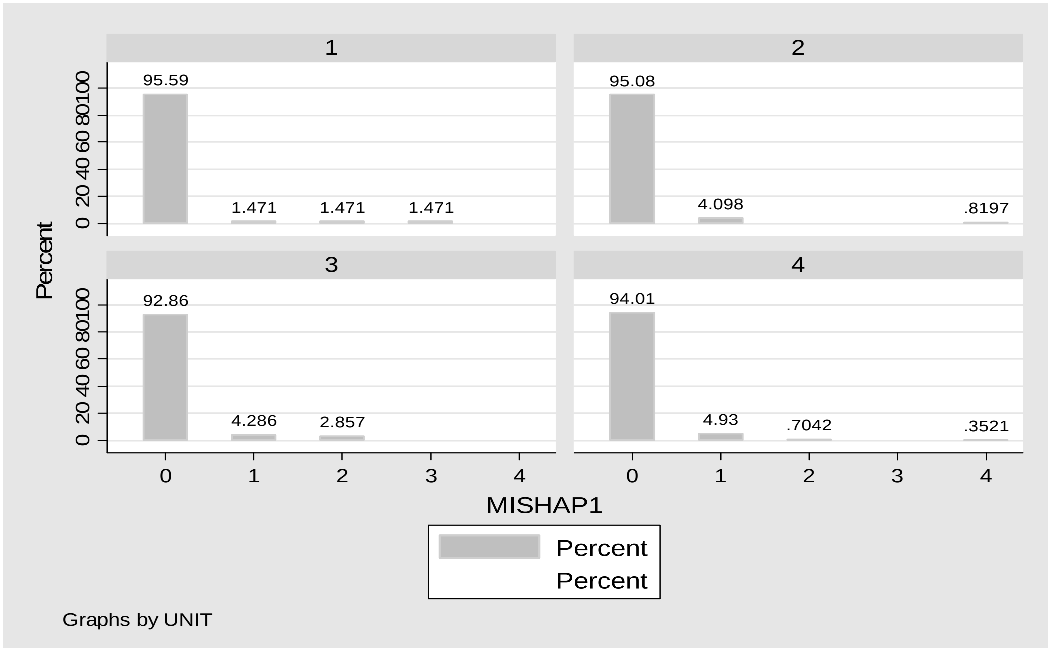
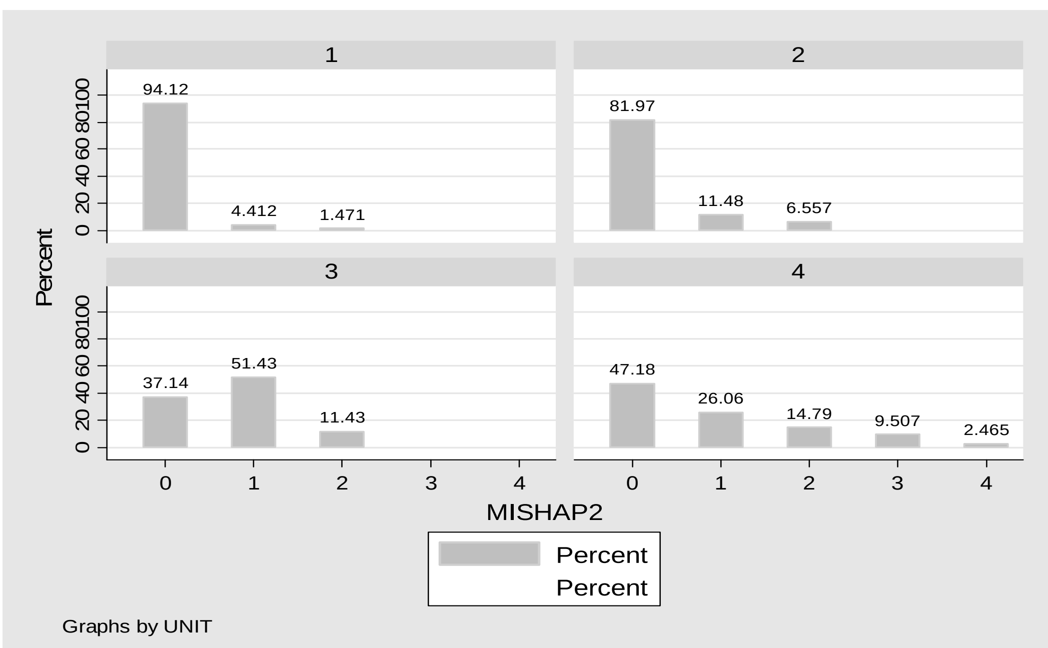


Figure E.10 *mishap2* Summary by Unit (Enlisted)



Appendix F

<u>*Safety Climate Improvement Choices (Oceana Survey)*</u>

Figure F.1 Safety Climate Improvement Choices, Officer (Second Choice)

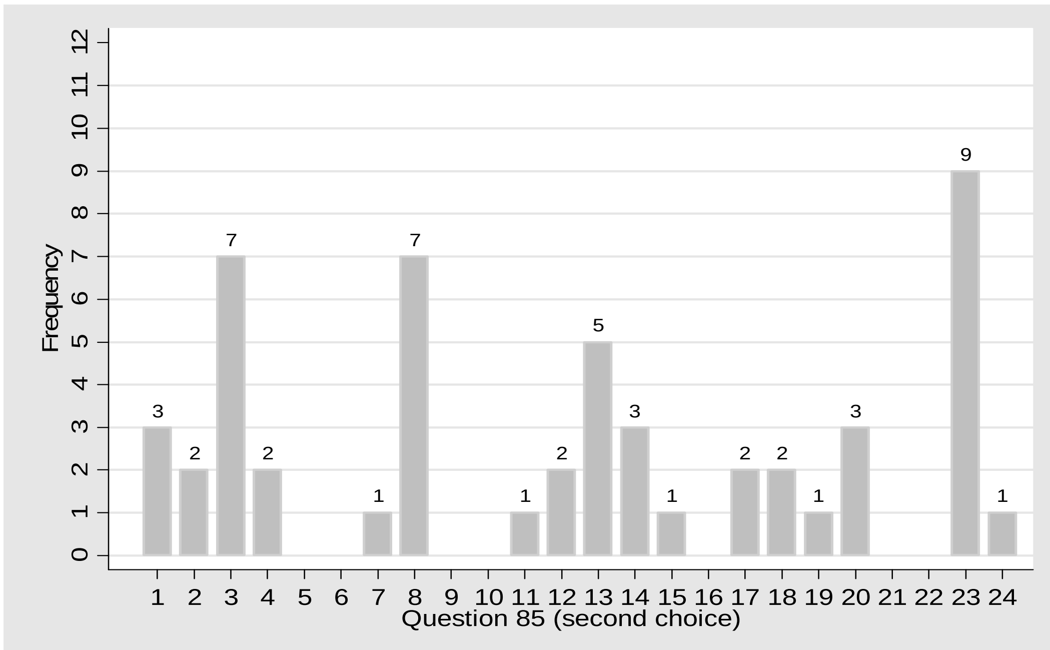


Figure F.2 Safety Climate Improvement Choices, Officer (Third Choice)

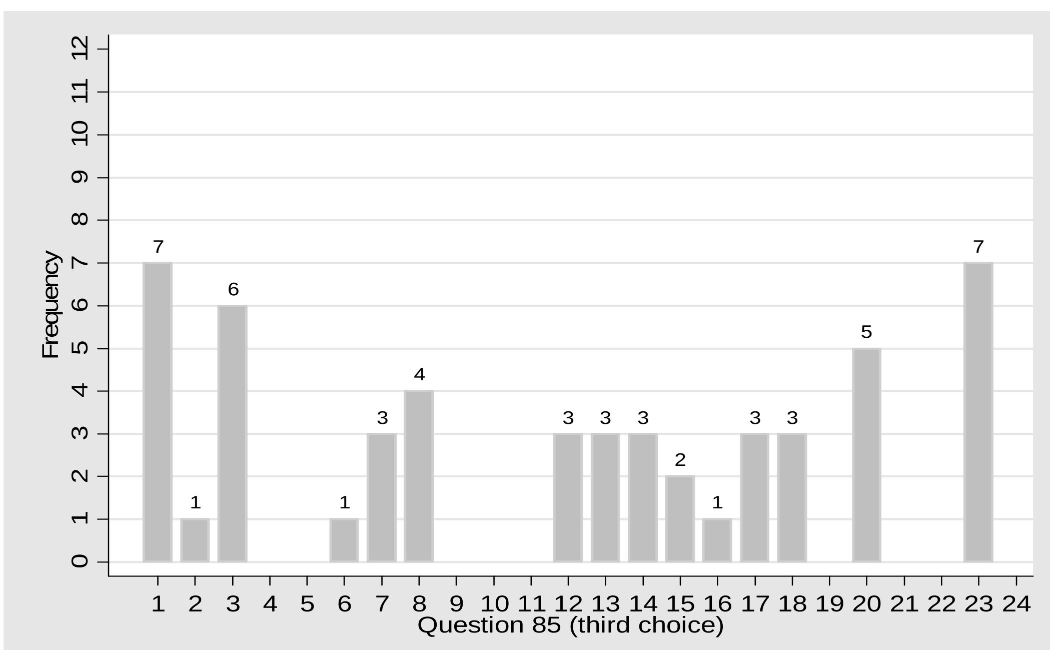


Figure F.3 Safety Climate Improvement Choices, Officer (First Choice by Unit)

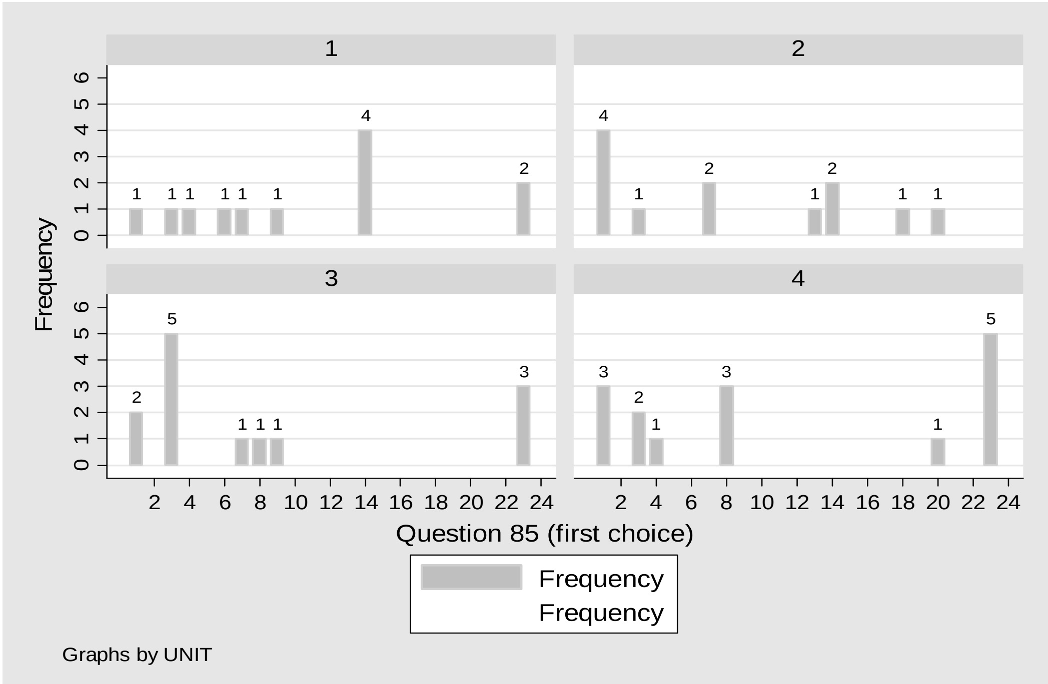


Figure F.4 Safety Climate Improvement Choices, Officer (Second Choice by Unit)

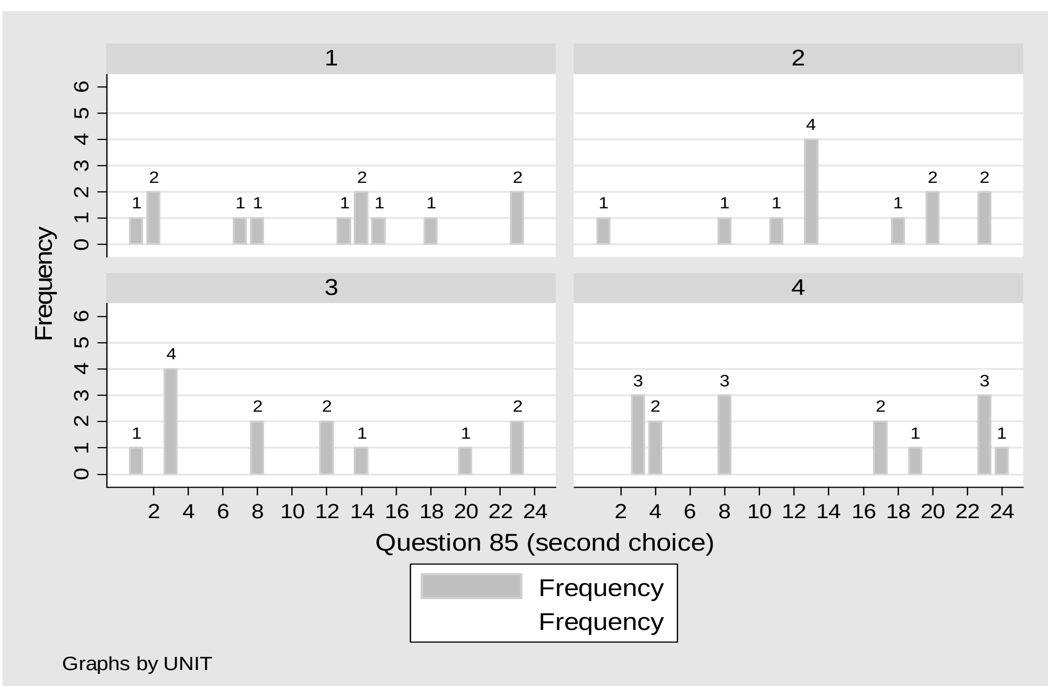


Figure F.5 Safety Climate Improvement Choices, Officer (Third Choice by Unit)

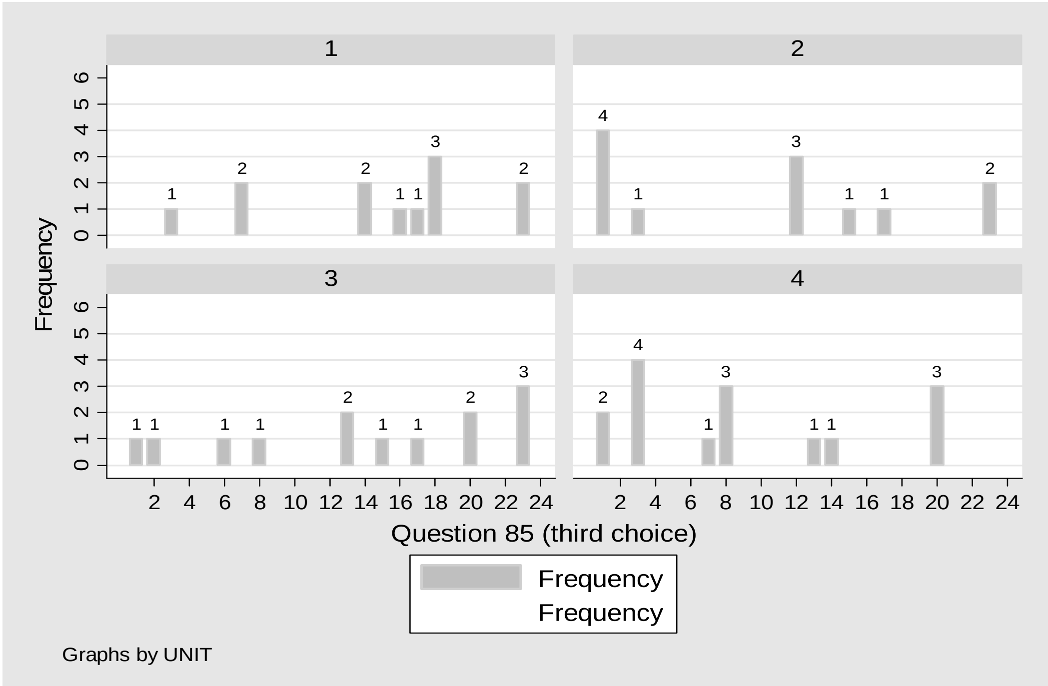


Figure F.6 Safety Climate Improvement Choices, Enlisted (Second Choice)

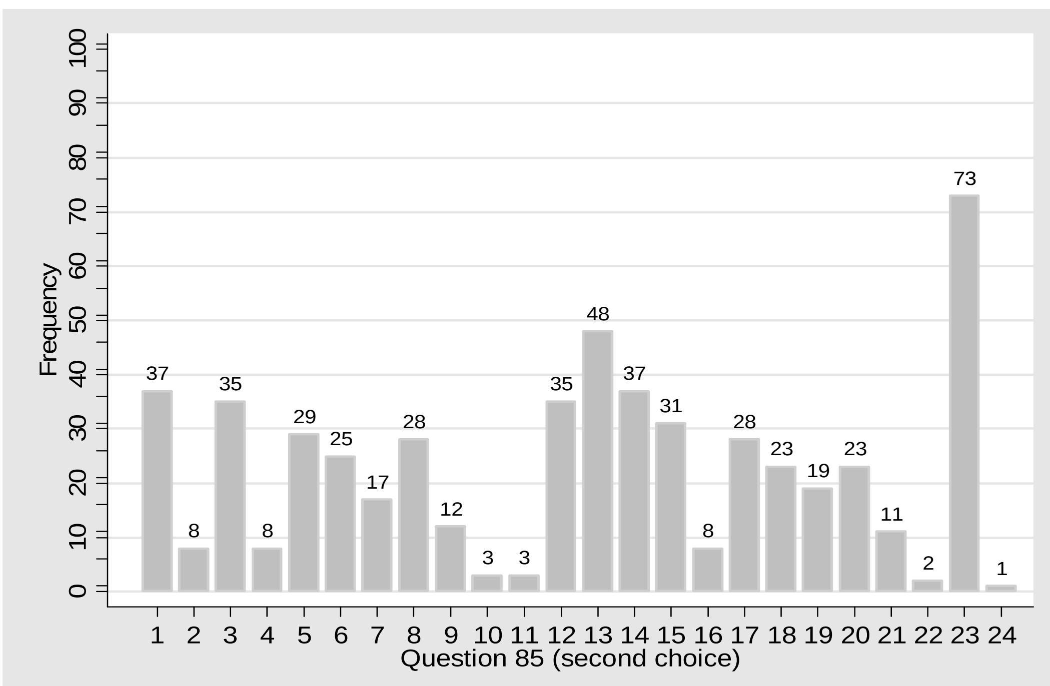


Figure F.7 Safety Climate Improvement Choices, Enlisted (Third Choice)

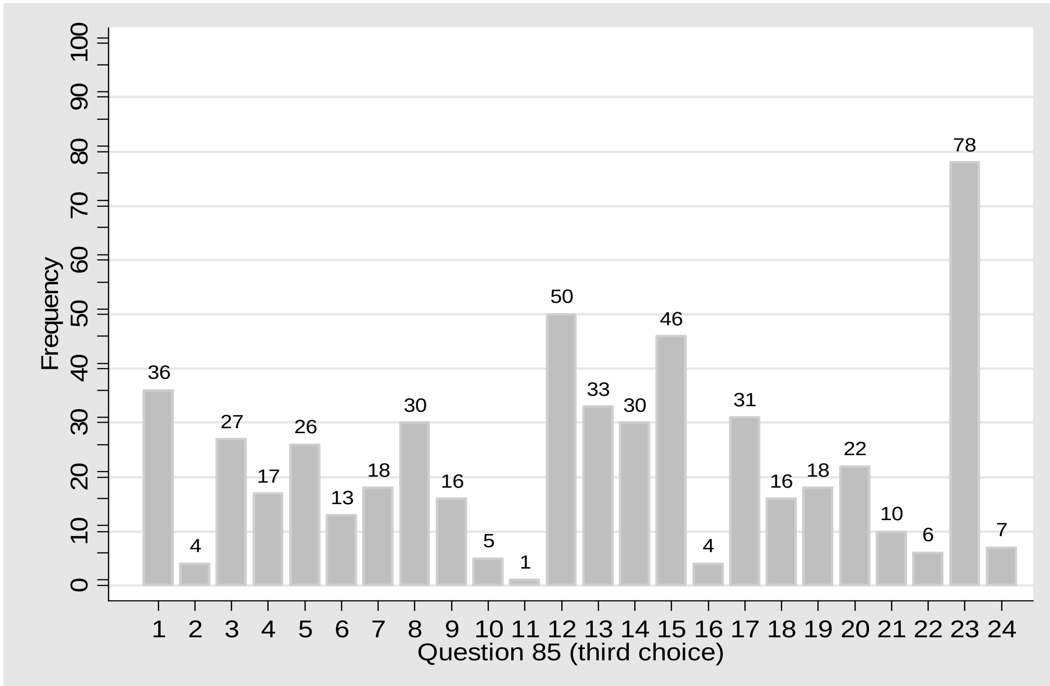


Figure F.8 Safety Climate Improvement Choices, Enlisted (First Choice by Unit)

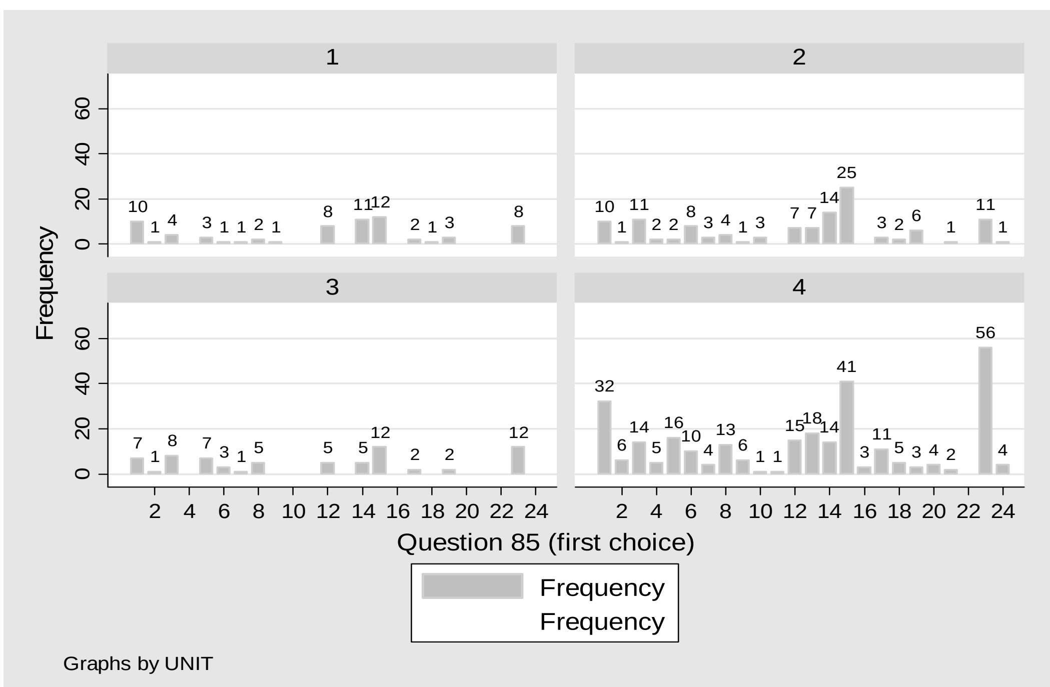


Figure F.9 Safety Climate Improvement Choices, Enlisted (Second Choice by Unit)

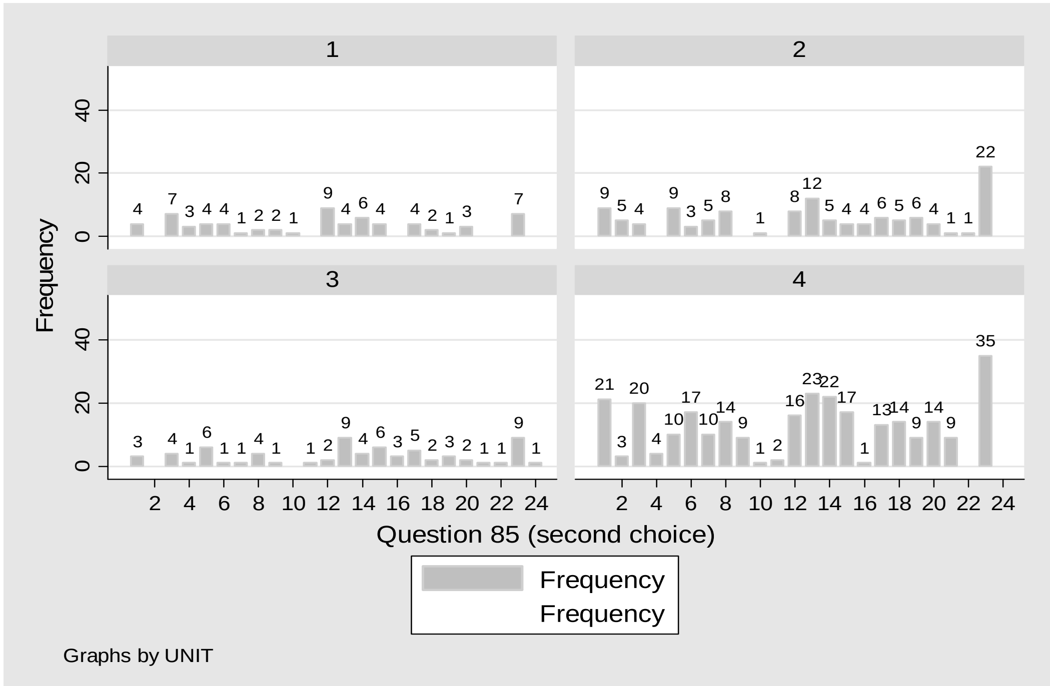
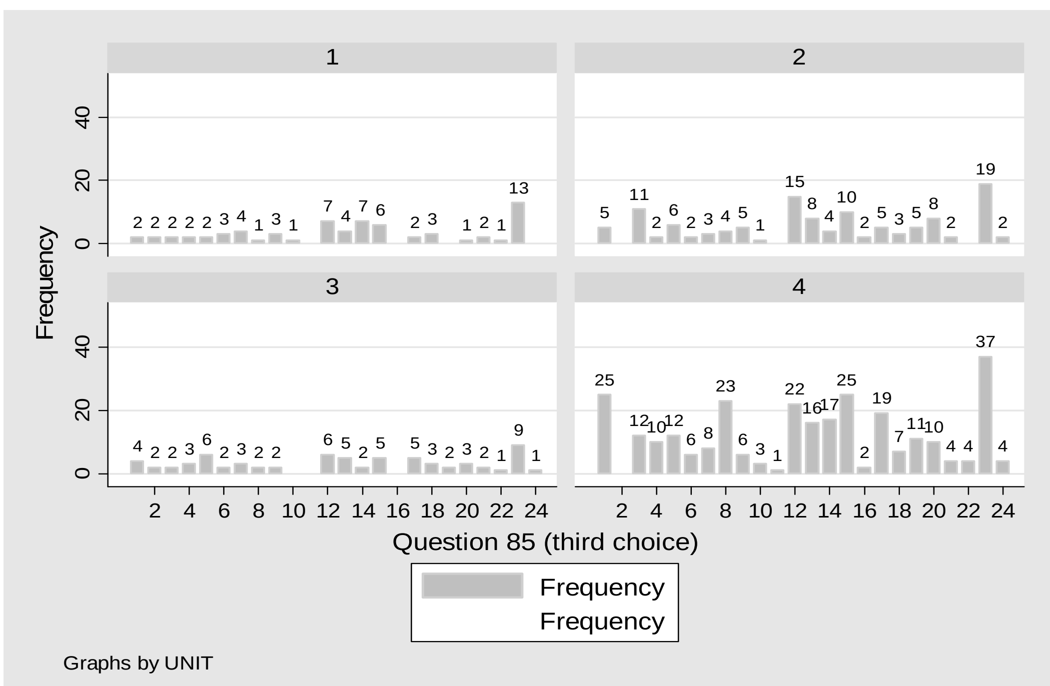


Figure F.10 Safety Climate Improvement Choices, Enlisted (Third Choice by Unit)



Appendix G

Safety Climate Assessment by Demographic Category (CSA/MCAS Survey)

Table G.1 Favorable Safety Climate CSA survey responses (USN/VFA)

Demographic variables	Favorable response to "safety climate" survey statement, *population percentage %*					
	SC1*	***SC2****	***SC3****	***SC11*****	***SC21*****	***SC31*****
Rank						
Junior Off (O-1 to O-3)	92.3	95.8	95.8	39.3	57.1	48.8
Senior Officer (O-4 to O-6)	96.4	97.4	98.3	52.6	60.8	56.0
Designation						
Pilot	93.8	96.4	96.8	44.3	59.0	52.1
NFO	94.8	95.6	95.3	39.4	52.9	44.0
Total flight hours						
Flight Hours < 500	94.5	94.5	96.5	37.3	58.8	49.8
Flight Hours ≥500 ; <1000	91.8	96.4	96.4	37.9	57.3	49.1
Flight Hours ≥1000; <2000	93.0	96.3	95.2	44.0	56.3	48.2
Flight Hours ≥ 2000	97.1	97.1	99.1	53.6	62.2	59.1
Authority						
Non-Department Head	93.4	96.2	96.2	41.9	58.0	50.1
Department Head	95.9	97.3	98.4	50.8	59.6	55.5
Status						
Regular	93.6	96.3	96.1	44.3	57.8	50.9
Active Reserve	95.0	96.5	98.5	40.8	60.1	50.9
Drilling Reserve	94.1	97.1	100	52.9	61.8	67.7
Parent Command						
CNAL	95.8	98.0	97.8	48.6	61.3	55.5
CNAP	92.8	95.7	96.4	43.3	56.0	48.9
CNARF	93.6	93.6	97.9	53.2	61.7	66.0
CNATRA	95.0	95.0	95.0	30.0	65.0	60.0
NAVAIR	93.2	95.2	95.6	39.6	58.7	49.8
Other	94.3	95.9	95.9	33.6	57.4	45.1
Unit's location						
Ashore	93.9	96.2	96.7	44.6	59.8	52.0
Afloat	94.6	96.1	97.6	43.4	56.7	52.2
FRS	94.4	96.3	95.0	36.7	56.5	50.3
Overseas	93.4	97.5	97.0	45.2	53.3	48.2

n=1783. Survey conducted between November 2000 and June 2005.
* respondent answered ***agree*** or ***strongly agree*** with positive safety climate statement
** respondent answered ***strongly agree*** with positive safety climate statement

Table G.2 Favorable Safety Climate CSA survey responses (USMC/VMFA)

Demographic variables	**Favorable response to " safety climate" survey statement *population percentage %***					
	SC1*	***SC2****	***SC3****	***SC11*****	***SC21*****	***SC31*****
Rank						
Junior Officer (O-1 to O-3)	93.8	97.6	96.8	34.1	50.6	47.1
Senior Officer (O-4 to O-6)	93.0	94.4	94.1	48.0	53.1	54.7
Designation						
Pilot	95.2	97.9	97.2	39.7	53.6	51.3
NFO	88.7	93.1	92.4	35.1	45.0	44.7
Total flight hours						
Flight Hours < 500	94.4	98.5	96.8	34.3	53.4	47.5
Flight Hours ≥500 ; <1000	92.7	97.4	97.8	29.7	47.0	44.0
Flight Hours ≥1000; <2000	94.2	96.3	95.7	42.4	51.3	51.6
Flight Hours ≥2000	92.1	93.8	93.3	47.5	52.9	55.0
Authority						
Non-Department Head	93.2	96.6	95.9	37.2	51.5	49.3
Department Head	94.6	96.6	95.9	42.3	51.0	50.3
Status						
Regular	94.2	97.0	96.5	37.2	50.8	49.2
Active Reserve	92.1	98.2	95.8	38.2	53.3	47.9
Drilling Reserve	98.6	98.6	98.6	61.4	62.9	62.9
Parent Command						
1 MAW	94.1	96.9	96.9	28.6	42.2	42.9
2 MAW	93.5	95.0	96.0	39.9	52.9	52.2
3 MAW	93.9	98.3	96.7	37.5	51.6	49.0
4 MAW	95.5	97.8	97.0	53.7	61.2	57.5
Unit's location						
Ashore	94.2	97.3	97.3	41.2	54.9	52.1
Afloat	100	100	100	33.3	50.0	50.0
FRS	93.6	98.6	95.0	36.7	51.8	50.0
Overseas	94.1	95.5	95.5	33.2	41.4	42.7

n=1160. Survey conducted between November 2000 and June 2005.
* respondent answered ***agree*** or ***strongly agree*** with positive safety climate statement
** respondent answered ***strongly agree*** with positive safety climate statement

Table G.3 Favorable Safety Climate MCAS survey responses (USN/VFA)

Demographic variables	**Favorable response to "safety climate" survey statement** ***population percentage %***					
	SC1*	***SC2****	***SC3****	***SC11*****	***SC21*****	***SC31*****
Rank						
E-1 to E-3	78.2	77.7	76.5	22.6	26.2	19.5
E-4 to E-5	72.4	75.6	72.7	18.2	23.0	13.9
E-6 to E-7	81.7	83.3	81.5	25.2	31.8	16.9
E-8 to E-9	91.4	92.8	89.4	44.5	49.7	25.3
WO-1 to CWO-5	85.9	82.8	82.8	45.3	37.5	39.1
O-1 to O-3	93.1	90.8	91.8	47.6	51.5	27.3
O-4 to O-6	97.2	97.2	97.2	69.4	50.0	41.7
Work center						
Airframes	73.1	76.7	73.1	17.6	23.2	13.9
Avionics	70.9	74.5	71.9	16.3	22.9	12.6
Flight line	78.1	77.4	76.5	22.3	25.3	19.6
Ordnance	80.2	81.5	80.3	24.9	27.6	20.2
Power plants	75.2	78.2	75.2	20.8	25.6	16.0
Quality assurance	81.3	84.3	79.5	27.3	33.2	15.5
Survival	75.6	79.0	75.6	21.2	28.3	14.1
Maintenance Control	85.9	86.8	86.3	33.8	37.3	21.3
Other	76.6	75.2	73.6	23.2	27.6	17.1
Primary shift						
Day check	79.3	80.0	78.7	24.6	28.6	18.3
Night check	73.1	76.0	72.6	18.5	24.1	14.7
Status						
Regular	77.1	78.6	76.5	22.3	27.0	16.8
Active reserve	71.7	73.9	71.6	20.9	23.6	16.5
Drilling reserve	79.5	83.8	80.3	24.0	28.2	21.4
Parent Command						
CNAL	77.7	78.5	77.6	20.8	24.8	15.0
CNAP	77.8	79.3	77.6	24.1	29.5	18.6
CNARF	74.8	78.2	75.4	20.1	23.8	15.0
CNATRA	83.1	91.5	79.7	23.7	35.6	22.0
NAVAIR	75.7	77.6	74.3	21.0	25.5	16.2
Other	75.0	76.8	74.3	22.2	26.2	16.8
Unit's location						
Afloat	77.4	79.9	77.1	20.5	26.9	16.5
Ashore	77.0	78.0	76.2	22.7	26.5	17.1
FRS	77.4	75.1	79.5	24.2	26.5	17.3
Overseas	74.7	80.3	74.7	20.9	29.8	15.3

n=14,242. Survey conducted between November 2000 and June 2005.
* respondent answered ***agree*** or ***strongly agree*** with positive safety climate statement
** respondent answered ***strongly agree*** with positive safety climate statement

Table G.4 Favorable Safety Climate MCAS survey responses (USMC/VMFA)

Demographic variables	Favorable response to "safety climate" survey statement *population percentage %*					
	SC1*	***SC2****	***SC3****	***SC11*****	***SC21*****	***SC31*****
Rank						
E-1 to E-3	80.8	80.1	79.2	29.2	30.3	21.5
E-4 to E-5	71.7	73.2	71.5	20.1	21.9	13.5
E-6 to E-7	73.4	75.1	75.1	22.3	25.0	16.1
E-8 to E-9	93.2	85.7	88.0	45.1	42.1	30.1
WO-1 to CWO-5	94.8	84.4	90.6	52.1	43.8	30.2
O-1 to O-3	95.0	88.3	81.7	41.7	45.0	18.3
O-4 to O-6	100.0	94.1	94.1	64.7	64.7	47.1
Work center						
Airframes	76.6	76.8	73.4	21.1	24.5	14.6
Avionics	76.5	78.3	78.6	24.8	26.8	17.9
Flight line	72.6	72.6	71.2	24.4	27.7	18.8
Ordnance	81.2	79.3	81.4	28.3	28.0	19.9
Power plants	70.4	71.5	70.2	22.5	23.9	15.3
Quality assurance	67.3	73.4	67.6	21.7	21.4	11.9
Survival	75.9	74.2	73.2	23.7	25.0	15.4
Maintenance Control	83.5	81.5	81.2	29.9	31.2	20.8
Other	73.9	74.6	71.5	24.5	25.6	17.6
Primary shift						
Day check	77.7	77.1	76.5	25.6	26.7	18.0
Night check	73.0	75.1	73.4	23.1	25.2	16.0
Status						
Regular	75.5	76.1	75.0	24.1	26.0	16.6
Active reserve	74.7	74.5	74.5	25.3	24.6	18.3
Drilling reserve	87.2	83.2	83.5	34.1	30.4	27.0
Parent Command						
1 MAW	80.8	80.0	83.3	27.8	27.2	18.7
2 MAW	76.8	81.3	77.5	25.1	30.3	17.6
3 MAW	73.6	73.1	71.9	23.5	24.1	16.2
4 MAW	78.7	73.7	76.5	24.3	22.0	18.0
Other	66.7	68.5	63.0	34.3	25.9	24.1
Unit's location						
Afloat	88.9	82.2	84.4	33.3	31.1	22.2
Ashore	75.6	75.6	74.5	24.6	25.8	17.2
FRS	77.9	81.4	78.7	24.5	24.5	19.8
Overseas	77.0	78.3	77.8	25.2	27.1	16.9

n=7,134. Survey conducted between November 2000 and June 2005.
* respondent answered ***agree*** or ***strongly agree*** with positive safety climate statement
** respondent answered ***strongly agree*** with positive safety climate statement

Appendix H

Safety Climate Assessment by Demographic Category (Oceana Survey)

Table H.1 Safety Climate Assessment by Demographic Category (Officer)

Demographic variables	Response to Q33, "Safety Climate assessment" 4 or 5 on Likert Scale n/population %	5 on Likert scale n/population %
Organization		
Squadron 1	12/100.0	6/50.0
Squadron 2	12/100.0	3/25.0
Squadron 3	13/100.0	10/76.9
Squadron 4	15/100.0	5/33.3
Rank		
CWO	3/100.0	0/0.0
O-1	1/100.0	0/0.0
O-2	6/100.0	4/66.7
O-3	29/100.0	13/44.8
O-4	12/100.0	6/50.0
O-5	1/100.0	1/100
Gender		
Male	47/100.0	21/44.7
Female	5/100.0	3/60.0
Designation		
Pilot	35/100.0	17/48.6
NFO	12/100.0	6/50.0
Maintenance	3/100.0	1/33.3
Intelligence	1/100.0	0/0.0
Other	1/100.0	0/0.0
Race		
Caucasian	48/100.0	23/47.9
African American	2/100.0	0/0.0
Other	2/100.0	1/50.0
Total flight hours		
Flight Hours: < 500	9/100.0	4/44.4
Flight Hours: 500-1000	16/100.0	8/50.0
Flight Hours: 1001-1500	8/100.0	4/50.0
Flight Hours: 1501-2000	8/100.0	4/50.0
Flight Hours: 2001-2500	3/100.0	1/33.3
Flight Hours: >2500	3/100.0	2/66.7
N/A	5/100.0	1/20.0
Authority		
Non-Department Head	44/100.0	23/52.0
Department Head/XO/CO	8/100.0	4/50.0

Marital Status		
Married	37/100.0	16/43.2
Single	15/100.0	8/53.3
Spouse's living arrangements		
Spouse lives with member	36/100.0	16/44.4
Spouse lives elsewhere	1/100.0	0/0.0
N/A	15/100.0	8/53.3
Spouse's work		
Works full time	18/100.0	7/38.9
Works part time	5/100.0	2/40.0
Not employed	14/100.0	7/50.0
N/A	15/100.0	8/53.3
Spouse's occupation		
Serves in military	4/100.0	2/50.0
Does not serve in military	35/100.0	16/45.7
N/A	13/100.0	6/46.2
Children		
0	26/100.0	11/42.3
1-2	22/100.0	12/54.6
3-4	3/100.0	0/0.0
5+	1/100.0	1/100.0
Education		
2 year degree	3/100.0	1/33.3
4 year degree	45/100.0	22/48.9
Masters degree	3/100.0	1/33.3
Other	1/100.0	0/0.0
Commissioning Source		
U.S. Naval Academy (USNA)	21/100.0	11/52.4
Officer Candidate School (OCS)	17/100.0	7/41.2
ROTC	9/100.0	4/44.4
Other	5/100.0	2/40.0
Geographic Region		
North East	15/100.0	11/73.3
North West	4/100.0	2/50.00
South East	18/100.0	6/33.3
South West	7/100.0	3/42.9
Mid West	8/100.0	2/25.0
Geographic Setting		
Suburban	26/100.0	12/46.2
Urban	8/100.0	2/25.0
Rural	17/100.0	9/52.9
Other	1/100.0	1/100.0
Military Parents		
Both	1/100.0	1/100.0
One	31/100.0	11/35.5
None	20/100.0	12/60.0

Tenure in Squadron (years)		
<1	24/100.0	12/50.0
1-2	13/100.0	9/69.2
2-3	12/100.0	3/25.0
3-4	2/100.0	0/0.0
>4	1/100.0	0/0.0
Sleep (Avg hours per night)		
5-6	3/100.0	0/0.0
6-7	29/100.0	14/48.3
7-8	17/100.0	9/52.9
8-9	2/100.0	1/50.0
>9	1/100.0	0/0.0
Promotion recommendation		
Promotable (P)	4/100.0	2/50.0
Must Promote (MP)	17/100.0	9/52.9
Early promote (EP)	23/100.0	10/43.5
Don’t Know	7/100.0	3/42.9
Not Observed (NOB)	1/100.0	0/0.0
Served in Safety Department		
Yes	13/100.0	9/69.2
No	39/100.0	15/38.5

n=52. Survey data collected August 2006.

Table H.2 Safety Climate Assessment by Demographic Category (Enlisted)

Demographic variables	**Response to Q33, "Safety Climate assessment"** 4 or 5 on Likert Scale n/population %	5 on Likert scale n/population %
Organization		
Squadron 1	54 / 79.4%	17 / 25.0%
Squadron 2	92 / 75.5%	33 / 27.1%
Squadron 3	57 / 81.4%	22 / 31.4%
Squadron 4	154 / 54.2%	21 / 7.4%
Rank		
E-1/2	39 / 63.9%	10 / 16.4%
E-3	105 / 71.7%	32 / 21.1%
E-4	66 / 58.9%	18 / 16.1%
E-5	81 / 59.6%	17 / 12.5%
E-6	52 / 72.2%	15 / 20.8%
E-7	4 / 80.0%	0 / 0.0%
E-8/9	6 / 100.0%	1 / 16.7%
Gender		
Male	300 / 66.7%	77 / 17.1%
Female	57 / 36.6%	16 / 17.0%
Citizenship		
U.S. born	322 / 64.8%	84 / 16.9%
U.S. naturalized	28 / 71.8%	5 / 12.8
Non U.S. citizen	7 / 87.5%	4 / 50.0%
Specialization		
Maintenance	329 / 65.5%	86 / 17.1%
Administration	23 / 69.7%	5 / 15.2%
Service	3 / 60.0%	2 / 40.0%
Other	2 / 50.0%	0 / 0.00%
Race		
Caucasian	231 / 66.2%	57 / 16.3%
African American	60 / 66.7%	22 / 24.4%
Hispanic	36 / 66.7%	6 / 11.1%
Native American	0 / 0.0%	0 / 0.0%
Asian	5 / 50.0%	2 / 20.0%
Pacific Islander	5 / 71.4%	0 / 0.0%
Other	20 / 69.5%	6 / 20.7%
Work center		
Maintenance Control	30 / 71.43%	7 / 16.7
Quality Assurance	17 / 80.95%	5 / 23.8%
Power Plants	37 / 64.9%	7 / 12.3%
Air frames	39 / 63.9%	10 / 16.4%
Avionics	68 / 62.4%	18 / 16.5%
Ordnance	27 / 62.8%	9 / 20.9%
Line	82 / 70.1%	18 / 15.4%

Corrosion	9 / 42.9%	4 / 19.1%
Survival	26 / 72.2%	7 / 19.4%
Parachute Rigger	3 / 50.0%	1 / 16.7%
Other	1 / 33.3%	0 / 0.0%
N/A	18 / 64.3	7 / 25.0%
Work Shift		
Day check	198 / 68.3%	55 / 19.0%
Night check	123 / 69.5%	35 / 19.8%
Mid check	36 / 46.8%	3 / 3.9%
Marital Status		
Married	168 / 68.3%	42 / 17.1%
Single	159 / 63.6%	42 / 16.8%
Separated	15 / 60.0%	4 / 16.0%
Divorced	15 / 65.2%	5 / 21.7%
Spouse's living arrangements		
Spouse lives with member	145 / 66.5%	35 / 16.1%
Spouse lives elsewhere	39 / 70.9%	11 / 20.0%
N/A	173 / 63.8%	47 / 17.3%
Spouse's work		
Works full time	98 / 67.6%	23 / 15.9%
Works part time	26 / 61.9%	8 / 19.1%
Not employed	58 / 68.2%	13 / 15.3%
N/A	175 / 64.3%	49 / 18.01%
Spouse's occupation		
Serves in military	25 / 54.3%	6 / 13.0%
Does not serve in military	158 / 69.3%	40 / 17.5%
N/A	174 / 64.5%	47 / 17.4%
Children		
0	215 / 66.0%	60 / 18.4%
1-2	112 / 65.1%	26 / 15.1%
3-4	29 / 67.4%	7 / 16.3%
5+	1 / 33.3%	0 / 0.0%
Education		
Some High School	4 / 57.15%	1 / 14.3%
High School diploma	177 / 67.6%	46 / 17.6%
GED	12 / 57.2%	4 / 19.1%
Some College	135 / 62.5%	38 / 17.6%
College degree	26 / 78.8%	3 / 9.1%
Masters degree	2 / 100.0%	0 / 0.0%
Other	1 / 33.3%	1 / 33.3%
Authority		
Worker	250 / 64.6%	68 / 17.6%
Leading Petty Officer	24 / 77.4%	8 / 25.8%
Shift supervisor	57 / 64.1%	13 / 14.6%
Work center supervisor	19 / 63.3%	4 / 13.3%
Branch Chief Petty Officer	2 / 100.0%	0 / 0.0%

Division Chief Petty Officer	5 / 100.0%	0 / 0.0%
Geographic Region		
North East	79 / 59.9%	24 / 18.2%
North West	18 / 69.2%	3 / 11.5%
South East	108 / 68.4%	25 / 15.8%
South West	37 / 64.9%	10 / 17.5%
Mid West	82 / 64.6%	21 / 16.5%
Pacific Islands	3 / 75.0%	1 / 25.0%
N/A	30 / 75.0%	9 / 22.5%
Geographic Setting		
Suburban	92 / 73.6%	27 / 21.6%
Urban	145 / 62.8%	40 / 17.3%
Rural	110 / 62.9%	23 / 13.1%
Other	10 / 76.9%	3 / 23.1%
Military Parents		
Both	18 / 69.2%	5 / 19.3%
One	126 / 66.7%	31 / 16.4%
None	213 / 64.8%	57 / 17.3%
Tenure in Squadron (years)		
<1	120 / 65.6%	28 / 15.3%
1-2	119 / 61.7%	29 / 15.0%
2-3	78 / 72.9%	25 / 23.4%
3-4	31 / 67.4%	9 / 19.6%
>4	9 / 60.0%	2 / 13.3%
Sleep (Average hours per night)		
<5	40 / 54.1%	5 / 6.8%
5-6	121 / 61.4%	32 / 16.2%
6-7	112 / 68.3%	31 / 18.9%
7-8	68 / 79.1%	22 / 25.6%
8-9	12 / 66.7%	1 / 5.6%
>9	4 / 80.0%	2 / 40.0%
Promotion recommendation		
Promotable (P)	40 / 67.8%	9 / 15.3%
Must Promote (MP)	198 / 68.5%	55 / 19.0%
Early promote (EP)	93 / 63.7%	22 / 15.1%
Don’t Know	22 / 52.4%	5 / 11.9%
Served in Safety Department		
Yes	20 / 71.4%	6 / 21.4%
No	337 / 65.3%	87 / 16.9%

n=544. Survey data collected August 2006.

Appendix I

Sample Interview Question (Oceana Survey)

1) Describe the squadron's work environment/climate.
2) Describe the squadron's safety climate.
3) Do most people feel the same way?
4) Do you feel satisfied in your job?
5) What has worked well to make the squadron safer?
6) What improvements could be made for safety?
7) What would stand in the way of such improvements?
8) How do you tell whether your safety performance is good?
9) What happens if there is an accident?
10) What happens if someone gets hurt?
11) Are injuries reported?
12) What one thing could your superiors do to most improve safety?
13) What is the most important thing you could do to improve safety?
14) Who has the authority to shut down an unsafe operation?
15) Can you refuse to do unsafe work without fear of reprisal or repercussion?
16) Are you asked to take greater risks during high-tempo operations?
17) Do you feel obliged to take greater risks during high tempo operations?
18) Do you feel personally satisfied when you complete a tough job safely?
19) Do you feel personally responsible for the safety of junior personnel working under your supervision?
20) Do you ever perform unsafe acts? Why?
21) Are there other things happening in the organization that distract you during your work? What are they?
22) What drives the safety effort here?
23) Are there certain supervisors that you like working for? Why?
24) What are some of the qualities in your supervisor you find particularly admirable?
25) Who talks to you about safety; under what circumstances?
26) How much of your time is devoted to safety?

27) Is production viewed as being more important than safety?

28) Do safety awards make you more diligent in your work?

29) Do you trust your superiors to make your personal safety a priority?

30) Do the workers get recognized for their commitment to safety?

31) When a supervisor takes an interest in your personal development, does it improve your attitude about your job?

32) Does this change in attitude make you work more safely?

Appendix J

Safety Climate ANOVA Means Comparison (Oceana Survey)

Table J.1 ANOVA Means Comparison by Demographic Category (Officer)

Respondent's assessment of safety climate in unit (Q33) (1-5 Likert scale)										
Demographic Variables	**n**	**Mean**	**SD**	**means comparison/statistical significance[1]**						
Unit				**a**	**b**	**c**				
e.	Squadron 1	12	4.5	.52	-					
f.	Squadron 2	12	4.25	.45	.25	-				
g.	Squadron 3	13	4.8	.44	.27	**.52***	-			
h.	Squadron 4	15	4.33	.49	.17	.08	.44			
Rank					**a**	**b**	**c**	**d**	**e**	
a.	CWO	3	4	0	-					
b.	O-1	1	4	0	0.0	-				
c.	O-2	6	4.67	.52	.67	.67	-			
d.	O-3	29	4.45	.51	.45	.45	.22	-		
e.	O-4	12	4.5	.52	.5	.5	.17	.05	-	
f.	O-5	1	5	0	1.0	1.0	.33	.55	.5	
Gender					**a**					
a.	Male	47	4.45	.50	-					
b.	Female	5	4.60	.55	.15					
Race					**a**	**b**				
a.	Caucasian	48	4.48	.50	-					
b.	African American	2	4.0	0.0	.48	-				
c.	Other	2	4.5	.71	.02	.5				
Designator					**a**	**b**	**c**	**d**		
a.	Pilot	35	4.49	.52	-					
b.	NFO	12	4.5	0.0	.01	-				
c.	Intelligence	1	4.0	.57	.49	.5	-			
d.	Maintenance	3	4.33	0.0	.15	.17	.33	-		
e.	Other	1	4.0	0.0	.49	.5	0.0	.33		
Flight Experience					**a**	**b**	**c**	**d**	**e**	**f**
a.	<500	9	4.44	.53	-					
b.	500-1000	16	4.5	.52	.06	-				
c.	1001-1500	8	4.5	.53	.06	0.0	-			
d.	1501-2000	8	4.5	.53	.06	0.0	0.0	-		
e.	2001-2500	3	4.33	.58	.11	.17	.17	.17	-	
f.	>2500	3	4.67	.58	.22	.17	.17	.17	.33	
Job										
a.	Branch Officer	7	4.43	.53	-					
b.	Phase Head	4	4.5	..58	.07	-				
c.	Division Officer	17	4.36	.49	.08	.15	-			
d.	Department Head	7	4.43	.53	0.0	.07	.08	-		
e.	CO/XO	1	5.0	0.0	.57	.5	.65	.57	-	
f.	Other	16	4.56	.51	.13	.06	.21	.13	.44	
Married					**a**					
a.	Yes	37	4.43	.50	-					
b.	No	15	4.53	.52	.1					
Spouse's living arrangements					**a**	**b**				
a.	Spouse lives w/ mbr	36	4.44	.50	-	-				

b.	Spouse lives elsewhere	1	4.00	0.00	.44	-		
c.	N/A	15	4.53	.52	.09	.53		
Spouse's work					**a**	**b**	**c**	
a.	Works full time	18	4.39	.50	-	-	-	
b.	Works part time	5	4.40	.55	.01	-	-	
c.	Not employed	14	4.50	.52	.11	.10	-	
d.	N/A	15	4.53	.52	.14	.13	.03	
Spouse's occupation					**a**	**b**		
a.	Serves in military	4	4.50	.58	-	-		
b.	Does not serve in mil	35	4.46	.51	.04	-		
c.	N/A	13	4.46	.52	.04	.04		
Children					**a**	**b**	**c**	
a.	0	26	4.42	.51	-	-	-	
b.	1-2	22	4.55	.51	.13	-	-	
c.	3-4	3	4.00	0.0	.42	.55	-	
d.	5+	1	5.00	0.0	.58	.45	1.00	
Education					**a**	**b**	**c**	
a.	2 year degree	3	4.33	.58	-	-	-	
b.	4 year degree	45	4.49	.51	.16	-	-	
c.	Masters	3	4.33	.58	0.0	.16	-	
d.	Other	1	4.00	0.0	.33	.49	.33	
Commissioning Source					**a**	**b**	**c**	
a.	OCS	17	4.41	.51	-	-	-	
b.	ROTC	9	4.44	.53	.03	-	-	
c.	USNA	21	4.52	.51	.11	.12	-	
d.	Other	5	4.40	.55	.01	.04	.12	
Geographic Region					**a**	**b**	**c**	**d**
a.	North East	15	4.73	.46	-	-	-	-
b.	North West	4	4.50	.58	.23	-	-	-
c.	South East	18	4.33	.49	.40	.17	-	-
d.	South West	7	4.43	.53	.30	.07	.10	-
e.	Mid West	8	4.25	.46	.48	.25	.08	.18
Geographic Setting					**a**	**b**	**c**	**d**
a.	Suburban	26	4.46	.51	-	-	-	-
b.	Urban	8	4.25	.46	.21	-	-	-
c.	Rural	17	4.53	.51	.07	.28	-	-
d.	Other	1	5.00	0.0	.54	.75	.75	.47
Military Parents					**a**	**b**		
a.	Both	1	5.00	0.0	-	-		
b.	One	31	4.35	.49	.65	-		
c.	None	20	4.60	.50	.40	.25		
Tenure in Squadron (yrs)					**a**	**b**	**c**	**d**
a.	<1	24	4.50	.51	-	-	-	-
b.	1-2	13	4.69	.48	.19	-	-	-
c.	2-3	12	4.25	.45	.25	.44	-	-
d.	3-4	2	4.00	0.0	.50	.69	.25	-
e.	>4	1	4.00	0.0	.50	.69	.25	0.0
Sleep (Avg. hrs per night)					**a**	**b**	**c**	**d**
g.	5-6	3	4.00	0.0	-	-	-	-
h.	6-7	29	4.48	.51	.48	-	-	-
i.	7-8	17	4.53	.51	.53	..05	-	-
j.	8-9	2	4.50	.71	.50	.02	.03	-

k. >9	1	4.00	0.0	0.0	0.0	.53	.50	
Promotion recommendation				**a**	**b**	**c**	**d**	**e**
a. Promotable (P)	4	4.50	.58	-	-	-	-	-
b. Must Promote (MP)	17	4.52	.51	.02	-	-	-	-
c. Early Promote (EP)	23	4.43	.51	.07	.09	-	-	-
d. Don't Know	7	4.42	.53	.08	.10	.11	.01	-
e. Not Observed (NOB)	1	4.00	0.0	.50	.52	.43	.43	.42
Served in Safety Dept								
c. Yes	13	4.69	.48	-				
d. No	39	4.38	.49	**.31***				
Individual injuries past year (on the job)				**a**				
a. None	51	4.47	.50	-				
b. 1 time	1	4.00	0.0	.47				
Individual injuries past year (during leisure)				**a**	**b**			
a. None	39	4.46	.51	-	-			
b. 1 time	10	4.50	.53	.04	-			
c. 2 times	3	4.33	.58	.13	.17			
Number of people seen injured past year				**a**	**b**	**c**		
a. 0	28	4.54	.51	-	-	-		
b. 2	18	4.33	.49	.21	-	-		
c. 4	5	4.40	.55	.14	.07	-		
d. 6	1	5.00	0.0	.46	.67	.60		
Involvement in workplace mishap over the past year				**a**				
a. None	51	4.45	.50	-				
b. 1 time	1	5.00	0.0	.55				
Command mishaps over the past year				**a**	**b**	**c**	**d**	
a. None	4.44	27	.51	-	-	-	-	
b. 1 time	4.57	14	.51	.13	-	-	-	
c. 2 times	4.50	2	.71	.06	.07	-	-	
d. 3 times	4.29	7	.49	.15	.28	.21	-	
e. > 3 times	4.50	2	.71	.06	.07	0.0	.21	
Assessment of command's operational performance				**a**	**b**	**c**	**d**	
a. 1	1	5.00	0.0	-	-	-	-	
b. 3	2	4.00	0.0	1.00	-	-	-	
c. 4	10	4.20	.42	.80	.20	-	-	
d. 5	22	4.50	.51	.50	.50	.30	-	
e. 6	17	4.59	.51	.41	.59	.39	.09	
Assessment of command's safety performance				**a**	**b**	**c**	**d**	
a. 1	1	5.00	0.0	-	-	-	-	
b. 3	1	4.00	0.0	1.00	-	-	-	
c. 4	4	4.25	.50	.75	.25	-	-	
d. 5	25	4.24	.44	.76	.24	.01	-	

e.	6	21	4.76	.44	.24	.76	.51	**.52****	
Job satisfaction									
a.	1	1	5.00	0.0	-	-	-	-	-
b.	2	2	4.00	0.0	1.00	-	-	-	-
c.	3	4	4.00	0.0	1.00	0.0	-	-	-
d.	4	5	4.40	.55	.60	.40	.40	-	-
e.	5	23	4.48	.51	.52	.48	.48	.08	-
f.	6	17	4.59	.51	.41	.59	.59	.19	.11

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 Analysis of Variance (ANOVA)
Scheffe's multiple comparison test
Bartlett's test for equal variance

Table J.2 ANOVA Means Comparison by Demographic Category (Enlisted)

Respondent's assessment of safety climate (Q33) (0-5 Likert scale)										
Demographic Variables	**n**	**Mean**	**SD**	**means comparison / statistical significance[1]**						
Organization				**a**	**b**	**c**				
e. Squadron 1	68	4.09	.82	-	-	-				
f. Squadron 2	122	4.05	.88	.04	-	-				
g. Squadron 3	70	4.10	.76	.01	.05	-				
h. Squadron 4	284	3.55	.84	**.53*****	**.50*****	**.55*****				
Rank				**a**	**b**	**c**	**d**	**e**	**f**	
a. E-1/2	61	3.80	1.09	-	-	-	-	-	-	
b. E-3	152	3.92	.76	.12	-	-	-	-	-	
c. E-4	112	3.65	.92	.15	.27	-	-	-	-	
d. E-5	136	3.74	.88	.06	.18	.09	-	-	-	
e. E-6	72	3.86	.83	.06	.06	.21	.12	-	-	
f. E-7	5	3.80	.45	.00	.12	.15	.06	.06	-	
g. E-8/9	6	4.17	.41	.36	.25	.51	.42	.31	.37	
Gender				**a**						
a. Male	450	3.80	.88	-						
b. Female	94	3.79	.87	.02						
Citizenship				**a**	**b**					
a. U.S. born	497	3.80	.87	-	-					
b. U.S. naturalized	39	3.82	.68	.02	-					
c. Non U.S. citizen	8	4.00	1.69	.20	.18					
Specialization				**a**	**b**	**c**				
a. Maintenance	502	3.79	.87	-	-	-				
b. Administration	33	4.00	.87	.21	-	-				
c. Service	5	4.00	1.0	.21	0.0	-				
d. Other	4	3.25	.96	.54	.75	.75				
Race				**a**	**b**	**c**	**d**	**e**	**f**	
a. Caucasian	349	3.77	.82	-	-	-	-	-	-	
b. African American	90	3.92	1.00	.15	-	-	-	-	-	
c. Hispanic	54	3.89	1.06	.12	.03	-	-	-	-	
d. Native American	5	2.80	.45	.97	1.12	1.09	-	-	-	
e. Asian	10	3.70	.82	.07	.22	.19	.90	-	-	
f. Pacific Islander	7	3.71	.49	.05	.21	.17	.91	.01	-	
g. Other	29	3.90	.72	.13	.03	.01	1.10	.20	.18	
Work center				**a**	**b**	**c**	**d**	**e**	**f**	**g**
a. Maintenance Control	42	3.95	.73	-	-	-	-	-	-	-
b. Quality Assurance	21	4.05	.67	.10	-	-	-	-	-	-
c. Power Plants	57	3.71	.90	.23	.33	-	-	-	-	-
d. Air frames	61	3.67	.94	.28	.38	.05	-	-	-	-
e. Avionics	109	3.80	.84	.15	.25	.08	.13	-	-	-
f. Ordnance	43	3.72	.93	.23	.33	.01	.05	.08	-	-
g. Line	117	3.79	.79	.16	.25	.08	.12	.01	.07	-
h. Corrosion	21	3.62	1.16	.33	.43	.10	.05	.18	.10	.18
i. Survival	36	3.83	.94	.12	.21	.11	.16	.04	.11	.04
j. Parachute Rigger	6	4.17	1.17	.21	.12	.45	.49	.37	.45	.37
k. Other	3	3.33	.58	.62	.71	.39	.34	.46	.39	.46
l. N/A	28	4.07	.98	.12	.02	.35	.40	.27	.35	.28

	h	**i**	**j**	**k**
H Corrosion	-	-	-	-
i. Survival	.21	-	-	-
j. Para Rigger	.55	.33	-	-
k. Other	.29	.5	.83	-

				l. N/A		.45	.24	.10	.74
Work Shift	**n**	**Mean**	**SD**	**a**	**b**				
d. Day check	290	3.83	.91	-	-				
e. Night check	177	3.90	.83	.07	-				
f. Mid check	77	3.48	.75	**.35****	**.42****				
Marital Status				**a**	**b**	**c**			
a. Married	246	3.88	.84	-	-	-			
b. Single	250	3.73	.92	.15	-	-			
c. Separated	25	3.76	.72	.12	.03	-			
d. Divorced	23	3.83	.83	.05	.10	.07			
Spouse's living arrangements				**a**	**b**				
d. Spouse lives w/ mbr	218	3.84	.84	-	-				
e. Spouse lives elsewhere	55	3.95	.78	.10	-				
f. N/A	271	3.74	.92	.11	.21				
Spouse's work				**a**	**b**	**c**			
e. Works full time	145	3.89	.80	-	-	-			
f. Works part time	42	3.88	.80	.01	-	-			
g. Not employed	85	3.78	.88	.11	.10	-			
h. N/A	272	3.75	.92	.14	.13	.03			
Spouse's occupation				**a**	**b**				
d. Serves in military	46	3.78	.87	-	-				
e. Does not serve in mil	228	3.87	.82	.09	-				
f. N/A	270	3.74	.92	.04	.13				
Children				**a**	**b**	**c**			
e. 0	326	3.80	.90	-	-	-			
f. 1-2	172	3.81	.82	.01	-	-			
g. 3-4	43	3.84	.90	.04	.03	-			
h. 5+	3	3.33	.58	.46	.47	.50			
Education				**a**	**b**	**c**	**d**	**e**	**f**
e. Some High School	7	3.71	.76	-	-	-	-	-	-
f. High School diploma	262	3.82	.81	.11	-	-	-	-	-
g. GED	21	3.57	1.12	.14	.25	-	-	-	-
h. Some College	216	3.80	.95	.09	.02	.23	-	-	-
i. College degree	33	3.79	.74	.07	.03	.22	.01	-	-
j. Masters degree	2	4.00	0.00	.29	.18	.43	.20	.21	-
k. Other	3	3.67	1.15	.05	.15	.10	.13	.12	.33
Authority				**a**	**b**	**c**	**d**	**e**	
e. Worker	387	3.78	.90	-	-	-	-	-	
f. Leading Petty Officer	31	4.06	.89	.28	-	-	-	-	
g. Shift supervisor	89	3.74	.76	.04	.32	-	-	-	
h. Work center supervisor	30	3.97	.85	.19	.09	.23	-	-	
i. Br Chief Petty Officer	2	4.00	0.00	.22	.06	.26	.03	-	
j. Div Chief Petty Officer	5	4.00	0.00	.22	.06	.26	.03	0.00	
Geographic Region				**a**	**b**	**c**	**d**	**e**	**f**
f. North East	132	3.71	1.00	-	-	-	-	-	-
g. North West	26	3.69	.84	.02	-	-	-	-	-
h. South East	158	3.80	.79	.09	.11	-	-	-	-
i. South West	57	4.00	.93	.29	.31	.20	-	-	-
j. Mid West	127	3.75	.83	.04	.06	.05	.25	-	-
k. Pacific Islands	4	4.00	.82	.29	.31	.20	0.00	.25	-
l. N/A	40	4.03	.80	.32	.34	.23	.03	.28	.03
Geographic Setting				**a**	**b**	**c**			
e. Suburban	125	3.95	.83	-	-	-			
f. Urban	231	3.78	.93	.17	-	-			
g. Rural	175	3.71	.82	.24	.07	-			

	n	Mean	SD	a	b	c	d	e
h. Other	13	3.92	.86	.03	.14	.21		
Military Parents	**n**	**Mean**	**SD**	**a**	**b**			
d. Both	26	3.81	.85	-	-			
e. One	189	3.80	.87	.01	-			
f. None	329	3.80	.88	.01	0.00			
Tenure in Squadron (yrs)				**a**	**b**	**c**	**d**	
f. <1	183	3.83	.89	-	-	-	-	
g. 1-2	193	3.72	.87	.11	-	-	-	
h. 2-3	107	3.89	.87	.06	.17	-	-	
i. 3-4	46	3.89	.85	.06	.17	0.00	-	
j. >4	15	3.67	.82	.16	.05	.22	.22	
Sleep (Avg. hrs per night)				**a**	**b**	**c**	**d**	**e**
l. <5	74	3.42	.94	-	-	-	-	-
m. 5-6	197	3.77	.90	.35	-	-	-	-
n. 6-7	164	3.85	.83	.43*	.08	-	-	-
o. 7-8	86	4.09	.78	**.67***	.32	.24	-	-
p. 8-9	18	3.72	.57	.30	.03	.13	.27	-
q. >9	5	4.20	.84	.78	.43	.35	.11	.48
Promotion recommendation				**a**	**b**	**c**		
f. Promotable (P)	59	3.85	.78	-	-	-		
g. Must Promote (MP)	289	3.84	.86	.01	-	-		
h. Early promote (EP)	146	3.72	.87	.13	.12	-		
i. Don’t Know	42	3.79	1.00	.06	.05	.07		
Served in Safety Dept				**a**				
e. Yes	28	3.75	1.08	-				
f. No	516	3.80	.86	.05				
Individual injuries past year (on the job)				**a**	**b**	**c**	**d**	
c. None	440	3.81	.86	-	-	-	-	
d. 1 time	73	3.81	.88	0.00	-	-	-	
e. 2 times	19	3.42	1.02	.39	.39	-	-	
f. 3 times	5	4.20	1.30	.39	.39	.78	-	
g. > 3 times	7	4.14	1.07	.34	.33	.72	.06	
Individual injuries past year (during leisure)				**a**	**b**	**c**	**d**	
d. None	428	3.80	.87	-	-	-	-	
e. 1 time	75	3.85	.88	.05	-	-	-	
f. 2 times	25	3.88	.66	.08	.03	-	-	
g. 3 times	8	3.38	1.18	.43	.48	.51	-	
h. > 3 times	8	3.38	1.06	.43	.48	.51	0.00	
Number of people seen injured past year				**a**	**b**	**c**	**d**	
e. 0	211	3.89	.83	-	-	-	-	
f. 2	227	3.78	.89	.10	-	-	-	
g. 4	79	3.70	.91	.19	.09	-	-	
h. 6	17	3.65	1.11	.24	.14	.05	-	
i. 8	10	3.5	.53	.39	.28	.20	.15	
Involvement in workplace mishap over the past year				**a**	**b**	**c**	**d**	
a. None	513	3.81	.86	-	-	-	-	
b. 1 time	23	3.65	.83	.16	-	-	-	
c. 2 times	5	3.00	1.22	.81	.65	-	-	
d. 3 times	1	5.00	0.00	1.18	1.34	2.00	-	
e. > 3 times	2	3.50	3.54	.31	.15	.50	1.50	

Command mishaps over the past year				**a**	**b**		**d**	
f. None	324	3.88	.89	-	-	-	-	
g. 1 time	127	3.87	.76	.01	-	-	-	
h. 2 times	59	3.52	.95	**.35***	.34	-	-	
i. 3 times	27	3.33	.62	**.54***	**.53***	.19	-	
j. > 3 times	7	3.14	1.07	.73	.72	.38	.19	
Assessment of command's operational performance				**a**	**b**	**c**	**d**	**e**
g. 1	9	3.11	1.05	-	-	-	-	-
h. 2	26	3.23	.91	.12	-	-	-	-
i. 3	94	3.29	.96	.18	.06	-	-	-
j. 4	178	3.72	.75	.61	.49	**.44****	-	-
k. 5	167	4.07	.62	**.95***	**.83*****	**.78*****	**.34****	-
l. 6	70	4.35	.96	**1.25****	**1.12*****	**1.07*****	**.63*****	.29
Assessment of command's safety performance				**a**	**b**	**c**	**d**	**e**
g. 1	6	2.50	1.22	-	-	-	-	-
h. 2	21	2.71	.95	.21	-	-	-	-
i. 3	84	3.26	.78	.76	.55	-	-	-
j. 4	148	3.61	.78	**1.11***	**.90*****	**.35****	-	-
k. 5	193	4.04	.60	**1.54*****	**1.33*****	**.78*****	**.43*****	-
l. 6	92	4.41	.88	**1.9*****	**1.70*****	**1.15*****	**.80*****	**.37***
Job satisfaction				**a**	**b**	**c**	**d**	**e**
g. 1	41	3.44	.95	-	-	-	-	-
h. 2	49	3.35	.80	.09	-	-	-	-
i. 3	99	3.44	.91	.01	.10	-	-	-
j. 4	124	3.82	.74	.38	**.48***	**.38***	-	-
k. 5	151	4.08	.74	**.64****	**.73*****	**.64*****	.26	-
l. 6	80	4.15	.92	**.71*****	**.80*****	**.71*****	.33	.07

[1] absolute value of means difference
*= p≤ 0.05, **= p≤ 0.01, ***= p≤ 0.001
STATA 8.2 Analysis of Variance (ANOVA)
Scheffe's multiple comparison test
Bartlett's test for equal variance

Appendix K

Regression Results (Oceana Survey)

Table K.1 Regression Results, Principal Factors (Officer)

Principal Factor Variables	Model (1) safetyclimate1
SC1	0.730
	(0.005)**
SC2	0.145
	(0.370)
SC3	0.100
	(0.435)
SP1	0.089
	(0.634)
SP2	-0.073
	(0.421)
SP3	-0.194
	(0.253)
SP4	-0.125
	(0.337)
SP5	0.196
	(0.133)
UP1	0.170
	(0.292)
UP2	0.370
	(0.072)
UP3	-0.155
	(0.169)
LS1	-0.239
	(0.087)
LS2	0.169
	(0.219)
LS3	-0.149
	(0.265)
LS4	0.330
	(0.020)*
LS5	-0.234
	(0.114)
# of variables	16
Respondents	52
Pseudo R2	.51

Survey conducted August 2006.
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table K.2 Regression Results, Demographic Factors (Officer)

	Model (1) safetyclimate1
Independent Demographic Variables	
unit1	0.449
	(0.132)
unit2	0.184
	(0.593)
unit3	0.795
	(0.000)**
pilot	0.093
	(0.724)
flighthrs500	-0.385
	(0.233)
flighthrs500to1000	0.015
	(0.947)
flighthrs1501to2000	-0.167
	(0.592)
flighthrs2001to2500	0.606
	(0.149)
flighthrsgreaterthan2500	0.165
	(0.717)
brancho	-0.585
	(0.003)**
phasehd	0.202
	(0.405)
departhd	-0.529
	(0.013)*
single	0.553
	(0.027)*
se	-0.691
	(0.006)**
midwest	-0.647
	(0.001)**
nw	0.053
	(0.897)
sw	-0.143
	(0.681)
urban	-0.599
	(0.000)**
suburban	-0.555
	(0.004)**
# of variables	20
Respondents	52
Pseudo R2	.47

Survey conducted August 2006.
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses
*significant at 5%; ** significant at 1%; dprobit results. Coefficients indicate marginal effects.

Table K.3 Regression Results, Performance Factors (Officer)

	Model (1) safetyclimate1
Independent Performance Variables	
leisureinjury1	0.268
	(0.259)
leisureinjury2	0.030
	(0.951)
peopleinjured1to2	-0.126
	(0.503)
peopleinjured3to4	0.520
	(0.066)
sqdmishapzero	-0.230
	(0.223)
sqdmishaptwo	0.407
	(0.300)
sqdmishapthree	-0.373
	(0.106)
sqdmishapfour	0.294
	(0.529)
opperf4	-0.188
	(0.555)
opperf5	0.332
	(0.082)
safetyperf4	-0.255
	(0.387)
safetyperf5	-0.824
	(0.000)**
jobsat4	0.477
	(0.146)
jobsat5	0.235
	(0.301)
# of variables	14
Respondents	52
Pseudo R2	.35

Survey conducted August 2006.
safetyclimate1: respondents ***strongly agreed*** to safety climate survey statement (Q33)
Robust p values in parentheses
Significant at 5%, ** significant at 1%; dprobit results. Coefficients indicate marginal effects.

Table K.4 Regression Results, Unit Factors (Officer)

	Model (1) safetyclimate1
Safety and Unit Programs Variables	
safetypriority	0.363
	(0.441)
recommendtofriend	0.169
	(0.691)
morale	0.295
	(0.315)
myopinion	-0.903
	(0.241)
standdowns	-0.035
	(0.873)
humanfactorbds	0.616
	(0.077)
safetydata	-0.617
	(0.179)
safetyawards	0.981
	(0.015)*
bestpeoplesafety	-0.800
	(0.077)
counselingguidlines	0.250
	(0.541)
counselinghelpful	-0.473
	(0.453)
mentoring	0.973
	(0.036)*
meaningfulreward	-0.030
	(0.924)
familyimpact	0.339
	(0.453)
prodevplan	-0.610
	(0.110)
perfjobassignment	-0.866
	(0.055)
leaderpride	0.596
	(0.157)
leaderinspiration	-0.974
	(0.015)*
leadersacrifice	-0.328
	(0.608)
leadermoralstand	0.532
	(0.039)*
goalsknown	-0.813

	(0.080)
leaderawardrec	-0.100
	(0.751)
leaderperfawareness	-0.597
	(0.074)
leadermicro	0.244
	(0.424)
leadergetsit	0.603
	(0.016)*
# of variables	25
Respondents	46
Pseudo R2	.48

Survey conducted August 2006.
Safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Significant at 5%; ** significant at 1%; dprobit results. Coefficients indicate marginal effects.

Table K.5 Regression Results, Principal Factors (Enlisted)

	Model (1) safetyclimate	**Model (2) safetyclimate1**
Principal Factor Variables		
SC1	0.207	0.104
	(0.000)**	(0.000)**
SC2	-0.160	-0.044
	(0.000)**	(0.003)**
SP1	0.104	0.068
	(0.000)**	(0.001)**
SP2	0.013	0.020
	(0.598)	(0.158)
UP1	-0.052	-0.056
	(0.100)	(0.007)**
UP2	0.049	0.042
	(0.066)	(0.041)*
LS1	-0.008	-0.013
	(0.802)	(0.558)
LS2	-0.034	-0.012
	(0.179)	(0.447)
LS3	-0.007	-0.010
	(0.751)	(0.497)
# of variables	9	9
Respondents	544	544
Pseudo R2	.27	.23

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses; significant at 5%; ** significant at 1%dprobit results. Marginal effects

Table K.6 Regression Results, Demographic Factors (Enlisted)

	Model (1) safetyclimate	**Model (2) safetyclimate1**
Independent Demographic Variables*		
E1orE2	0.061	0.053
	(0.497)	(0.452)
E3	0.090	0.061
	(0.161)	(0.222)
E5	-0.061	-0.034
	(0.400)	(0.475)
E6	-0.085	0.034
	(0.424)	(0.588)
male	0.042	0.024
	(0.524)	(0.593)
noncitizen	0.216	0.444
	(0.215)	(0.014)*
naturalized	0.067	-0.062
	(0.482)	(0.312)
africanamerican	0.014	0.102
	(0.833)	(0.035)*
hispanic	0.022	-0.075
	(0.794)	(0.147)
asian	-0.260	0.096
	(0.148)	(0.466)
airframes	-0.044	0.011
	(0.678)	(0.878)
avionics	-0.067	0.025
	(0.490)	(0.717)
corrosion	-0.391	0.039
	(0.009)**	(0.715)
line	-0.037	-0.052
	(0.707)	(0.372)
wcnone	-0.069	0.089
	(0.594)	(0.366)
ord	-0.071	0.050
	(0.538)	(0.550)
pp	-0.016	0.011
	(0.882)	(0.883)
pr	-0.221	-0.019
	(0.303)	(0.882)
qa	0.091	0.057
	(0.545)	(0.582)
survival	-0.016	0.013
	(0.898)	(0.876)
daycheck	0.198	0.185

	(0.002)**	(0.003)**
nightcheck	0.212	0.254
	(0.001)**	(0.001)**
single	-0.091	-0.071
	(0.162)	(0.101)
divorced	-0.009	0.074
	(0.935)	(0.412)
separated	0.017	-0.020
	(0.876)	(0.771)
milspouse	-0.158	-0.047
	(0.084)	(0.436)
basehousing	-0.041	0.016
	(0.534)	(0.730)
kids0	0.060	0.077
	(0.332)	(0.057)
kids3or4	-0.046	-0.025
	(0.618)	(0.691)
somehs	-0.274	-0.098
	(0.203)	(0.213)
ged	-0.137	-0.007
	(0.255)	(0.930)
somecollege	-0.039	-0.002
	(0.418)	(0.954)
college	0.086	-0.084
	(0.395)	(0.164)
eduother	-0.260	0.157
	(0.342)	(0.421)
worker	-0.280	-0.050
	(0.009)**	(0.518)
shiftsup	-0.225	-0.031
	(0.075)	(0.645)
workcentersup	-0.293	-0.031
	(0.053)	(0.727)
northwest	0.103	-0.045
	(0.331)	(0.546)
southeast	0.061	-0.026
	(0.303)	(0.549)
southwest	0.056	-0.000
	(0.482)	(0.994)
midwest	0.044	0.010
	(0.468)	(0.827)
pacisland	0.131	0.054
	(0.611)	(0.767)
regionnone	0.143	0.028
	(0.118)	(0.687)
rural	-0.121	-0.077

	(0.049)*	(0.042)*
urban	-0.150	-0.039
	(0.011)*	(0.300)
milparent1	0.033	0.011
	(0.482)	(0.734)
milparent2	0.044	0.026
	(0.640)	(0.722)
tenurelessthan1	0.086	0.016
	(0.126)	(0.690)
tenure2to3	0.127	0.065
	(0.032)*	(0.159)
tenure3to4	0.059	0.053
	(0.503)	(0.410)
tenuremorethan4	0.041	0.017
	(0.748)	(0.862)
mp	0.115	0.044
	(0.016)*	(0.196)
p	0.130	0.035
	(0.063)	(0.554)
nonsafetydept	-0.015	-0.045
	(0.890)	(0.552)
# of variables	54	54
Respondents	544	544
Pseudo R2	.11	.11

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%; dprobit results. Coefficients indicate marginal effects.

Table K.7 Regression Results, Unit Factors (Enlisted)

	Model (1) **safetyclimate**	**Model (2)** **safetyclimate1**
Safety and Unit Program Variables		
safetypriority	0.103	0.072
	(0.042)*	(0.002)**
recommendtofriend	0.129	-0.058
	(0.044)*	(0.007)**
morale	-0.024	0.045
	(0.722)	(0.090)
myopinion	0.049	0.046
	(0.448)	(0.090)
expectedaccidents	-0.206	0.002
	(0.000)**	(0.937)
standdowns	0.166	0.038
	(0.001)**	(0.119)
orm	0.034	0.021
	(0.580)	(0.518)
handleschange	0.105	0.055
	(0.062)	(0.048)*
safetystats	0.002	-0.037
	(0.977)	(0.147)
safetydata	0.025	0.003
	(0.698)	(0.913)
fairassessment	0.075	-0.039
	(0.218)	(0.135)
safetyawards	0.007	0.012
	(0.903)	(0.628)
empowered	0.061	0.016
	(0.214)	(0.548)
sufficienttime	-0.008	0.031
	(0.884)	(0.231)
bestpeoplesafety	-0.043	0.030
	(0.489)	(0.252)
injuriesreported	0.082	0.017
	(0.129)	(0.471)
counselingguidlines	0.035	-0.128
	(0.577)	(0.001)**
counselinghelpful	0.103	0.182
	(0.099)	(0.000)**
evaluation	0.014	-0.014
	(0.790)	(0.568)
mentoring	0.079	0.084
	(0.152)	(0.001)**
meaningfulreward	0.001	-0.058

	(0.986)	(0.018)*
familyimpact	0.037	-0.001
	(0.626)	(0.979)
prodevplan	0.012	0.032
	(0.850)	(0.243)
perfjobassignment	-0.008	-0.032
	(0.898)	(0.185)
racebias	0.119	0.022
	(0.029)*	(0.364)
leaderdevelopment	-0.044	0.036
	(0.430)	(0.151)
leaderpride	-0.099	-0.085
	(0.155)	(0.008)**
leaderinspiration	0.065	0.097
	(0.316)	(0.002)**
leadersacrifice	0.104	0.020
	(0.086)	(0.450)
leadermoralstand	-0.068	0.003
	(0.269)	(0.905)
goalsknown	0.140	0.067
	(0.008)**	(0.012)*
leaderawardrec	-0.071	-0.011
	(0.230)	(0.699)
leaderperfawareness	0.010	-0.059
	(0.865)	(0.036)*
leaderdecide	-0.006	0.000
	(0.909)	(0.987)
leadermicro	0.021	0.018
	(0.719)	(0.525)
leadergetsit	-0.006	-0.013
	(0.913)	(0.642)
# of variables	36	36
Respondents	544	544
Pseudo R2	.39	.33

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Table K.8 Regression Results, Performance Factors (Enlisted)

	Model (1) **safetyclimate**	**Model (2)** **safetyclimate1**
Performance Variables		
jobinjury1	0.061	0.137
	(0.344)	(0.048)*
jobinjury2	-0.101	0.007
	(0.383)	(0.943)
jobinjury3	-0.307	#
	(0.328)	
jobinjury4	0.244	0.120
	(0.213)	(0.538)
leisureinjury1	-0.006	0.051
	(0.932)	(0.334)
leisureinjury2	0.100	-0.113
	(0.276)	(0.250)
leisureinjury3	-0.304	#
	(0.232)	
leisureinjury4	-0.127	-0.060
	(0.560)	(0.624)
mymishap1	0.078	-0.082
	(0.460)	(0.267)
mymishap2	-0.378	0.163
	(0.272)	(0.482)
unitmishap1	-0.066	-0.050
	(0.259)	(0.250)
unitmishap2	-0.107	-0.105
	(0.173)	(0.068)
unitmishap3	-0.227	#
	(0.055)	
unitmishap4	-0.323	#
	(0.113)	
unitinjury2	-0.015	-0.000
	(0.775)	(0.999)
unitinjury4	0.071	0.041
	(0.289)	(0.531)
unitinjury6	-0.036	0.068
	(0.832)	(0.630)
unitinjury8	-0.105	#
	(0.532)	
opperf1	-0.172	#
	(0.373)	
opperf2	-0.300	-0.130
	(0.055)	(0.102)
opperf3	-0.538	-0.236

	(0.000)**	(0.000)**
opperf4	-0.264	-0.215
	(0.007)**	(0.000)**
opperf5	-0.084	-0.162
	(0.375)	(0.002)**
safetyperf1	-0.586	#
	(0.008)**	
safetyperf2	-0.389	-0.123
	(0.013)*	(0.131)
safetyperf4	-0.002	-0.175
	(0.976)	(0.001)**
safetyperf5	0.174	-0.144
	(0.004)**	(0.003)**
jobsat1	-0.173	-0.054
	(0.119)	(0.490)
jobsat2	-0.113	#
	(0.299)	
jobsat3	-0.161	-0.064
	(0.086)	(0.316)
jobsat4	0.020	-0.039
	(0.807)	(0.507)
jobsat5	0.092	0.015
	(0.259)	(0.777)
# of variables	32	24
Respondents	541	439
Pseudo R2	.26	.25

Survey conducted August 2006.
safetyclimate: respondents either ***agreed*** or ***strongly agreed*** to safety climate statement (Q33)
safetyclimate1: respondents ***strongly agreed*** to safety climate statement (Q33)
predicts failure perfectly, observations dropped.
Robust p values in parentheses, significant at 5%; ** significant at 1%
dprobit results. Coefficients indicate marginal effects.

Glossary

AIMD	Aircraft Intermediate Maintenance Department
AO	Aviation Ordnanceman
AMRAAM	Advanced Medium Range Air to Air Missile
AE	Aviation Electrician
CAIB	Columbia Accident Investigation Board
CC	Command and Control
CDI	Collateral Duty Inspector
C/FR	Communications
CMC	Commandant of the Marine Corps
CNA	Center for Naval Analyses
CNO	Chief of Naval Operations
CO	Commanding Officer
COMNAVAIRFOR	Commander Naval Air Forces
CSA	Command Safety Assessment
CSCAS	Command Safety Climate Assessment Survey
DCI	Detailed Claim Information
DEA	Drug Enforcement Agency
DH	Department Head
DOD	Department of Defense
DON	Department of the Navy
DSOC	Defense Safety Oversight Council
FEMA	Federal Emergency Management Agency
FRP	Fleet Response Plan
FRS	Fleet Replacement Squadron (FRS)
FM	Flight Mishap
FNAEB	Field Naval Aviator Evaluation Board
FYDP	Future Years Defense Plan
GPWS	Ground Proximity Warning System
HRO	High Reliability Organization

JDAM	Joint Direct Attack Munitions
JSOW	Joint Stand-Off Weapon
MC	Maintenance Control
MCAS	Maintenance Climate Assessment Survey
MFOQA	Military Flight Operations Quality Assurance
N/A	Not Applicable
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NCCI	National Council on Compensation Insurance
NCO	Non-Commissioned Officer
NMCSC	Navy and Marine Corps Safety Council
NSC	National Safety Council
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
PA	Process Auditing
PMV	Private Motor Vehicle
QA	Quality Control
QAR	Quality Assurance Representative
RM	Risk Management
RS	Reward System
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
SES	Senior Executive Service
TAWS	Target Acquisition Weapons Software
TMS	Type/Model/Series
NPGS	Naval Post Graduate School
USN	United States Navy
USMC	United States Marine Corps
VFA	Fixed-Wing Fighter-Attack Squadron (Navy)
VMFA	Fixed-Wing Fighter-Attack Squadron (Marine Corps)
VPP	Voluntary Protection Program

XO	Executive Officer

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