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THE RELATIONSHIP BETWEEN NAVAL AVIATION MISHAPS AND SQUADRON MAINTENANCE SAFETY CLIMATE

by

Cynthia J. Brittingham

December 2006

Co-Advisors: Janice Laurence
David Annis

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Naval Aviation has been known for over half a century as being one of the most fascinating professions. Although aircrew may always play a role in the mishap rate, the Navy has shifted its focus to aviation maintenance safety climate as a possible indicator of a future mishap. The School of Aviation Safety developed and implemented a survey, the Maintenance Climate Assessment Survey (MCAS), to assess the safety climate of Naval Aviation squadrons. Researchers have begun reviewing the possible direct relationship between the maintainer, how they view their squadron's climate and aviation mishaps. This thesis examines the construct of squadron maintenance safety climate survey and its relationship to aviation mishaps. The raw data employed includes MCAS responses from 126,058 maintainers between August 2000 and August 2005. This study finds that the MCAS survey construction needs to be revised. The findings are substantial to verify that most questions are formulated to focus on the same factor. Since the survey requires reconstruction, the question of whether it can determine the likelihood of mishaps was never visited. Revising the survey, based on psychometrics, may produce more significant results and gauge maintenance safety climate based on separate and distinct factors.

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Cynthia J. Brittingham
Lieutenant, United States Navy
B.S., Purdue University, 1996

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December 2006

Author: Cynthia J. Brittingham

Approved by: Janice Laurence
Thesis Co-Advisor

David Annis
Thesis Co-Advisor

Robert Beck
Dean, Graduate School of Business and Public Policy

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ABSTRACT

Naval Aviation has been known for over half a century as being one of the most fascinating professions. In that time, however, many brave men and women have lost their lives for their country and the mission for which they were assigned. Improvements in aircraft and warship design and the development of the Naval Aviation Training and Operating Procedures Standards have all played a role in decreasing the overall mishap rate of the Navy and Marine Corps. Although aircrew may always contribute to the mishap rate, the Navy has shifted its focus to the aviation maintenance safety climate as a possible indicator of a future mishap. During the last part of the 1990's the School of Aviation Safety developed and implemented a survey, the Maintenance Climate Assessment Survey (MCAS), to assess the maintenance safety climate of Naval Aviation squadrons. Data accumulated over the past six years have allowed for researchers to begin reviewing the possible direct relationship between maintainers, their views of their squadron's climate and aviation mishaps. This thesis examines the construct of squadron maintenance safety climate survey and its possible relationship to aviation mishaps. The raw data employed includes MCAS responses from 126,058 maintainers between August 2000 and August 2005. This study finds that the MCAS survey construction needs to be revised. The findings indicate that most questions are formulated to focus on the same factor. Since the survey requires reconstruction, the question of whether it can determine the likelihood of mishaps was never visited. Revising the survey based on psychometrics may produce more meaningful results and gauge maintenance safety climate based on the combination of several distinct factors.

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I. INTRODUCTION

A. BACKGROUND

Naval Aviation is inherently dangerous. Practically every aircraft platform in the Navy and Marine Corps inventory has experienced some failure resulting from factors such as human error, material failure or maintenance error. In light of the many safety demands and post-mishap reports, the Naval School of Aviation Safety at Naval Air Station Pensacola, Florida, developed and implemented two on-line surveys in July 2000. These two surveys, the Command Safety Assessment (CSA) survey and the Maintenance Climate Assessment Survey (MCAS), were designed to enable the Navy and Marine Corps to assess the climate of aviation squadrons across the platform spectrum.

At the beginning of 2006, the Department of the Navy (DON) released its top five objectives, one of which was to "Emphasize Safety, manage risk to improve mission effectiveness and to safeguard the people and resources of the Navy-Marine Corps Team" (DON, 2006, para. 4). Three underlying initiatives of this objective include:

- Improve safety performance across DON to meet Secretary of Defense Strategic Planning Guidance to reduce baseline mishap rates by 75% by the end of FY 2008.

- Promulgate and execute the Naval Safety Strategy and Action Plan.

- Establish a corporate risk management and mitigation strategy and ensure that department leaders and managers use risk-based approaches for planning and problem solving.

It is the never ending endeavor of the Navy and Marine Corps to reduce the mishap rate to ensure the safety of all its members. Mishap reduction and risk management and mitigation continue to be some of the Navy and Marine Corps main objectives.

On 24 November 2004, the Commander of Naval Air Forces (CNAF), Vice Admiral Zortman, released a message remarking on the mishap reduction goals of the Navy. VADM Zortman delineated his plan to further reduce the mishap rate through operational risk management (ORM), intrusive leadership, training, communication, and safety climate surveys. "Mission and safety are directly linked to readiness – keeping our people and equipment operational" (Zortman, 2004, para. 6).

B. MISHAPS

OPNAVINST 3750.6R (2001) defines a naval aviation mishap as "an unplanned event or series of events, directly involving naval aircraft or Unmanned Aerial Vehicle (UAV) which results in any of the following: (1) Damage in the amount of twenty thousand dollars or more to naval aircraft or UAV, other aircraft [Department of Defense (DOD) or non-DOD], or property (DOD or non-DOD). Property damage includes costs to repair or replace facilities, equipment or material, (2) An injury as defined in paragraph 307 (of OPNAVINST 3750.6R), or (3) Damage incurred as a result of salvage efforts do not count as mishap costs on that aircraft or UAV; however, other damage such as corrosion or fire that happen while the aircraft is awaiting salvage must be included."

Mishaps are delineated along two dimensions: category and severity. The Navy and Marine Corps use the following scheme for tracking mishaps involving a DOD aircraft or UAV.

1. Mishap Categories

The category identifies the circumstances surrounding the mishap (i.e., whether it happened in the air or on the ground). These categories are defined by OPNAVINST 3750.6R (2001) as:

a. Flight Mishaps (FM)

This category encompasses those mishaps which result in $20,000 or more damage to a DOD aircraft or UAV or the loss of a DOD aircraft or UAV - when intent for flight for DOD aircraft or UAV existed at the time of the mishap. Other property damage, injury or death is irrelevant to this classification.

b. Flight-Related Mishaps (FRM).

Those mishaps which result in less than $20,000 damage to a DOD aircraft or UAV - when intent for flight existed at the time of the mishap and, additionally, $20,000 or more total DOD and non-DOD damage or a reportable injury or death occurred.

c. Aviation Ground Mishap (AGM).

Those mishaps in which the intent for flight did not exist but a DOD aircraft or UAV was lost, or more than $20,000 damage was sustained by a DOD aircraft or UAV, or DOD or non-DOD property was damaged in the amount of $20,000 or more, or a reportable injury occurred.

2. Mishap Severity

Each mishap is given a mishap severity code expressing how costly the mishap was in terms of loss of life, injury or property damage cost. These severity classes are defined by OPNAVINST 3750.6R (2001) as:

a. Class A Severity.

A Class A mishap is one in which the total cost of damage to property or aircraft or UAV exceeds $1,000,000, or a naval aircraft is destroyed or missing, or any fatality or permanent total disability results from the direct involvement of naval aircraft or UAV. Loss of a UAV is not a Class A unless the cost is $1,000,000 or greater.

b. Class B Severity

A Class B mishap is one in which the total cost of damage to property or aircraft or UAV is more than $200,000 but less than $1,000,000, or a permanent partial disability or the hospitalization of three or more personnel results.

c. Class C Severity

A Class C mishap is one in which the total cost of damage to property or aircraft or UAVs is $20,000 or more, but less than $200,000, or an injury requiring five or more lost workdays results.

The resultant label will include one variable from each section (i.e., Class A FM or Class C AGM). Mishap data from the Naval Safety Center show that since August 2000 the Navy and Marine Corps have experienced mishaps from all mishap categories.

Numerous factors play a role in mishaps, and the goal is and will always be a zero mishap rate. However, because humans are involved, this may never become reality. Nevertheless, the Navy and Marine Corps continue to strive toward that goal by implementing new strategies and programs to identify the hazards associated with aviation and control the involved risks.

C. SQUADRON SAFETY

Naval aviation squadrons, which include active and reserve Navy and Marine Corps, are normally organized to include a department dedicated to safety. The officer presence in this department typically includes a Safety Officer (SO) as the department head, an Aviation Safety Officer (ASO) and a Ground Safety Officer (GSO). The SO is directly responsible for the promotion of safety within the squadron. The ASO is a graduate of the Naval School of Aviation Safety at Naval Air Station Pensacola and "act(s) as principal advisor to the commanding officer on all aviation safety matters" (OPNAVINST 3750.6R, 2001, chpt 1, p. 23). He or she is responsible for duties such as maintaining the squadron Pre-Mishap Plan, updating Operational Risk Management worksheets, conducting climate surveys, reporting and investigating mishaps as they occur, and other miscellaneous aviation safety associated duties. The GSO is responsible for ground-related safety matters, such as automobile and personal safety. The Safety Department strives to ensure that safety is emphasized and is viewed by all squadron members as paramount, above and beyond the mission in most cases.

D. PURPOSE OF THE STUDY

It is essential for the Navy and Marine Corps to isolate possible indicators of mishaps to decrease the likelihood of further personnel and aircraft losses. The purpose of this study is to determine whether a relationship exists between the safety climate of a naval aviation squadron, as measured by the MCAS, and the number and severity of mishaps. Although the MCAS was originally designed as a tool for Commanding Officers to assess the maintenance safety climate of their squadrons, it has recently become the focus of interest as a possible instrument to indicate the likelihood of a future mishap. Since the MCAS became available via the internet in July 2000, survey data have accumulated to provide an initial foundation for analysis. The goal of this thesis is to analyze the mishap data and their potential relationship to a squadron's safety climate, based on average squadron survey item results. It will attempt to verify whether the survey may be used as a valid tool to determine the likelihood of mishaps. This research will first explore MCAS content and construct validity, the variance, reliability and correlation of survey items, and the survey's Model of Safety Effectiveness (MOSE) scales and their correlation to each other and to mishaps.

E. RESEARCH QUESTIONS

This study focuses on one primary research question and one secondary question.

1) Can MCAS results indicate the likelihood of aviation mishaps for Naval & Marine Corps Aviation squadrons (High Reliability Organizations)?

2) Are the MOSE scales of the MCAS independent and optimal? [Assess the construction of the survey.]

F. SCOPE AND LIMITATIONS

The intent of this study is to gain perspective of the survey and its potential to be a useful tool in the reduction of mishaps. This research is a continuation of prior research conducted by Baker (1998), Oneto (1999) and Hernandez (2001). The survey results utilized for this research are primarily from Naval and Marine Corps aviation maintenance personnel only. Existing survey data were employed for this study with no further subjects solicited for the research.

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II. LITERATURE REVIEW

A. OVERVIEW

Naval Aviation is considered a high-reliability organization (HRO), or an organization that depends on organizational culture to sustain a safe working environment in an attempt to keep the mishap numbers at a minimum (Hernandez, 2001). A study by Reason (cited in Hernandez, 2001) determined that strong evidence exists that an organization's safety culture impacts maintenance safety. Operational tempo (OPTEMPO) is another issue that could possibly impact a unit's overall safety culture and climate. During increased military presence abroad and wartime events, the operational demands of military units increase and therefore the operational tempo of these units also increases. Analysis by Conway and Svenson (cited in Zacharatos, Barling, & Iverson, 2005) adds that "safety infractions increase during periods of economic growth, presumably because the need for greater production to meet demand results in an increase in work pace" (p. 80). Further studies by Baugher & Roberts and Hofman & Stetzer (cited in Zacharatos et al., 2005) show that "when managers feel hindered by an unusually heavy workload, safety is compromised" (p. 81). Pressure to perform and complete work on schedule was also a major cause of work-related accidents. "If production is stressed over safety, employees will infer that managers consider safety a low priority regardless of what they say about its importance" (Erickson, 2006, p. 3).

B. HIGH RELIABILITY ORGANIZATIONS

High reliability organizations (HRO) are those that maintain a superior safety record while operating in hazardous settings with high danger and error potential (Roberts, 1990). Naval aviation is considered a high reliability organization due to its extremely volatile mission and environments. Whether maintainers are working on a flight line repairing a helicopter or launching jets from a nuclear aircraft carrier, naval aviation is very high paced and there is no room for error. "In such organizations, performance reliability rivals productivity as a dominant goal" (Roberts, 1990, p. 102).

Many researchers compare naval aviation operations to those of similar high performing work teams. Some include "nuclear aircraft carriers, nuclear power generating plants, power grid dispatching centers, air traffic control systems, aircraft operations, hospital emergency departments, hostage negotiating teams, fire fighting crews, continuous processing firms" (Department of Energy, 2004, para. 2). These high reliability organizations, or high performing work systems, all have many attributes in common. The members of these organizations understand that for their HRO to maintain an injury and catastrophe-free environment while operating at the high-reliability level, safety during production must be kept as the highest priority. Systems of checks and balances allow for individuals to report safety incidents without fear of reprisal. Process audits, quality control, rewards, risk management, decision-making authority, formal procedures, training, redundancy and many other attributes all play key roles in a HROs safety and keep the members focused toward a common goal of an injury or incident free environment (Department of Energy, 2004).

C. SAFETY CLIMATE

1. Culture versus Climate

Though often used synonymously, culture and climate carry different connotations. It is essential to understand these differences if we are to understand how safety plays a role in the organization. "By culture, we mean the shared values and beliefs of an organization commonly described as 'the way we do things around here'" (Stircoff, 2005, p. 2). Culture is also based on informal rules, and attitudes that affect how we interact, perform duties and train (Quessenberry & Boyer, 2004). These informal rules and personal values can influence the developed culture within a squadron, both positively and negatively. Culture can be affected by informal leaders, who may believe they have the best of intentions, but do not understand the negative impact of their role. "These people permit certain attitudes and rules to exist, by the way they act and by what they tolerate" (Quessenberry & Boyer, 2004, para. 3). Culture is often deeply entrenched within an organization; it is long term, is very difficult to change or takes longer to change (Stircoff, 2005) and employees are motivated to be safe by top-down management (Erickson, 2006). Edgar Schein (1999) identifies three key aspects of culture: it is deep, broad and stable. "It is the sum total of all the shared, taken-for-granted assumptions that a group has learned throughout its history" (Schein, 1999, p.

29). Mangers must realize that if they want to attempt to change culture elements, they are “tackling some of the stablest parts” of the organization (Schein, 1999, p. 26).

Climate, however, is different from culture. Although climate is heavily influenced by culture and they affect each other, climate is defined as “the prevailing influences on a particular area of functioning (such as safety) at a point in time” (Stircoff, 2005, p. 2). A key attribute of climate is that it can change easily and quickly. Management and leadership stereotypically have a “knee jerk” reaction to a workplace injury or mishap. This reaction could include punishment, non-scheduled training or re-evaluation of the process during which the incident occurred. Climate is affected by these reactions, which may strengthen the climate, but the change may not last over the long term and climate will often return to the way it was before the injury or mishap took place (Stircoff, 2005). Often, the reaction by management will lower morale and cause employees to get frustrated and pessimistic with the process in general. Reaction may also hold the person who caused the original incident liable for the extra work and training that stemmed from the mishap.

2. Safety Culture and Climate

"The term 'Safety Culture' was first introduced in INSAG's (International Nuclear Safety Advisory Group) *Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident*, published by the IAEA (International Atomic Energy Agency) as Safety Series No.75-INSAG-l in 1986” (IAEA, 1991, pg. 7). Many organizations tend to be reactive to incidents rather than proactive. The issue with this mindset is that as long as management and employees only focus on the symptoms, there will only be temporary fixes to the problem. The cause of the incident is often overlooked and the safety incident experienced is all that is typically addressed (Erickson, 2006). As Reason (cited in Ciavarelli & Crowson, 2004, p. 3) stated, “safety is defined and measured more by its absence than its presence.”

On September 11, 1991, Continental Express Flight 2574 experienced an in-flight structural breakup and crashed near Eagle Lakes, Texas. According to Meshkati (cited in Weigmann, Zhang, Thaden, Sharma, Mitchell, 2002), this accident was considered “the most dramatic turning point for ‘safety culture’ in the United States” (p. 4). The findings from this accident brought safety culture to the attention of the U.S. National Summit on

Transportation Safety. Dr. John Lauber, a member of the National Transportation Safety Board (NTSB) at the time of the accident, suggested a probable cause of the accident as "the failure of Continental Express management to establish a corporate culture which encouraged and enforced adherence to approved maintenance and quality assurance procedures" (Weigmann et al., 2002, p. 4). Safety culture has since become a highly regarded topic of discussion and study among aviation safety professionals and culture researchers.

Carillo (2004) identified ten toxins to an organization's safety culture. These ten are: meeting deadlines has priorities over safety; management not visible in work areas; lack of concern for employee welfare; not keeping commitments; lack of agreement on a common direction or standards; poor accountability; poor communication of important information; blame fixing, personal attack and retribution are the norm in handling conflict; response and follow up to safety concerns is slow or non-existent; and fear in the workplace. Naval aviation squadrons, as high reliability organizations, can not afford to allow these negative mindsets to penetrate maintenance operations and must therefore mitigate the toxin before they are able to infiltrate the culture.

In particular, one which can be very detrimental to a naval aviation safety culture is the fear of retribution, personal attack and blame fixing. If an individual feels he or she will be reprimanded for an incident that could cause severe injury or disaster, he or she normally will not report the safety event and the organization cannot be proactive in preventing the possible incident (Weigmann et al., 2002). Naval Aviation strives to conquer this mindset. There are programs in place at commands that allow maintainers to submit unsafe practices that may relate to safety culture or climate. One such program, called "Anymouse," which is a play on the word anonymous, allows squadron members to report such incidents. As the squadron leadership receives these inputs, they are addressed at the appropriate level. The command can then assess the issue as a current climate issue or an underlying culture issue. Although this program is in place, it is difficult to say if the fear of retribution still exists since the cultural mindsets run deep and may be hard to assess.

Zohar refers to safety climate as "the shared perception of the people in an organization that their leaders are genuinely committed to safety of operations, and have taken appropriate measures to communicate safety standards and procedures" (cited in Ciavarelli & Crowson, 2004, p. 2). Safety climate is at the heart of naval aviation maintenance safety. How management and leaders perceive and contribute to the squadron's commitment to safety has a significant impact on how safety is viewed by maintenance personnel. This attribute of safety climate, the commitment to safety at all levels, especially management and leadership, supports the reality "that an organization's safety climate does influence injuries and safety-related events" (cited in Evans, Michael, Wiedenbeck & Ray, 2005, p. 23). Kelly asserts that "whatever management permits, management condones. For example, if management allows employees to compromise their safety then the unsafe behaviors, in many cases, become routine and may eventually lead to a mishap, injury or fatality" (cited in Evans et al., 2005, p. 24).

Three distinct differences that set safety climate apart from safety culture are that safety climate is: "1) a psychological phenomenon, which is usually defined by as the perceptions of the state of safety at a particular time, 2) closely concerned with intangible issues such as situational and environmental factors, and 3) a temporal phenomenon, a 'snap shot' of safety culture, relatively unstable and subject to change" (Weigmann et al, 2002, p. 9). Differences in safety climate and safety culture at naval aviation commands may be a significant factor in identifying unsafe safety attitudes and behavior (Ciavarelli & Crowson, 2004). A weaker safety climate may be indicative of a climate in which the managers and leaders only view safety as an artificial priority and not true value (Evans et al., 2005). If commands want a strong safety climate, they must be proactive with their management and insist the leadership is leading by example. Management should expect safe behavior from their subordinates and, collectively, they should align with a strong safety climate and underlying safety culture.

3. Safety Climate and Safety Performance

Research by Evans et al. (2005) within the wood manufacturing industry studied the relationship between safety climate, quality climate and productivity climate and their effect on safety performance. Noronha (cited in Evans et al., 2005, p. 24), defines quality climate as "employees' perception regarding the quality objectives of the organization," meaning if an employee perceives the quality climate to be high, production rates would be slower and perhaps the organization would have fewer accidents. In naval aviation maintenance, quality climate may be a contributor to the safety climate in that quality and safety are stressed, but productivity and fast aircraft turn-around are essential to the squadron's success. Therefore, productivity climate becomes a factor. This is a term defined as "employees' attitudes and beliefs with respect to management's emphasis on production in the work environment" (Evans et al., 2005, p. 24). This team found that although there is no known research on productivity climate and its direct relationship to safety, a study by Hoffman and Stetzer (cited Evans et al., 2005) supports a positive relationship between performance pressure and safety performance.

D. MAINTENANCE CLIMATE ASSESSMENT SURVEY (MCAS)

1. MCAS Overview

In July 2000, the MCAS became available online for Naval and Marine Corps squadrons. Since its inception in the late 1990's, the MCAS has been presented as a prominent tool for Commanding Officers to gauge the maintenance safety climate of their squadrons. Originally, the survey was voluntary for all aviation squadrons, though highly recommended to be completed by all squadrons on a reoccurring basis. The concept behind the survey is to take a "snap shot" of the safety climate of a particular command and allow the Commanding Officer to address issues that could possibly lead to injury or mishaps. Since the timing of safety assessments in naval aviation squadrons is critical, Commanding Officers need current survey data to set initial standards for their command. In 2004, VADM Zortman declared the MCAS and CSA mandatory for all squadrons to complete semi-annually and within 30 days following a change of command (Zortman, 2004)

> The results shall be made available to your CAG and Commodore, giving all a baseline for the new CO. This plan will remove the 'report card' aspect of compromising confidentiality, allow the (Commodore) to help if necessary, and establish an environment where seeking help is seen as a positive. My intent is for us to evolve these important tools into vehicles for visibility, not accountability or attribution. Additionally, all unit commanders shall review their progress with their CAG or Commodore six months after the change of command surveys are complete. This allows for the new CO's plans for intervention and action to begin taking effect but does not wait too long for adjustment (Zortman, 2004, para. 2).

The MCAS was developed in response to the criticism that little to no attention has been paid to the effects of organizational influences on safety and “even less attention has been spent on maintainers and maintenance error, despite their involvement in FM’s” (Ciavarelli, Figlock, Schmidt, & Sengupta, n.d., p. 1). The Naval School of Aviation Safety tailored the Model of Organizational Safety Effectiveness (MOSE) and identified five main categories, and a sixth one added later, that may influence how Naval Aviation maintenance departments conduct operations (categories are labeled as they are on the current MCAS):

- Process Auditing (PA): A system of ongoing checks to identify hazards and correct safety problems.

- Reward System & Safety Culture (RS/SC): The expected social rewards and disciplinary actions used to reinforce safe behavior, and correct unsafe behavior.

- Quality Assurance (QA): The policies and procedures for promoting high quality work performance.

- Risk Management (RM): A systematic process used to identify hazards and control operational risk.

- Command and Control (CC): The organization’s overall safety climate, leadership effectiveness, and the policies and procedures used in the management of flight operations and safety.

- Communication/Functional Relationships (C/FR): An environment where information is freely exchanged, quality assurance is a positive influence, and maintenance workers are shielded from external pressures to complete a task.

As of 30 August 2005, hundreds of aviation squadrons and thousands of personnel in the Navy and Marine Corps had participated in the MCAS. Many had taken the survey repeatedly over the five year period since the survey was released via internet in July 2000. The survey currently consists of 45 survey items. Of these, 43 are statements offering responses along a 5-point Likert Scale with answers ranging from “Strongly Disagree” to “Strongly Agree.” The respondents may also answer “Don’t Know” and “Not Applicable.” Furthermore, all 43 survey items must be answered before the survey may be submitted. The remaining two questions are essay and optional, but the respondent must select “No comment” or “My response is:” for the survey to be accepted. Each question on the survey has its applicable MOSE category in parenthesis following the query to identify the scale for which the specific query belongs.

Demographic information is gathered at the beginning of the survey. This information consists of rank, years of aviation maintenance experience, work center, primary shift, current model aircraft, status, service, parent command, and unit’s location. Before the MCAS was initialized on the internet, the survey was provided to squadrons in paper form. In this format, there was an explicit statement indicating the information was collected solely to aid in response analysis and no attempts to identify individuals would be made. The current internet version says only that no demographic information will be made available to the Commanding Officer. It is not made clear now to the survey taker what this information is used for and may be viewed by some participants as unnecessary information.

In conjunction with the maintenance safety climate surveys, a squadron’s Commanding Officer may request a Culture Workshop from the Naval Safety Center (NSC). As another tool for the Commanding Officer to use in the effort of gauging their squadron’s safety climate, the Culture Workshop requires the MCAS be completed prior to the workshop. Since they are used in conjunction, this requirement is for the benefit of the Commanding Officer and can be included in the overall assessment of the command’s culture. The command conducting the culture workshop invites a pilot or Naval Flight Officer (NFO) and a senior maintainer (E-7/E-8), both preferably from outside the hosting command, to assist the NSC facilitator. Informal interviews and interactive discussion groups are held to determine how the squadron members view culture in their command.

A study conducted by Quessenberry and Boyer (2004) shows the results of how a culture workshop may affect a command’s climate. They relate squadrons who conducted Culture Workshops to a lower mishap rate for that group. As shown in the first two columns of Figure 1, 67 of the Class A FM within the prior two years of their study were experienced by the 172 squadrons who had not conducted a Culture

Workshop. Some 99 Squadrons had conducted a workshop and experienced only 5 of the 72 total Class A flight mishaps. In January 2003, the Commander of Naval Air Forces made it mandatory for all deployable units to conduct a Culture Workshop during their inter-deployment training cycle (IDTC) and non-deployable units to conduct a workshop every two years (Quessenberry & Boyer, 2004). The workshops bring safety related issues to commanding officers' attention and they can therefore be addressed and possibly remedied. The workshops themselves may not directly prevent mishaps, but they can identify safety areas in which the command needs to focus. The end state was for all aviation units to complete a MCAS and Culture Workshop in an effort to gauge squadron safety and therefore, expectantly, reduce mishaps.

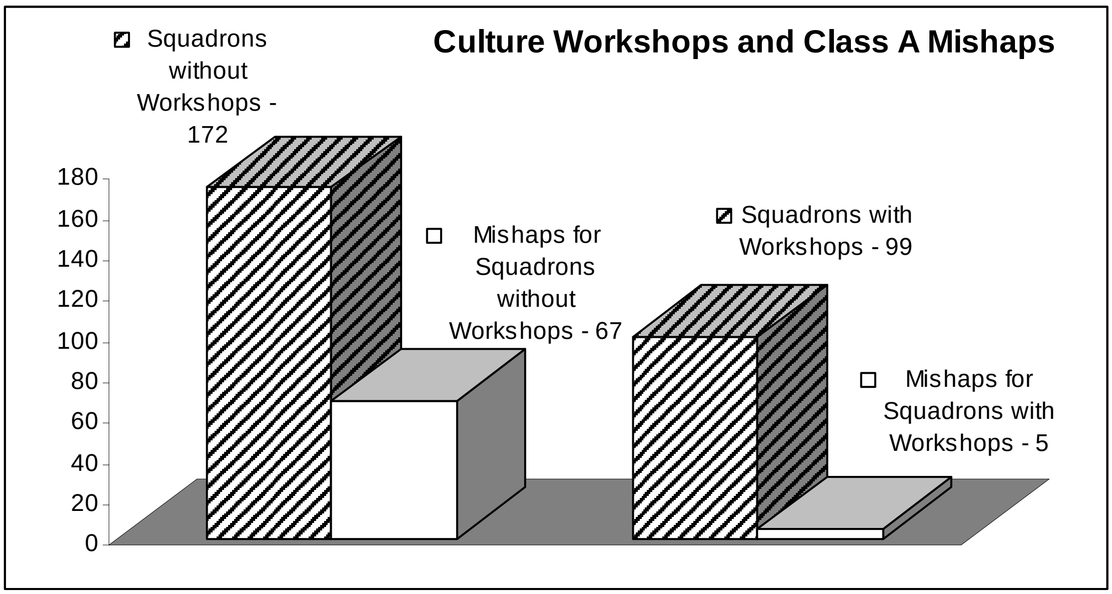

Figure 1. Culture Workshops and Class A Mishaps (Quessenberry & Boyer, 2004)

In conjunction with Naval School of Aviation Safety, Baker (1998) developed the MCAS from the CSA and determined the questions to be asked on the survey. His results concluded that by using 35 line item inquiries, an adequate assessment of naval reserve maintenance safety perceptions can be made. He recommended it be evaluated at active duty squadrons. Oneto (1999) further researched the MCAS and revised Baker's findings to include an additional 5 questions. Stanley (2000) reviewed the impact of demographic information on survey results. Individual or group demographics, such as work shift, may have an impact on attitudes, behavior and overall view of maintenance safety climate by certain teams (Figlock & Schimpf, 2006). Focus on these groups may be a potential indicator or predictor of mishaps. Though there may be large amounts of variance in the scoring due to human component dependence, this variance cannot be explained solely by demographic factors (Stanley, 2000). Hernandez (2001) addressed questions regarding the difference between the internet and the paper-and-pencil version. Her results showed that there were no differences and both were equally effective at capturing the maintenance safety perception. Her principal component analysis showed that no specific MOSE category question was responsible for controlling the outcome of the survey. All questions loaded on one main component factor, meaning that all questions are fairly similar in content and mainly relate to that one factor. No known prior thesis research has been conducted to determine the predictive ability of the MCAS and the MOSE category scales relative to climate and aviation mishaps. There may be concern over the design of the survey due to a possible lack of discrimination between the questions and within the categories due to factor analysis conducted by numerous researchers. For a survey to be useful, it must measure what it was intended to measure. An instantaneous picture of a naval aviation squadron's safety climate is the primary objective of the MCAS. This research will determine if the MCAS is measuring what it was originally developed to quantify and if so, whether the results can give insight and forewarning of a possible mishap.

2. General Survey Construction and Administration

Survey construction and administration are vital for an instrument to be valid and reliable. Construct and content validity must be proven before a survey instrument may be utilized as a tool to gauge or evaluate what it was intended to assess in the way its meant to be measured. "A measure is content valid when its items are judged to accurately reflect the domain of the construct as defined conceptually" (Schwab, 1999, p. 39). Validating the content of a survey is required to ensure the questions are defining factors for which it was designed. These factors should be specific and separate. In the case of the MCAS, these factors are the six MOSE categories. Each category division, or scale, within the MCAS has between six and nine questions that define it. Therefore content validity, along with factor analysis, should yield six distinct categories.

a. Construction

Factor analysis is the primary vehicle for researchers to verify if a tool has construct validity. It analyzes the interdependence of questions, variables or scales and to understand the underlying relationships between them then combines groups of like items into new and fewer groups (Aaker, Kumar, & Day, 2004). Principal component analysis has been the primary factor analysis method for summarizing this information based on the total amount of variance, but principal axis factor analysis has recently become more visible for summarizing the data. Principal axis analysis does not analyze based on total variance, instead it focuses only the factors which account for the most variance (Wuensch, 2004).

Since, by definition, HROs have a low rate of accidents, it is difficult to forecast and determine whether the safety climate will have a direct impact on the occurrence of a mishap or injury. Low base rate behavior or rare events are very difficult to predict. It can be said that since there are already few mishaps in Naval Aviation, there is not much for which the MCAS can determine the likelihood. However, if we were to employ a psychometric perspective, we may be able to improve the survey and thereby possibly predict a mishap-prone safety environment. Climate is elusive; it is a latent construct. It is "seen" through perceptions of individuals and in order to gauge a climate, survey developers may need to include psychometric evaluation. Psychometrics is defined as "a branch of psychology concerned with the measurement of psychological characteristics, especially intelligence, abilities, personality, and mood states. Psychometric tests are carefully constructed and standardized to provide measures of the highest possible reliability and validity" (Crystal Reference Encyclopedia, 2006). It is the branch of survey research that allows survey designers to determine if the survey instrument measures what it was intended to measure (Litwin, 2003). Thus, a psychometric assessment of MCAS is appropriate to determine the extent to which the safety climate of a naval aviation squadron is being accurately measured and hence providing value to the aviation community by promoting an understanding of the correlates of mishaps.

b. Administration

Administration of the survey can influence the results. Ethical issues and federal law protects individuals from invasion of privacy and personal rights. If accurate information is the goal, survey designers must “give respondents the opportunity to not respond and create conditions which encourage them to respond, despite possible apprehension, by protecting their privacy” (Watson, 1997, p. 92). It is difficult to ascertain if naval aviation maintenance personnel feel they are participating in the survey willingly, honestly or confidentially. As mentioned, VADM Zortman mandated that the survey be taken by all squadrons and the results made available to the Commodore of each squadron’s respective wing. With this in mind, the Commanding Officer of a squadron may therefore require each person in his or her squadron to take the survey. If the Commanding Officer orders each individual to take the survey, it is no longer voluntary and this may cause the results to be biased or skewed.

E. RISK MANAGEMENT

Risk management has been the focus of the Navy and Marine Corps for several years and is one of the Navy’s 2006 Objectives. In a 2001 review of the MCAS, Hernandez (p. 45) found that risk management is one specific category that “should be reviewed by all Naval Aviation units since this area consistently is ranked the lowest of the six MOSE areas.”

In his 2004 review of mishap reduction strategies, VADM Zortman delineated that “attaining our mishap reduction goals requires embracing a safety culture rooted in Operational Risk Management (ORM) and a ‘zero mishap mentality’” (para. 1). ORM is a program developed by the Department of the Army in the 1990’s and was quickly adopted by the Navy and Marine Corps. ORM is defined by OPNAVINST 3500.39B (2004) as the process of dealing with risk associated within military operations, which includes risk assessment, risk decision making and implementation of effective risk controls.

There are five steps to the ORM process: Identify Hazards, Assess the Hazards, Make Risk Decisions, Implement Controls and Supervise. This formal process is typically the documented version of deliberate or in-depth planning conducted by leaders and managers to evaluate a procedure or mission. Most ORM conducted by maintainers and non-operational planning personnel is considered time-critical or "on the run" ORM. This level does not require lengthy, drawn out preparation, but uses requisite knowledge and experience to make the proper risk management decision. OPNAVINST 3500.39B (2004, Encl 1, p. 3) describes time-critical ORM as follows:

> An 'on the run' mental or oral review of the situation using the five step process without recording the information on paper. The time critical level of ORM is employed by experienced personnel to consider risk while making decisions in a time-compressed situation. It is the normal level of ORM used during the execution phase of training or operations, as well as in planning during crisis response scenarios. It is particularly helpful in choosing the appropriate course of action when an unplanned event occurs during the execution of a planned operation or daily routine.

General George S. Patton once said, "Take calculated risks. That is quite different from being rash" (Cook, 1997, p. 397). ORM has adopted four main principles in which the Navy expects all its personnel manage their every day tasks and duties. These are:

- Accept Risk When Benefits Outweigh the Cost.
- Accept No Unnecessary Risk
- Anticipate and Manage Risk by Planning
- Make Risk Decisions at the Right Level

The difficulty with risk management is that some may feel that there may never be a time when the benefit outweighs the cost of a possible mishap. Whenever people are involved in an evolution, maintenance or airborne, there is always a possibility that a disaster might occur. If people allow this mentality to govern their behavior, the mission or task may never be attempted or completed. This is not the intent of ORM. ORM simply implies that if all procedures are followed correctly, safety is aligned as a priority in task completion and calculated risk management is effectively employed, a mishap is unlikely to occur. Vincent van Gogh once said "The fishermen know that the sea is dangerous and the storm terrible, but they have never found these dangers sufficient reason for remaining ashore" (Cook, 1997, p. 394). If we do not take risk in naval aviation, we will not succeed in our missions, training or war efforts. Risk must be managed and mitigated, but likely can not be avoided completely.

F. CHAPTER SUMMARY

High reliability organizations have a troubling responsibility to the public to ensure that they incur minimal mishaps. It is the goal of the United States Navy and Marine Corps to ensure that the aviators, maintainers and any other personnel involved in aviation related activities are safe from injury. The cost of losing or damaging an aircraft, UAV or other aviation asset is a price incurred by the American people, and should therefore be minimized whenever possible. With the human component involved, it may be impossible to be mishap free. By identifying and improving weak or poor safety climates, the Navy will be more prepared in its endeavor to minimize the mishap rate.

Currently, the MCAS is the primary tool by which the Navy gauges the safety climate of individual squadrons. By analyzing the survey results, Commanding Officers can identify the weak areas within their commands and employ sound measures in an effort to improve the current climate. By establishing a culture in which good time-critical ORM is reinforced, people will make more informed and possibly wiser decisions. ORM is a valuable tool which when used correctly, could make a huge impact on the climate and entrenched culture of an aviation squadron. With a firm grasp of ORM through training and reinforcement from the chain of command, maintenance members will feel empowered to make sensible risk management judgments and thus, create a safer maintenance environment.

In conjunction with sound ORM, MCAS results and improving safety climate, Naval Aviation squadrons can improve or dramatically reduce the over all mishap rate. Reviewing the construction of the survey will verify the validity of the MCAS as an instrument to assess safety climate and further, determine the likelihood of mishaps.

III. METHODOLOGY

A. RESEARCH APPROACH

The intent of this study is to determine whether the Maintenance Climate Assessment Survey (MCAS) is a suitable tool for determining the likelihood of mishaps for Naval Aviation squadrons. The study employs MCAS data from hundreds of active duty and reserve Navy and Marine Corps squadrons from 21 August 2000 through 30 August 2005. The MCAS data are first examined to verify the validity of the survey as an instrument to assess the safety climate of aviation squadrons. The MOSE categories were examined to determine whether or not they address those areas for which they were intended. The study includes a thorough extraction through principal component and principal axis factoring analysis, analysis of variance, and correlation and discrimination of survey items and MOSE categories (scales). Demographics were not utilized.

B. DATA COLLECTION

1. Subjects

Since the inception of the survey in 2000, hundreds of active duty and reserve Navy and Marine Corps squadrons (ashore and afloat) and thousands of personnel have participated in the MCAS. This analysis reviews the results of 126,058 respondents from 952 cases and the mishaps that may have occurred subsequent to those cases. A case refers to a specific completed survey by a squadron. The participants are primarily Navy and Marine Corps enlisted personnel involved in maintenance activities in the 952 cases. Maintenance safety climate survey results from a mixture of fixed and rotary wing, fleet and training squadrons are studied. All current and recently retired airframes within the Navy and Marine Air elements of Naval Aviation are included. Shore maintenance facilities are not incorporated in this research.

2. Instrument

The MCAS is an internet based survey through the NSC Naval School of Aviation Safety website (https://www.cnet.navy.mil/nascweb/sas/index.htm). It is self-administered and mandatory for all Naval Aviation squadrons to participate. Although the survey was originally voluntary, the Chief of Naval Air Forces (CNAF) has mandated all squadrons complete the surveys semi-annually and within 30-days following a change of command. Commanding Officers of participating squadrons determine how many command maintenance members take a survey then request the appropriate amount of ID numbers required. The MCAS has two principal sections of questions - demographic and climate perception. Demographics are not utilized in this research since there are conflicting results with regard to some demographic items and do not pertain to this analysis. The MCAS consists of 45 survey items. Of these, 43 are statements offering responses along a 5-point Likert scale: 5 - Strongly Agree, 4 - Agree, 3 - Neutral, 2 - Disagree, and 1 - Strongly Disagree. Don't Know and Not Applicable response options are also available, but are not included as part of this research. The 43 survey items are sequential, but are grouped within their MOSE category: Process Auditing (PA), System & Safety Culture (RS/SC), Quality Assurance (QA), Risk Management (RM), Command and Control (CC), and Communication/Functional Relationships (C/FR). The last two questions are essay, or qualitative in nature, and will also not be utilized in this research. MCAS question 21 – "Multiple job assignments and collateral duties adversely affect maintenance" is a reverse ordered, or negatively phrased, question and has been deleted from the analysis. See Appendix A for a full list of MCAS questions.

3. Procedure

The process of administering and taking the survey is fairly simple and user-friendly. When a squadron wishes to conduct a MCAS, the CO, SO or ASO contacts an agent of the Naval Safety Center and is assigned a bank of survey ID numbers. These ID numbers are specific to that squadron - one number provided for each individual taking the survey. These numbers are drawn at random by each participant after which the member is directed to the website to complete the survey. Typically, the participants are requested to take the survey in the Safety Department, since a representative is present to answer any questions and ensure each member who takes a number participates in the survey. Once complete, the survey number is discarded and not utilized again.

C. DATA ANALYSIS

1. Data Tabulation

Aggregate survey data are in Excel spreadsheet format with each row representing one MCAS case. The demographic information is presented first as well as the date each squadron finished the MCAS. Following the squadron demographic data are columns containing the case average score for each of the 43 survey items on the MCAS, as well as a column dedicated to the response average for that squadron. Next are six columns for the average response scores of questions in their respective MOSE category. These six columns are averages of subsets of the 43 MCAS questions aggregated for the spreadsheet. The next set of columns is the mishap data based on category and severity of mishaps split into time blocks of 6-month increments from 6-months post-survey out to 30-month post-survey. Data were then transferred to SPSS v12.0 for analysis and interpretation.

Raw survey data are utilized to verify the validity of the MCAS as a climate assessment tool. The data were presented in two Excel spreadsheets, due to the number of data included. The data were then transferred to SPSS v12.0 for analysis and interpretation.

2. Statistical Analysis

a. Aggregate Data

Principal axis factor analysis was utilized for aggregate data analysis. After reviewing the preliminary results of the aggregate data, the raw data were requested to substantiate the findings.

b. Raw Data

Raw data were requested based on the preliminary results of the aggregate data analysis. Once the 126,058 respondent data were imported into SPSS v12.0, summary descriptive statistics were computed for all respondents. Simple descriptive statistics were developed to gain perspective of the survey data and the individuals taking the survey. Principal component and principal axis factor analysis were employed to determine survey factors. These factors should be based on the six discrete factors based on MOSE scales. This factor analysis determines if the MCAS is indeed measuring safety climate based on the six distinct categories. After factor analysis completion of the raw data, the results provide a basis for conclusions of the MCAS survey content and construct validity.

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IV. RESULTS

A. DESCRIPTIVE STATISTICS

Frequencies were analyzed for all questions and demographic items to establish an overall feel for the survey results and its contents. Descriptive statistic results can be found in Appendix B.

B. FACTOR ANALYSIS

Table 1 shows the content of the MCAS by rationally-derived MOSE theoretical categories. The MCAS was designed to examine six distinct dimensions (as indicated in the left column) each consisting of six to nine items (as indicated in the right column). An exploratory principal axis factor analysis with varimax rotation was performed using SPSS to empirically assess the dimensions of the MCAS. Three factors with Eigen values greater than 1 were extracted accounting for 53.82% of the variance.

Table 1. MCAS Questions by MOSE Category

MOSE Category	**MCAS Question**
Process Auditing	1, 2, 3, 4, 5, 6
Reward System and Safety Culture	7, 8, 9, 10, 11, 12, 13, 14
Quality Assurance	15, 16, 17, 18, 19, 20
Risk Management	21, 22, 23, 24, 25, 26, 27, 28, 29
Command and Control	30, 31, 32, 33, 34, 35, 36, 37
Communication/Functional Relationships	38, 39, 40, 41, 42, 43

Table 2. Total Variance Explained by Principal Axis Factor Analysis of MCAS

Factor	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	21.075	50.178	50.178	20.623	49.103	49.103	11.166	26.586	26.586
2	1.745	4.156	54.334	1.277	3.040	52.144	8.736	20.800	47.386
3	1.125	2.679	57.013	.704	1.677	53.820	2.702	6.434	53.820

Extraction Method: Principal Axis Factoring.

The Scree Plot (See Figure 2), which summarizes results, indicates that, before rotation, only one factor is substantive in accounting for MCAS contents, accounting for almost 50% of the variance. Upon rotation, a second factor emerges with considerable variance. However, despite varimax rotation, there is no clear differentiation between factors. Thus, the MCAS would seem to comprise only one dimension, rather than the six it claims. The pattern of rotated loadings suggests the presence of two diffuse factors; the first consisting of overall command attention to safety and the second related to workload and appropriate resources.

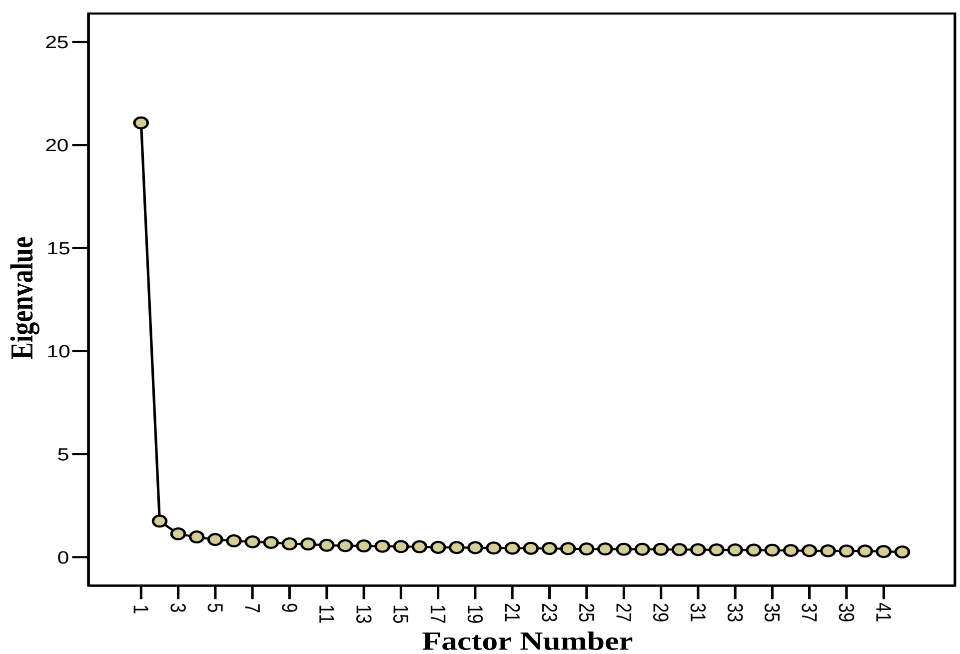

Figure 2. Scree Plot of MCAS Principal Axis Factor Analysis

Table 3. Principal Axis Factor Matrix

Unrotated Factor Matrix(a)			
	Factor	Factor	Factor
	1	2	3
CC 34. In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety.	0.807		
CC 32. Supervisors communicate command safety goals and are actively engaged in the safety program.	0.801		
CC 36. All maintenance evolutions are properly briefed, supervised and staffed by qualified personnel.	0.787		
CC 35. Safety education and training are comprehensive and effective.	0.783		
RM 22. Safety is part of maintenance planning, and additional training/support is provided as needed.	0.781		
CC 33. Supervisors set the example for following maintenance standards and ensure compliance.	0.779		
C/FR 43. Maintainers are briefed on potential hazards associated with maintenance activities.	0.773		
RM 23. Supervisors recognize unsafe conditions and manage hazards associated with maintenance and the flight-line.	0.767		
C/FR 39. I get all the information I need to do my job safely.	0.766		
QA 16. QA and Safety are well respected and are seen as essential to mission accomplishment.	0.759		
CC 31. Safety decisions are made at the proper levels and work center supervisor decisions are respected.	0.758		
RS/SC 7. Our command climate promotes safe maintenance.	0.755		
RM 26. Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners.	0.744		
QA 15. The command has a reputation for quality maintenance and set standards to maintain quality control.	0.730		
C/FR 40. Work center supervisors coordinate their actions with other work centers and maintenance.	0.726		
QA 17. QARs/CDIs sign-off after required actions are complete and are not pressured by supervisors to sign off.	0.722		
C/FR 38. Effective communication exists up/down the chain of command.	0.721	0.298	
CC 37. Maintenance Control is effective in managing all maintenance activities.	0.717		
QA 18. Maintenance on detachments is of the same quality as that at home station.	0.709		
PA 3. The command uses safety and medical staff to identify/manage personnel at risk.	0.704		
PA 6. Signing off personnel qualifications is taken seriously.	0.703		
RM 28. Supervisors shield personnel from outside pressures and are aware of individual workload.	0.699		

PA 1. The command adequately reviews and updates safety procedures.	0.693	-0.269	
PA 2. The command monitors maintainer qualifications and has a program that targets training deficiencies.	0.691		
RM 24. I am provided adequate resources, time, personnel to accomplish my job.	0.683	0.306	
RS/SC 14. Unprofessional behavior is not tolerated in the command.	0.683		
C/FR 41. My command has effective pass-down between shifts.	0.681		
RS/SC 13. Safety NCO, QAR and CDI are sought after billets.	0.679		
PA 5. Tool Control and support equipment licensing are closely monitored.	0.667		
RS/SC 10. Violations of SOP, NAMP or other procedures are not common in this command.	0.664		
QA 20. QARs are helpful, and QA is not "feared" in my unit.	0.663		
RS/SC 12. Personnel are comfortable approaching supervisors about personal problems/illness.	0.657		
QA 19. Required publications/tools/equipment are available, current/serviceable and used.	0.650		
PA 4. CDIs/QARs routinely monitor maintenance evolutions.	0.647	-0.334	
RM 25. Personnel turnover does not negatively impact the command's ability to operate safely.	0.635		
RS/SC 11. The command recognizes individual safety achievement through rewards and incentives.	0.604		
C/FR 42. Maintenance Control troubleshoots/resolves gripes before flight.	0.601		
RS/SC 8. Supervisors discourage SOP, NAMP or other procedure violations and encourage reporting safety concerns	0.596		0.437
RS/SC 9. Peer influence discourages SOP, NAMP or other violations and individuals feel free to report them.	0.593		0.505
RM 29. Based upon my command's current assets/manning it is not over-committed.	0.586	0.395	
CC 30. My command temporarily restricts maintainers who are having problems.	0.577		
RM 27. Day/Night Check have equal workloads and staffing is sufficient on each shift.	0.564	0.416	

Extraction Method: Principal Axis Factoring.

Table 4. Principal Axis Factor Matrix – Varimax Rotation

Rotated Factor Matrix(a)

	Factor 1	Factor 2	Factor 3
CC 34. In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety.	0.694	0.421	
RM 23. Supervisors recognize unsafe conditions and manage hazards associated with maintenance and the flight-line.	0.677	0.361	
QA 15. The command has a reputation for quality maintenance and set standards to maintain quality control.	0.675	0.280	
PA 4. CDIs/QARs routinely monitor maintenance evolutions.	0.670		0.250
PA 1. The command adequately reviews and updates safety procedures.	0.656		0.272
CC 32. Supervisors communicate command safety goals and are actively engaged in the safety program.	0.638	0.476	
RM 22. Safety is part of maintenance planning, and additional training/support is provided as needed.	0.637	0.416	
CC 33. Supervisors set the example for following maintenance standards and ensure compliance.	0.634	0.453	
RS/SC 7. Our command climate promotes safe maintenance.	0.634	0.329	0.302
QA 16. QA and Safety are well respected and are seen as essential to mission accomplishment.	0.628	0.377	
PA 2. The command monitors maintainer qualifications and has a program that targets training deficiencies.	0.620		0.289
C/FR 43. Maintainers are briefed on potential hazards associated with maintenance activities.	0.614	0.467	
PA 5. Tool Control and support equipment licensing are closely monitored.	0.609		0.287
CC 35. Safety education and training are comprehensive and effective.	0.601	0.486	
PA 6. Signing off personnel qualifications is taken seriously.	0.587	0.298	0.305
PA 3. The command uses safety and medical staff to identify/manage personnel at risk.	0.558	0.339	0.296
C/FR 39. I get all the information I need to do my job safely.	0.554	0.534	
QA 18. Maintenance on detachments is of the same quality as that at home station.	0.539	0.400	
QA 17. QARs/CDIs sign-off after required actions are complete and are not pressured by supervisors to sign off.	0.534	0.420	
C/FR 40. Work center supervisors coordinate their actions with other work centers and maintenance.	0.527	0.511	
QA 20. QARs are helpful, and QA is not "feared" in my unit.	0.524	0.365	
RS/SC 14. Unprofessional behavior is not tolerated in the command.	0.515	0.388	
RS/SC 12. Personnel are comfortable approaching supervisors about personal problems/illness.	0.465	0.415	

QA 19. Required publications/tools/equipment are available, current/serviceable and used.	0.442	0.442	
C/FR 38. Effective communication exists up/down the chain of command.	0.346	0.681	
RM 27. Day/Night Check have equal workloads and staffing is sufficient on each shift.		0.674	
RM 29. Based upon my command's current assets/manning it is not over-committed.		0.670	
RM 24. I am provided adequate resources, time, personnel to accomplish my job.	0.298	0.663	
RM 28. Supervisors shield personnel from outside pressures and are aware of individual workload.	0.389	0.587	
RM 25. Personnel turnover does not negatively impact the command's ability to operate safely.	0.289	0.583	
CC 37. Maintenance Control is effective in managing all maintenance activities.	0.439	0.575	
CC 36. All maintenance evolutions are properly briefed, supervised and staffed by qualified personnel.	0.548	0.562	
RM 26. Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners.	0.470	0.558	
CC 31. Safety decisions are made at the proper levels and work center supervisor decisions are respected.	0.531	0.534	
C/FR 41. My command has effective pass-down between shifts.	0.455	0.514	
RS/SC 11. The command recognizes individual safety achievement through rewards and incentives.	0.300	0.502	
CC 30. My command temporarily restricts maintainers who are having problems.	0.311	0.465	
RS/SC 13. Safety NCO, QAR and CDI are sought after billets.	0.435	0.459	0.259
C/FR 42. Maintenance Control troubleshoots/resolves gripes before flight.	0.410	0.427	
RS/SC 9. Peer influence discourages SOP, NAMP or other violations and individuals feel free to report them.	0.281	0.291	0.671
RS/SC 8. Supervisors discourage SOP, NAMP or other procedure violations and encourage reporting safety concerns	0.365		0.631
RS/SC 10. Violations of SOP, NAMP or other procedures are not common in this command.	0.424	0.362	0.430

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 7 iterations.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

Aviation maintenance, the safety of the individuals conducting the maintenance and the safe return from flight of every aircraft and crew member is undoubtedly a top priority of all Naval Aviation squadrons. It is the responsibility these squadrons and every service member to ensure the environment in which they work is safe, free of hazards and generates mishap-free missions. As long as human beings are involved in these evolutions, the mishap rate may never be zero. Though the Navy has, throughout history, focused on the aircraft and crew involved in the mission as mishap factors, it has begun giving more attention to the maintenance aspect. The climate, specifically safety climate, in which the maintenance is performed, would have an impact on how maintenance is accomplished. A goal of the Maintenance Climate Assessment Survey (MCAS) is to gauge command maintenance safety climate and affect a positive response to the climate.

B. CONCLUSIONS

The primary focus of this report was to analyze the Maintenance Climate Assessment Survey (MCAS) and mishap data to see if a relationship exists between them and the likelihood of a mishap. Through data analysis, specifically, factor analysis, the MCAS was found to be an inadequate tool with questionable validity for gauging maintenance safety climate. It has one main factor on which every MCAS question loads. With one main factor, the MCAS is not providing the results in content areas as originally planned. The MCAS questions were based on items asked on the Climate Assessment Survey and do not appear to have much concrete psychometric influence. Consequently, the value of this survey as a tool to measure safety climate is fairly low. The analysis of the data clearly shows that with only one factor, versus six which would correspond to the six MOSE categories, the MCAS is not measuring what it was intended to measure. There are two secondary factors, but these have minimal influence. Since every survey item loads on the main factor significantly, it can be said that essentially the items are all asking the same general question. Due to these findings, the relationship between the MCAS, mishaps and whether the MCAS can determine the likelihood of mishaps was not analyzed by this research. Previous research has examined the predictive power of the MCAS. The present study sought to elucidate which aspects of the MCAS predict safety but results indicate that psychometrically there are no distinct aspects or factors to be found in the MCAS.

C. RECOMMENDATIONS

The MCAS should be evaluated by a survey developer to include psychometrics and valid question formulations. If the survey is intended to provide a measure of the maintenance safety climate at such a large scale, the instrument must present the best possible results based on proven methods of survey development.

APPENDIX A

Maintenance Climate Assessment Survey (MCAS)

Demographic Questions:

- Rank
- Total years aviation maintenance experience (<1, 1-2, 3-5, 6-10, 11-15, 16-20, 20+)
- Work center (Airframes, Avionics, Flight Line, Maintenance Control, Ordnance, Power Plants, QA, Survival, Other)
- Primary Shift (Day, Night)
- Current model aircraft
- Status (Regular, Active Reserve, Drilling Reserve)
- Service (USN, USMC, other)
- Parent command
- Unit location

Likert Scale Items

- Likert Scale response values: 1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, and 5 - Strongly Agree
- Respondents may also answer Don't Know or Not Applicable

Process Auditing

1. The command adequately reviews and updates safety procedures.
2. The command monitors maintainer qualifications and has a program that targets training deficiencies.
3. The command uses safety and medical staff to identify/manage personnel at risk.
4. CDIs/QARs routinely monitor maintenance evolutions.
5. Tool Control and support equipment licensing are closely monitored.
6. Signing off personnel qualifications is taken seriously.

Reward System and Safety Culture

7. Our command climate promotes safe maintenance.
8. Supervisors discourage SOP, NAMP or other procedure violations and encourage reporting safety concerns.
9. Peer influence discourages SOP, NAMP or other violations and individuals feel free to report them.
10. Violations of SOP, NAMP or other procedures are not common in this command.
11. The command recognizes individual safety achievement through rewards and incentives.
12. Personnel are comfortable approaching supervisors about personal problems/illness.

13. Safety NCO, QAR and CDI are sought after billets.
14. Unprofessional behavior is not tolerated in the command.

Quality Assurance

15. The command has a reputation for quality maintenance and set standards to maintain quality control.
16. QA and Safety are well respected and are seen as essential to mission accomplishment.
17. QARs/CDIs sign-off after required actions are complete and are not pressured by supervisors to sign-off.
18. Maintenance on detachments is of the same quality as that at home station.
19. Required publications/tools/equipment are available, current/serviceable and used.
20. QARs are helpful, and QA is not "feared" in my unit.

Risk Management

21. Multiple job assignments and collateral duties adversely affect maintenance.
22. Safety is part of maintenance planning, and additional training/support is provided as needed.
23. Supervisors recognize unsafe conditions and manage hazards associated with maintenance and the flight-line.
24. I am provided adequate resources, time, personnel to accomplish my job.
25. Personnel turnover does not negatively impact the command's ability to operate safely.
26. Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners.
27. Day/Night Check have equal workloads and staffing is sufficient on each shift.
28. Supervisors shield personnel from outside pressures and are aware of individual workload.
29. Based upon my command's current assets/manning it is not over-committed.

Command and Control

30. My command temporarily restricts maintainers who are having problems.
31. Safety decisions are made at the proper levels and work center supervisor decisions are respected.
32. Supervisors communicate command safety goals and are actively engaged in the safety program.
33. Supervisors set the example for following maintenance standards and ensure compliance.
34. In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety.
35. Safety education and training are comprehensive and effective.

36. All maintenance evolutions are properly briefed, supervised and staffed by qualified personnel.
37. Maintenance Control is effective in managing all maintenance activities.

Communication / Functional Relationships

38. Effective communication exists up/down the chain of command.
39. I get all the information I need to do my job safely.
40. Work center supervisors coordinate their actions with other work centers and maintenance.
41. My command has effective pass-down between shifts.
42. Maintenance Control troubleshoots/resolves gripes before flight.
43. Maintainers are briefed on potential hazards associated with maintenance activities.

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APPENDIX B

SQUADRON NUMBER

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	24	.0	.0	.0
SQDN 100	132	.1	.1	.1
SQDN 101	445	.4	.4	.5
SQDN 102	320	.3	.3	.7
SQDN 103	380	.3	.3	1.0
SQDN 106	713	.6	.6	1.6
SQDN 107	569	.5	.5	2.0
SQDN 108	413	.3	.3	2.4
SQDN 109	504	.4	.4	2.8
SQDN 11	46	.0	.0	2.8
SQDN 110	732	.6	.6	3.4
SQDN 112	411	.3	.3	3.7
SQDN 113	316	.3	.3	4.0
SQDN 114	302	.2	.2	4.2
SQDN 115	266	.2	.2	4.4
SQDN 116	246	.2	.2	4.6
SQDN 117	214	.2	.2	4.8
SQDN 118	875	.7	.7	5.5
SQDN 119	33	.0	.0	5.5
SQDN 12	161	.1	.1	5.6
SQDN 120	718	.6	.6	6.2
SQDN 121	198	.2	.2	6.4
SQDN 122	390	.3	.3	6.7
SQDN 123	363	.3	.3	7.0
SQDN 124	58	.0	.0	7.0
SQDN 125	743	.6	.6	7.6
SQDN 127	59	.0	.0	7.6
SQDN 128	318	.3	.3	7.9
SQDN 13	1004	.8	.8	8.7
SQDN 130	715	.6	.6	9.3
SQDN 131	430	.3	.3	9.6
SQDN 132	513	.4	.4	10.0
SQDN 135	356	.3	.3	10.3
SQDN 137	19	.0	.0	10.3
SQDN 138	316	.3	.3	10.6
SQDN 139	809	.6	.6	11.2
SQDN 14	546	.4	.4	11.6
SQDN 140	474	.4	.4	12.0
SQDN 141	576	.5	.5	12.5
SQDN 143	421	.3	.3	12.8

SQDN 144	500	.4	.4	13.2
SQDN 146	263	.2	.2	13.4
SQDN 147	459	.4	.4	13.8
SQDN 148	10	.0	.0	13.8
SQDN 149	215	.2	.2	13.9
SQDN 15	96	.1	.1	14.0
SQDN 150	571	.5	.5	14.5
SQDN 151	279	.2	.2	14.7
SQDN 152	1822	1.4	1.4	16.1
SQDN 154	46	.0	.0	16.2
SQDN 157	397	.3	.3	16.5
SQDN 158	123	.1	.1	16.6
SQDN 159	590	.5	.5	17.1
SQDN 16	362	.3	.3	17.3
SQDN 161	353	.3	.3	17.6
SQDN 162	212	.2	.2	17.8
SQDN 164	89	.1	.1	17.9
SQDN 165	345	.3	.3	18.1
SQDN 166	101	.1	.1	18.2
SQDN 167	39	.0	.0	18.2
SQDN 168	269	.2	.2	18.5
SQDN 169	538	.4	.4	18.9
SQDN 17	380	.3	.3	19.2
SQDN 170	356	.3	.3	19.5
SQDN 171	76	.1	.1	19.5
SQDN 172	329	.3	.3	19.8
SQDN 173	303	.2	.2	20.0
SQDN 174	636	.5	.5	20.5
SQDN 176	56	.0	.0	20.6
SQDN 177	286	.2	.2	20.8
SQDN 18	561	.4	.4	21.3
SQDN 180	476	.4	.4	21.6
SQDN 183	126	.1	.1	21.7
SQDN 185	290	.2	.2	22.0
SQDN 186	176	.1	.1	22.1
SQDN 188	290	.2	.2	22.3
SQDN 189	275	.2	.2	22.5
SQDN 19	217	.2	.2	22.7
SQDN 190	731	.6	.6	23.3
SQDN 191	235	.2	.2	23.5
SQDN 193	650	.5	.5	24.0
SQDN 194	589	.5	.5	24.5
SQDN 195	1275	1.0	1.0	25.5
SQDN 196	156	.1	.1	25.6
SQDN 197	58	.0	.0	25.7
SQDN 198	897	.7	.7	26.4
SQDN 199	387	.3	.3	26.7

SQDN 20	496	.4	.4	27.1
SQDN 200	396	.3	.3	27.4
SQDN 201	549	.4	.4	27.8
SQDN 202	648	.5	.5	28.3
SQDN 203	537	.4	.4	28.8
SQDN 206	202	.2	.2	28.9
SQDN 207	484	.4	.4	29.3
SQDN 208	289	.2	.2	29.5
SQDN 209	534	.4	.4	29.9
SQDN 21	181	.1	.1	30.1
SQDN 211	65	.1	.1	30.1
SQDN 212	275	.2	.2	30.4
SQDN 213	309	.2	.2	30.6
SQDN 214	1117	.9	.9	31.5
SQDN 216	542	.4	.4	31.9
SQDN 217	725	.6	.6	32.5
SQDN 218	355	.3	.3	32.8
SQDN 219	442	.4	.4	33.1
SQDN 22	930	.7	.7	33.9
SQDN 220	254	.2	.2	34.1
SQDN 221	657	.5	.5	34.6
SQDN 222	182	.1	.1	34.7
SQDN 223	258	.2	.2	34.9
SQDN 225	403	.3	.3	35.3
SQDN 226	559	.4	.4	35.7
SQDN 228	339	.3	.3	36.0
SQDN 229	1222	1.0	1.0	36.9
SQDN 23	78	.1	.1	37.0
SQDN 230	677	.5	.5	37.5
SQDN 231	381	.3	.3	37.8
SQDN 232	327	.3	.3	38.1
SQDN 234	312	.2	.2	38.3
SQDN 235	691	.5	.5	38.9
SQDN 236	58	.0	.0	38.9
SQDN 237	143	.1	.1	39.1
SQDN 238	934	.7	.7	39.8
SQDN 24	297	.2	.2	40.0
SQDN 240	20	.0	.0	40.0
SQDN 241	20	.0	.0	40.1
SQDN 242	30	.0	.0	40.1
SQDN 243	234	.2	.2	40.3
SQDN 244	417	.3	.3	40.6
SQDN 245	793	.6	.6	41.2
SQDN 246	643	.5	.5	41.7
SQDN 247	35	.0	.0	41.8
SQDN 248	227	.2	.2	42.0
SQDN 249	554	.4	.4	42.4

SQDN 25	1309	1.0	1.0	43.4
SQDN 250	510	.4	.4	43.8
SQDN 251	543	.4	.4	44.3
SQDN 252	283	.2	.2	44.5
SQDN 257	695	.6	.6	45.0
SQDN 258	422	.3	.3	45.4
SQDN 259	130	.1	.1	45.5
SQDN 260	560	.4	.4	45.9
SQDN 261	83	.1	.1	46.0
SQDN 262	415	.3	.3	46.3
SQDN 263	276	.2	.2	46.5
SQDN 264	185	.1	.1	46.7
SQDN 27	308	.2	.2	46.9
SQDN 270	644	.5	.5	47.4
SQDN 271	369	.3	.3	47.7
SQDN 272	462	.4	.4	48.1
SQDN 273	943	.7	.7	48.8
SQDN 275	361	.3	.3	49.1
SQDN 276	369	.3	.3	49.4
SQDN 277	706	.6	.6	50.0
SQDN 278	481	.4	.4	50.4
SQDN 279	57	.0	.0	50.4
SQDN 28	271	.2	.2	50.6
SQDN 280	580	.5	.5	51.1
SQDN 281	297	.2	.2	51.3
SQDN 282	587	.5	.5	51.8
SQDN 283	43	.0	.0	51.8
SQDN 284	221	.2	.2	52.0
SQDN 285	377	.3	.3	52.3
SQDN 286	393	.3	.3	52.6
SQDN 288	359	.3	.3	52.9
SQDN 289	101	.1	.1	53.0
SQDN 291	160	.1	.1	53.1
SQDN 292	73	.1	.1	53.2
SQDN 293	441	.3	.3	53.5
SQDN 294	513	.4	.4	53.9
SQDN 295	519	.4	.4	54.3
SQDN 296	599	.5	.5	54.8
SQDN 297	319	.3	.3	55.1
SQDN 298	405	.3	.3	55.4
SQDN 299	523	.4	.4	55.8
SQDN 300	211	.2	.2	56.0
SQDN 301	1698	1.3	1.3	57.3
SQDN 305	300	.2	.2	57.5
SQDN 306	334	.3	.3	57.8
SQDN 307	327	.3	.3	58.1
SQDN 309	523	.4	.4	58.5

SQDN 310	401	.3	.3	58.8
SQDN 312	573	.5	.5	59.3
SQDN 315	221	.2	.2	59.4
SQDN 316	303	.2	.2	59.7
SQDN 318	149	.1	.1	59.8
SQDN 32	152	.1	.1	59.9
SQDN 320	669	.5	.5	60.4
SQDN 321	447	.4	.4	60.8
SQDN 322	487	.4	.4	61.2
SQDN 323	335	.3	.3	61.4
SQDN 324	604	.5	.5	61.9
SQDN 325	95	.1	.1	62.0
SQDN 326	290	.2	.2	62.2
SQDN 327	35	.0	.0	62.3
SQDN 328	751	.6	.6	62.9
SQDN 329	1	.0	.0	62.9
SQDN 330	608	.5	.5	63.3
SQDN 331	465	.4	.4	63.7
SQDN 332	702	.6	.6	64.3
SQDN 335	27	.0	.0	64.3
SQDN 336	732	.6	.6	64.9
SQDN 338	390	.3	.3	65.2
SQDN 34	561	.4	.4	65.6
SQDN 341	304	.2	.2	65.9
SQDN 342	97	.1	.1	65.9
SQDN 344	831	.7	.7	66.6
SQDN 345	716	.6	.6	67.2
SQDN 35	387	.3	.3	67.5
SQDN 350	255	.2	.2	67.7
SQDN 351	494	.4	.4	68.1
SQDN 352	199	.2	.2	68.2
SQDN 353	494	.4	.4	68.6
SQDN 354	234	.2	.2	68.8
SQDN 356	345	.3	.3	69.1
SQDN 357	1366	1.1	1.1	70.2
SQDN 359	529	.4	.4	70.6
SQDN 36	219	.2	.2	70.8
SQDN 361	1666	1.3	1.3	72.1
SQDN 362	74	.1	.1	72.1
SQDN 364	320	.3	.3	72.4
SQDN 365	409	.3	.3	72.7
SQDN 366	355	.3	.3	73.0
SQDN 368	93	.1	.1	73.1
SQDN 369	609	.5	.5	73.6
SQDN 37	366	.3	.3	73.8
SQDN 371	95	.1	.1	73.9
SQDN 372	20	.0	.0	73.9

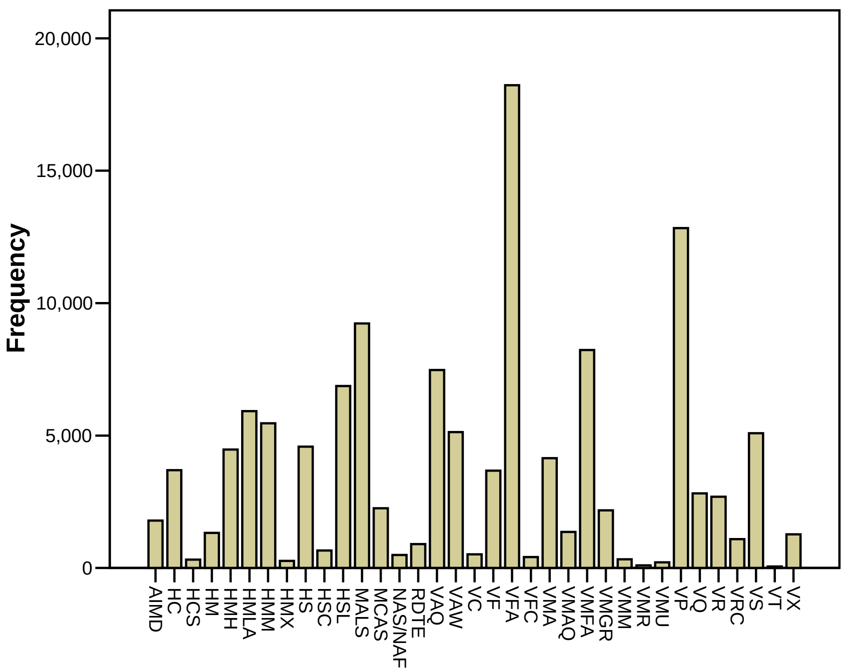
SQDN 373	115	.1	.1	74.0
SQDN 375	534	.4	.4	74.4
SQDN 376	430	.3	.3	74.8
SQDN 378	613	.5	.5	75.3
SQDN 379	195	.2	.2	75.4
SQDN 38	362	.3	.3	75.7
SQDN 381	520	.4	.4	76.1
SQDN 382	612	.5	.5	76.6
SQDN 383	812	.6	.6	77.3
SQDN 386	642	.5	.5	77.8
SQDN 387	349	.3	.3	78.0
SQDN 388	536	.4	.4	78.5
SQDN 390	1208	1.0	1.0	79.4
SQDN 391	919	.7	.7	80.2
SQDN 392	861	.7	.7	80.8
SQDN 393	867	.7	.7	81.5
SQDN 395	207	.2	.2	81.7
SQDN 396	664	.5	.5	82.2
SQDN 398	61	.0	.0	82.3
SQDN 40	441	.3	.3	82.6
SQDN 400	328	.3	.3	82.9
SQDN 401	158	.1	.1	83.0
SQDN 403	121	.1	.1	83.1
SQDN 404	399	.3	.3	83.4
SQDN 406	144	.1	.1	83.5
SQDN 410	180	.1	.1	83.7
SQDN 411	220	.2	.2	83.8
SQDN 413	391	.3	.3	84.2
SQDN 414	463	.4	.4	84.5
SQDN 416	119	.1	.1	84.6
SQDN 417	632	.5	.5	85.1
SQDN 418	623	.5	.5	85.6
SQDN 419	379	.3	.3	85.9
SQDN 44	23	.0	.0	85.9
SQDN 46	249	.2	.2	86.1
SQDN 47	267	.2	.2	86.3
SQDN 49	31	.0	.0	86.4
SQDN 5	247	.2	.2	86.6
SQDN 50	1	.0	.0	86.6
SQDN 51	100	.1	.1	86.6
SQDN 52	145	.1	.1	86.8
SQDN 54	624	.5	.5	87.3
SQDN 55	374	.3	.3	87.6
SQDN 56	268	.2	.2	87.8
SQDN 57	86	.1	.1	87.8
SQDN 6	369	.3	.3	88.1
SQDN 60	296	.2	.2	88.4

SQDN 61	367	.3	.3	88.7
SQDN 62	241	.2	.2	88.8
SQDN 64	711	.6	.6	89.4
SQDN 65	613	.5	.5	89.9
SQDN 66	649	.5	.5	90.4
SQDN 67	210	.2	.2	90.6
SQDN 68	854	.7	.7	91.3
SQDN 69	346	.3	.3	91.5
SQDN 7	760	.6	.6	92.1
SQDN 70	123	.1	.1	92.2
SQDN 71	465	.4	.4	92.6
SQDN 72	429	.3	.3	92.9
SQDN 73	499	.4	.4	93.3
SQDN 74	410	.3	.3	93.7
SQDN 75	426	.3	.3	94.0
SQDN 76	480	.4	.4	94.4
SQDN 77	743	.6	.6	95.0
SQDN 80	226	.2	.2	95.1
SQDN 81	336	.3	.3	95.4
SQDN 82	879	.7	.7	96.1
SQDN 83	175	.1	.1	96.2
SQDN 85	665	.5	.5	96.8
SQDN 87	528	.4	.4	97.2
SQDN 88	415	.3	.3	97.5
SQDN 89	496	.4	.4	97.9
SQDN 90	130	.1	.1	98.0
SQDN 93	625	.5	.5	98.5
SQDN 94	272	.2	.2	98.7
SQDN 96	201	.2	.2	98.9
SQDN 97	655	.5	.5	99.4
SQDN 98	362	.3	.3	99.7
SQDN 99	383	.3	.3	100.0
Total	126058	100.0	100.0	

Community

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	AIMD	1786	1.4	1.4	1.4
	HC	3695	2.9	2.9	4.3
	HCS	316	.3	.3	4.6
	HM	1323	1.0	1.0	5.6
	HMH	4473	3.5	3.5	9.2
	HMLA	5923	4.7	4.7	13.9
	HMM	5461	4.3	4.3	18.2
	HMX	269	.2	.2	18.4
	HS	4579	3.6	3.6	22.1
	HSC	661	.5	.5	22.6
	HSL	6873	5.5	5.5	28.0
	MALS	9233	7.3	7.3	35.4
	MCAS	2254	1.8	1.8	37.2
	NAS/NAF	490	.4	.4	37.6
	RDTE	904	.7	.7	38.3
	VAQ	7473	5.9	5.9	44.2
	VAW	5128	4.1	4.1	48.3
	VC	512	.4	.4	48.7
	VF	3676	2.9	2.9	51.6
	VFA	18225	14.5	14.5	66.0
	VFC	412	.3	.3	66.4
	VMA	4146	3.3	3.3	69.7
	VMAQ	1360	1.1	1.1	70.7
	VMFA	8229	6.5	6.5	77.3
	VMGR	2174	1.7	1.7	79.0
	VMM	327	.3	.3	79.3
	VMR	100	.1	.1	79.3
	VMU	215	.2	.2	79.5
	VP	12835	10.2	10.2	89.7
	VQ	2815	2.2	2.2	91.9
	VR	2692	2.1	2.1	94.1
	VRC	1086	.9	.9	94.9
	VS	5084	4.0	4.0	98.9
	VT	57	.0	.0	99.0
	VX	1272	1.0	1.0	100.0
	Total	126058	100.0	100.0	

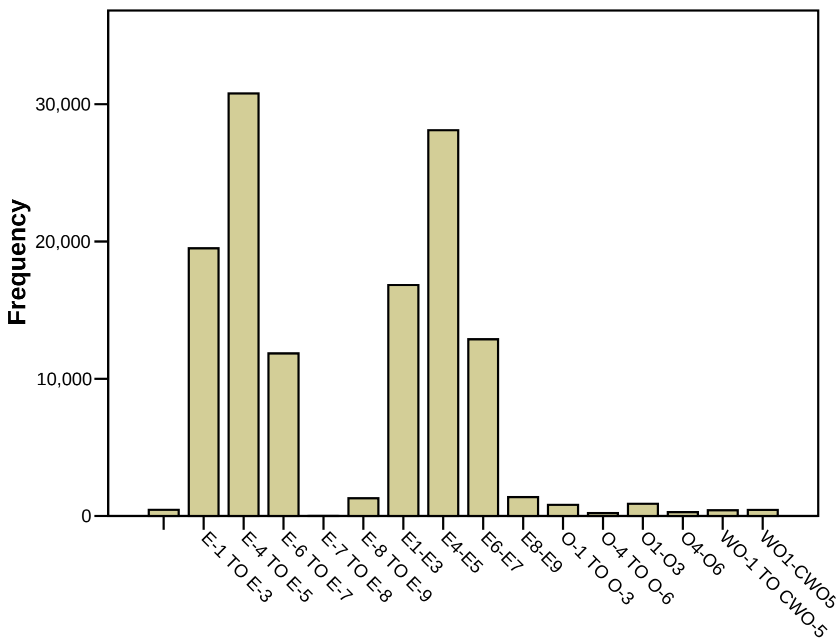
Community



Rank

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		450	.4	.4	.4
	E-1 TO E-3	19495	15.5	15.5	15.8
	E-4 TO E-5	30785	24.4	24.4	40.2
	E-6 TO E-7	11838	9.4	9.4	49.6
	E-7 TO E-8	3	.0	.0	49.6
	E-8 TO E-9	1285	1.0	1.0	50.7
	E1-E3	16826	13.3	13.3	64.0
	E4-E5	28113	22.3	22.3	86.3
	E6-E7	12867	10.2	10.2	96.5
	E8-E9	1371	1.1	1.1	97.6
	O-1 TO O-3	811	.6	.6	98.2
	O-4 TO O-6	201	.2	.2	98.4
	O1-O3	896	.7	.7	99.1
	O4-O6	271	.2	.2	99.3
	WO-1 TO CWO-5	407	.3	.3	99.7
	WO1-CWO5	439	.3	.3	100.0
	Total	126058	100.0	100.0	

Rank



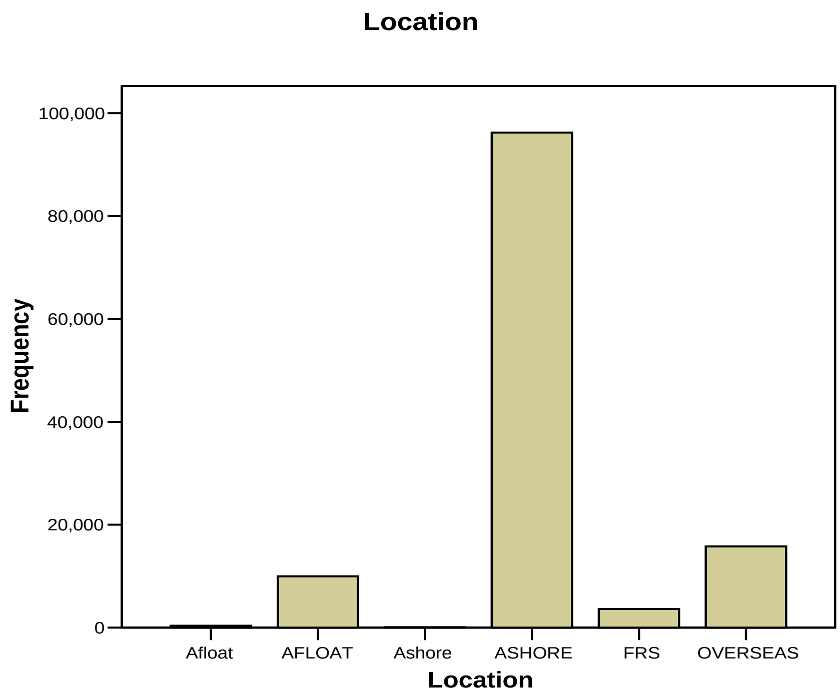
*Note on Rank Charts: The data were split into two separate worksheets and the ranks were named two different ways (i.e., E-1 TO E-3 and E-1-E-3). When added together, the total of those two divisions will denote the sum of all members who took the survey in that rank category.

Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		451	.4	.4	.4
	other	17	.0	.0	.4
	Other	266	.2	.2	.6
	USMC	42948	34.1	34.1	34.7
	USN	82376	65.3	65.3	100.0
	Total	126058	100.0	100.0	

Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Afloat	365	.3	.3	.3
	AFLOAT	9950	7.9	7.9	8.2
	Ashore	74	.1	.1	8.2
	ASHORE	96249	76.4	76.4	84.6
	FRS	3642	2.9	2.9	87.5
	OVERSEAS	15778	12.5	12.5	100.0
	Total	126058	100.0	100.0	



Note on Location Chart: The data were split into two separate worksheets and the locations were named two different ways (i.e., AFLOAT and Afloat). When added together, the total of those two divisions will denote the sum of all members who took the survey in that rank category.

For reference on frequencies for Questions 1-43 the "missing" Likert variables, 0 and 6, refer to Not Applicable and Don't Know responses. Neither of these responses was used in this study.

PA 1. The command adequately reviews and updates safety procedures.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1241	1.0	1.0	1.0
	Disagree	2780	2.2	2.3	3.3
	Neutral	16496	13.1	13.6	17.0
	Agree	75957	60.3	62.8	79.7
	Strongly agree	24562	19.5	20.3	100.0
	Total	121036	96.0	100.0	
Missing	0	351	.3		
	6	4671	3.7		
	Total	5022	4.0		
Total		126058	100.0		

PA 2. The command monitors maintainer qualifications and has a program that targets training deficiencies.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1687	1.3	1.4	1.4
	Disagree	6229	4.9	5.2	6.6
	Neutral	17778	14.1	14.7	21.3
	Agree	72115	57.2	59.7	81.0
	Strongly agree	23005	18.2	19.0	100.0
	Total	120814	95.8	100.0	
Missing	0	482	.4		
	6	4762	3.8		
	Total	5244	4.2		
Total		126058	100.0		

PA 3. The command uses safety and medical staff to identify/manage personnel at risk.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1956	1.6	1.6	1.6
	Disagree	7787	6.2	6.5	8.2
	Neutral	23895	19.0	20.0	28.2
	Agree	68846	54.6	57.7	85.9
	Strongly agree	16885	13.4	14.1	100.0
	Total	119369	94.7	100.0	
Missing	0	408	.3		
	6	6281	5.0		
	Total	6689	5.3		
Total		126058	100.0		

PA 4. CDIs/QARs routinely monitor maintenance evolutions.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1366	1.1	1.1	1.1
	Disagree	3620	2.9	3.0	4.1
	Neutral	13191	10.5	10.9	15.0
	Agree	64834	51.4	53.4	68.4
	Strongly agree	38404	30.5	31.6	100.0
	Total	121415	96.3	100.0	
Missing	0	750	.6		
	6	3893	3.1		
	Total	4643	3.7		
Total		126058	100.0		

PA 5. Tool Control and support equipment licensing are closely monitored.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1837	1.5	1.5	1.5
	Disagree	6510	5.2	5.3	6.8
	Neutral	17401	13.8	14.2	21.1
	Agree	64217	50.9	52.5	73.6
	Strongly agree	32311	25.6	26.4	100.0
	Total	122276	97.0	100.0	
Missing	0	571	.5		
	6	3211	2.5		
	Total	3782	3.0		
Total		126058	100.0		

PA 6. Signing off personnel qualifications is taken seriously.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3001	2.4	2.4	2.4
	Disagree	8595	6.8	7.0	9.4
	Neutral	20243	16.1	16.5	25.9
	Agree	61949	49.1	50.3	76.2
	Strongly agree	29249	23.2	23.8	100.0
	Total	123037	97.6	100.0	
Missing	0	408	.3		
	6	2613	2.1		
	Total	3021	2.4		
Total		126058	100.0		

RS/SC 7. Our command climate promotes safe maintenance.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2134	1.7	1.7	1.7
	Disagree	5275	4.2	4.3	6.0
	Neutral	18314	14.5	14.8	20.7
	Agree	67438	53.5	54.3	75.1
	Strongly agree	30932	24.5	24.9	100.0
	Total	124093	98.4	100.0	
Missing	0	329	.3		
	6	1636	1.3		
	Total	1965	1.6		
Total		126058	100.0		

RS/SC 8. Supervisors discourage SOP, NAMP or other procedure violations and encourage reporting safety concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3424	2.7	2.9	2.9
	Disagree	7748	6.1	6.5	9.3
	Neutral	21155	16.8	17.7	27.0
	Agree	64569	51.2	53.9	81.0
	Strongly agree	22797	18.1	19.0	100.0
	Total	119693	95.0	100.0	
Missing	0	687	.5		
	6	5678	4.5		
	Total	6365	5.0		
Total		126058	100.0		

RS/SC 9. Peer influence discourages SOP, NAMP or other violations and individuals feel free to report them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3405	2.7	2.9	2.9
	Disagree	11478	9.1	9.7	12.6
	Neutral	30624	24.3	25.9	38.6
	Agree	58815	46.7	49.8	88.4
	Strongly agree	13709	10.9	11.6	100.0
	Total	118031	93.6	100.0	
Missing	0	790	.6		
	6	7237	5.7		
	Total	8027	6.4		
Total		126058	100.0		

RS/SC 10. Violations of SOP, NAMP or other procedures are not common in this command.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2281	1.8	2.0	2.0
	Disagree	9760	7.7	8.5	10.4
	Neutral	29658	23.5	25.7	36.1
	Agree	60194	47.8	52.2	88.3
	Strongly agree	13489	10.7	11.7	100.0
	Total	115382	91.5	100.0	
Missing	0	704	.6		
	6	9972	7.9		
	Total	10676	8.5		
Total		126058	100.0		

RS/SC 11. The command recognizes individual safety achievement through rewards and incentives.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9470	7.5	7.9	7.9
	Disagree	19951	15.8	16.6	24.5
	Neutral	31204	24.8	26.0	50.4
	Agree	46928	37.2	39.0	89.5
	Strongly agree	12637	10.0	10.5	100.0
	Total	120190	95.3	100.0	
Missing	0	432	.3		
	6	5436	4.3		
	Total	5868	4.7		
Total		126058	100.0		

RS/SC 12. Personnel are comfortable approaching supervisors about personal problems/illness.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4866	3.9	3.9	3.9
	Disagree	9753	7.7	7.9	11.9
	Neutral	21720	17.2	17.6	29.5
	Agree	64319	51.0	52.1	81.6
	Strongly agree	22677	18.0	18.4	100.0
	Total	123335	97.8	100.0	
Missing	0	312	.2		
	6	2411	1.9		
	Total	2723	2.2		
Total		126058	100.0		

RS/SC 13. Safety NCO, QAR and CDI are sought after billets.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4012	3.2	3.5	3.5
	Disagree	12140	9.6	10.5	14.0
	Neutral	30236	24.0	26.2	40.1
	Agree	54338	43.1	47.0	87.1
	Strongly agree	14894	11.8	12.9	100.0
	Total	115620	91.7	100.0	
Missing	0	759	.6		
	6	9679	7.7		
	Total	10438	8.3		
Total		126058	100.0		

RS/SC 14. Unprofessional behavior is not tolerated in the command.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4095	3.2	3.3	3.3
	Disagree	9509	7.5	7.6	10.9
	Neutral	23308	18.5	18.7	29.7
	Agree	61270	48.6	49.3	78.9
	Strongly agree	26223	20.8	21.1	100.0
	Total	124405	98.7	100.0	
Missing	0	282	.2		
	6	1371	1.1		
	Total	1653	1.3		
Total		126058	100.0		

QA 15. The command has a reputation for quality maintenance and set standards to maintain quality control.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1531	1.2	1.2	1.2
	Disagree	3649	2.9	3.0	4.2
	Neutral	18031	14.3	14.7	18.9
	Agree	63786	50.6	52.0	70.9
	Strongly agree	35623	28.3	29.1	100.0
	Total	122620	97.3	100.0	
Missing	0	405	.3		
	6	3033	2.4		
	Total	3438	2.7		
Total		126058	100.0		

QA 16. QA and Safety are well respected and are seen as essential to mission accomplishment.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2328	1.8	1.9	1.9
	Disagree	6585	5.2	5.3	7.2
	Neutral	22546	17.9	18.3	25.5
	Agree	66865	53.0	54.2	79.7
	Strongly agree	25053	19.9	20.3	100.0
	Total	123377	97.9	100.0	
Missing	0	412	.3		
	6	2269	1.8		
	Total	2681	2.1		
Total		126058	100.0		

QA 17. QARs/CDIs sign-off after required actions are complete and are not pressured by supervisors to sign off.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3211	2.5	2.7	2.7
	Disagree	8433	6.7	7.1	9.8
	Neutral	21549	17.1	18.1	28.0
	Agree	63641	50.5	53.6	81.5
	Strongly agree	21918	17.4	18.5	100.0
	Total	118752	94.2	100.0	
Missing	0	953	.8		
	6	6353	5.0		
	Total	7306	5.8		
Total		126058	100.0		

QA 18. Maintenance on detachments is of the same quality as that at home station.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3133	2.5	2.9	2.9
	Disagree	7791	6.2	7.1	10.0
	Neutral	20381	16.2	18.6	28.5
	Agree	57802	45.9	52.7	81.2
	Strongly agree	20598	16.3	18.8	100.0
	Total	109705	87.0	100.0	
Missing	0	3553	2.8		
	6	12800	10.2		
	Total	16353	13.0		
Total		126058	100.0		

QA 19. Required publications/tools/equipment are available, current/serviceable and used.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4359	3.5	3.5	3.5
	Disagree	10107	8.0	8.2	11.8
	Neutral	19154	15.2	15.6	27.4
	Agree	66587	52.8	54.2	81.6
	Strongly agree	22655	18.0	18.4	100.0
	Total	122862	97.5	100.0	
Missing	0	532	.4		
	6	2664	2.1		
	Total	3196	2.5		
Total		126058	100.0		

QA 20. QARs are helpful, and QA is not "feared" in my unit.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2995	2.4	2.5	2.5
	Disagree	7292	5.8	6.0	8.5
	Neutral	22000	17.5	18.1	26.6
	Agree	66471	52.7	54.7	81.3
	Strongly agree	22755	18.1	18.7	100.0
	Total	121513	96.4	100.0	
Missing	0	697	.6		
	6	3848	3.1		
	Total	4545	3.6		
Total		126058	100.0		

RM 22. Safety is part of maintenance planning, and additional training/support is provided as needed.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1360	1.1	1.1	1.1
	Disagree	4625	3.7	3.8	4.9
	Neutral	21880	17.4	17.8	22.7
	Agree	77201	61.2	62.8	85.5
	Strongly agree	17884	14.2	14.5	100.0
	Total	122950	97.5	100.0	
Missing	0	440	.3		
	6	2668	2.1		
	Total	3108	2.5		
Total		126058	100.0		

RM 23. Supervisors recognize unsafe conditions and manage hazards associated with maintenance and the flight-line.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1239	1.0	1.0	1.0
	Disagree	3388	2.7	2.8	3.8
	Neutral	17927	14.2	14.6	18.4
	Agree	78689	62.4	64.3	82.7
	Strongly agree	21141	16.8	17.3	100.0
	Total	122384	97.1	100.0	
Missing	0	869	.7		
	6	2805	2.2		
	Total	3674	2.9		
Total		126058	100.0		

RM 24. I am provided adequate resources, time, personnel to accomplish my job.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7441	5.9	6.0	6.0
	Disagree	15505	12.3	12.5	18.5
	Neutral	26440	21.0	21.3	39.8
	Agree	60135	47.7	48.5	88.2
	Strongly agree	14590	11.6	11.8	100.0
	Total	124111	98.5	100.0	
Missing	0	585	.5		
	6	1362	1.1		
	Total	1947	1.5		
Total		126058	100.0		

RM 25. Personnel turnover does not negatively impact the command's ability to operate safely.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5276	4.2	4.4	4.4
	Disagree	13311	10.6	11.0	15.4
	Neutral	27857	22.1	23.1	38.5
	Agree	61970	49.2	51.4	89.9
	Strongly agree	12234	9.7	10.1	100.0
	Total	120648	95.7	100.0	
Missing	0	642	.5		
	6	4768	3.8		
	Total	5410	4.3		
Total		126058	100.0		

RM 26. Supervisors are more concerned with safe maintenance than the flight schedule, and do not permit cutting corners.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5247	4.2	4.3	4.3
	Disagree	11597	9.2	9.6	13.9
	Neutral	26720	21.2	22.1	36.0
	Agree	58101	46.1	48.0	83.9
	Strongly agree	19497	15.5	16.1	100.0
	Total	121162	96.1	100.0	
Missing	0	1358	1.1		
	6	3538	2.8		
	Total	4896	3.9		
Total		126058	100.0		

RM 27. Day/Night Check have equal workloads and staffing is sufficient on each shift.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	15850	12.6	13.6	13.6
	Disagree	24071	19.1	20.6	34.2
	Neutral	27864	22.1	23.8	58.0
	Agree	40595	32.2	34.7	92.7
	Strongly agree	8503	6.7	7.3	100.0
	Total	116883	92.7	100.0	
Missing	0	4604	3.7		
	6	4571	3.6		
	Total	9175	7.3		
Total		126058	100.0		

RM 28. Supervisors shield personnel from outside pressures and are aware of individual workload.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4305	3.4	3.5	3.5
	Disagree	12509	9.9	10.3	13.9
	Neutral	30918	24.5	25.5	39.3
	Agree	62272	49.4	51.3	90.6
	Strongly agree	11357	9.0	9.4	100.0
	Total	121361	96.3	100.0	
Missing	0	512	.4		
	6	4185	3.3		
	Total	4697	3.7		
Total		126058	100.0		

RM 29. Based upon my command's current assets/manning it is not over-committed.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8244	6.5	7.1	7.1
	Disagree	16318	12.9	14.1	21.2
	Neutral	35809	28.4	30.9	52.1
	Agree	47441	37.6	40.9	93.0
	Strongly agree	8108	6.4	7.0	100.0
	Total	115920	92.0	100.0	
Missing	0	718	.6		
	6	9420	7.5		
	Total	10138	8.0		
Total		126058	100.0		

CC 30. My command temporarily restricts maintainers who are having problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3340	2.6	3.1	3.1
	Disagree	12225	9.7	11.4	14.5
	Neutral	33043	26.2	30.7	45.2
	Agree	49763	39.5	46.3	91.5
	Strongly agree	9176	7.3	8.5	100.0
	Total	107547	85.3	100.0	
Missing	0	1091	.9		
	6	17420	13.8		
	Total	18511	14.7		
Total		126058	100.0		

CC 31. Safety decisions are made at the proper levels and work center supervisor decisions are respected.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3028	2.4	2.5	2.5
	Disagree	7672	6.1	6.3	8.7
	Neutral	23279	18.5	19.0	27.8
	Agree	72539	57.5	59.2	87.0
	Strongly agree	15918	12.6	13.0	100.0
	Total	122436	97.1	100.0	
Missing	0	426	.3		
	6	3196	2.5		
	Total	3622	2.9		
Total		126058	100.0		

CC 32. Supervisors communicate command safety goals and are actively engaged in the safety program.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1431	1.1	1.2	1.2
	Disagree	4880	3.9	4.0	5.2
	Neutral	25253	20.0	20.7	25.9
	Agree	74976	59.5	61.4	87.3
	Strongly agree	15537	12.3	12.7	100.0
	Total	122077	96.8	100.0	
Missing	0	410	.3		
	6	3571	2.8		
	Total	3981	3.2		
Total		126058	100.0		

CC 33. Supervisors set the example for following maintenance standards and ensure compliance.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2013	1.6	1.6	1.6
	Disagree	5453	4.3	4.4	6.1
	Neutral	22967	18.2	18.7	24.7
	Agree	74720	59.3	60.7	85.4
	Strongly agree	17914	14.2	14.6	100.0
	Total	123067	97.6	100.0	
Missing	0	482	.4		
	6	2509	2.0		
	Total	2991	2.4		
Total		126058	100.0		

CC 34. In my command safety is a key part of all maintenance operations and all are responsible/accountable for safety.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1454	1.2	1.2	1.2
	Disagree	3893	3.1	3.2	4.3
	Neutral	20548	16.3	16.6	21.0
	Agree	74464	59.1	60.3	81.2
	Strongly agree	23199	18.4	18.8	100.0
	Total	123558	98.0	100.0	
Missing	0	401	.3		
	6	2099	1.7		
	Total	2500	2.0		
Total		126058	100.0		

CC 35. Safety education and training are comprehensive and effective.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1816	1.4	1.5	1.5
	Disagree	6093	4.8	4.9	6.4
	Neutral	26779	21.2	21.7	28.1
	Agree	72068	57.2	58.3	86.4
	Strongly agree	16871	13.4	13.6	100.0
	Total	123627	98.1	100.0	
Missing	0	371	.3		
	6	2060	1.6		
	Total	2431	1.9		
Total		126058	100.0		

CC 36. All maintenance evolutions are properly briefed, supervised and staffed by qualified personnel.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2308	1.8	1.9	1.9
	Disagree	8983	7.1	7.4	9.3
	Neutral	24630	19.5	20.2	29.5
	Agree	69715	55.3	57.3	86.8
	Strongly agree	16128	12.8	13.2	100.0
	Total	121764	96.6	100.0	
Missing	0	641	.5		
	6	3653	2.9		
	Total	4294	3.4		
Total		126058	100.0		

CC 37. Maintenance Control is effective in managing all maintenance activities.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5172	4.1	4.3	4.3
	Disagree	10431	8.3	8.6	12.8
	Neutral	26122	20.7	21.5	34.3
	Agree	62365	49.5	51.3	85.6
	Strongly agree	17572	13.9	14.4	100.0
	Total	121662	96.5	100.0	
Missing	0	903	.7		
	6	3493	2.8		
	Total	4396	3.5		
Total		126058	100.0		

C/FR 38. Effective communication exists up/down the chain of command.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9147	7.3	7.4	7.4
	Disagree	18096	14.4	14.6	22.0
	Neutral	30671	24.3	24.8	46.9
	Agree	52998	42.0	42.9	89.7
	Strongly agree	12687	10.1	10.3	100.0
	Total	123599	98.0	100.0	
Missing	0	333	.3		
	6	2126	1.7		
	Total	2459	2.0		
Total		126058	100.0		

C/FR 39. I get all the information I need to do my job safely.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2474	2.0	2.0	2.0
	Disagree	6425	5.1	5.2	7.2
	Neutral	23211	18.4	18.7	25.9
	Agree	73262	58.1	59.0	84.9
	Strongly agree	18698	14.8	15.1	100.0
	Total	124070	98.4	100.0	
Missing	0	584	.5		
	6	1404	1.1		
	Total	1988	1.6		
Total		126058	100.0		

C/FR 40. Work center supervisors coordinate their actions with other work centers and maintenance.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2414	1.9	2.0	2.0
	Disagree	7892	6.3	6.5	8.5
	Neutral	23815	18.9	19.6	28.1
	Agree	71512	56.7	59.0	87.1
	Strongly agree	15610	12.4	12.9	100.0
	Total	121243	96.2	100.0	
Missing	0	680	.5		
	6	4135	3.3		
	Total	4815	3.8		
Total		126058	100.0		

C/FR 41. My command has effective pass-down between shifts.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3156	2.5	2.6	2.6
	Disagree	9333	7.4	7.8	10.4
	Neutral	25553	20.3	21.3	31.6
	Agree	64666	51.3	53.8	85.4
	Strongly agree	17515	13.9	14.6	100.0
	Total	120223	95.4	100.0	
Missing	0	2986	2.4		
	6	2849	2.3		
	Total	5835	4.6		
Total		126058	100.0		

C/FR 42. Maintenance Control troubleshoots/resolves gripes before flight.

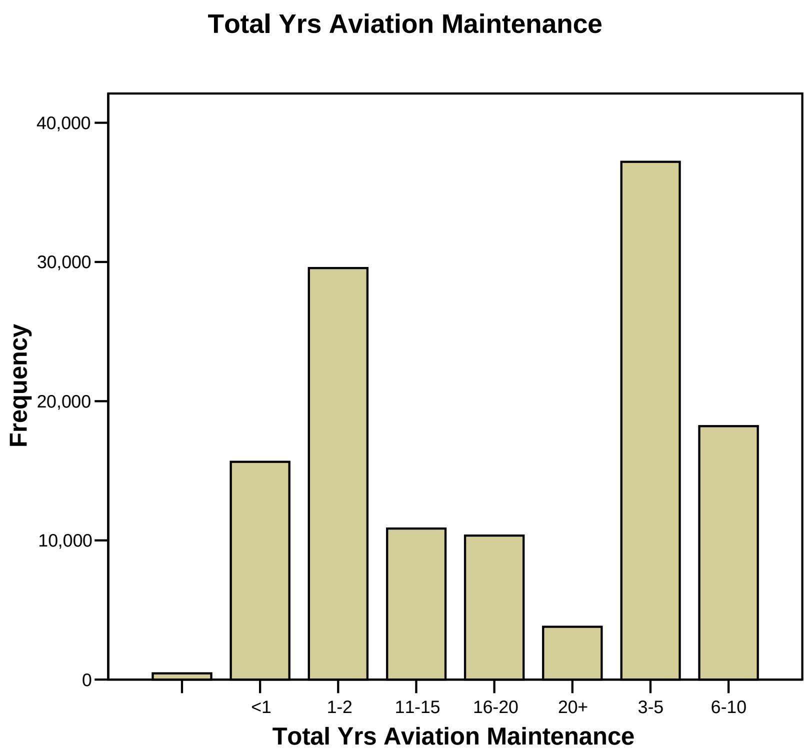
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3224	2.6	2.8	2.8
	Disagree	7104	5.6	6.2	9.0
	Neutral	26027	20.6	22.7	31.6
	Agree	61292	48.6	53.3	85.0
	Strongly agree	17243	13.7	15.0	100.0
	Total	114890	91.1	100.0	
Missing	0	3910	3.1		
	6	7258	5.8		
	Total	11168	8.9		
Total		126058	100.0		

C/FR 43. Maintainers are briefed on potential hazards associated with maintenance activities.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1853	1.5	1.5	1.5
	Disagree	5203	4.1	4.3	5.8
	Neutral	22526	17.9	18.6	24.5
	Agree	73852	58.6	61.1	85.6
	Strongly agree	17431	13.8	14.4	100.0
	Total	120865	95.9	100.0	
Missing	0	866	.7		
	6	4327	3.4		
	Total	5193	4.1		
Total		126058	100.0		

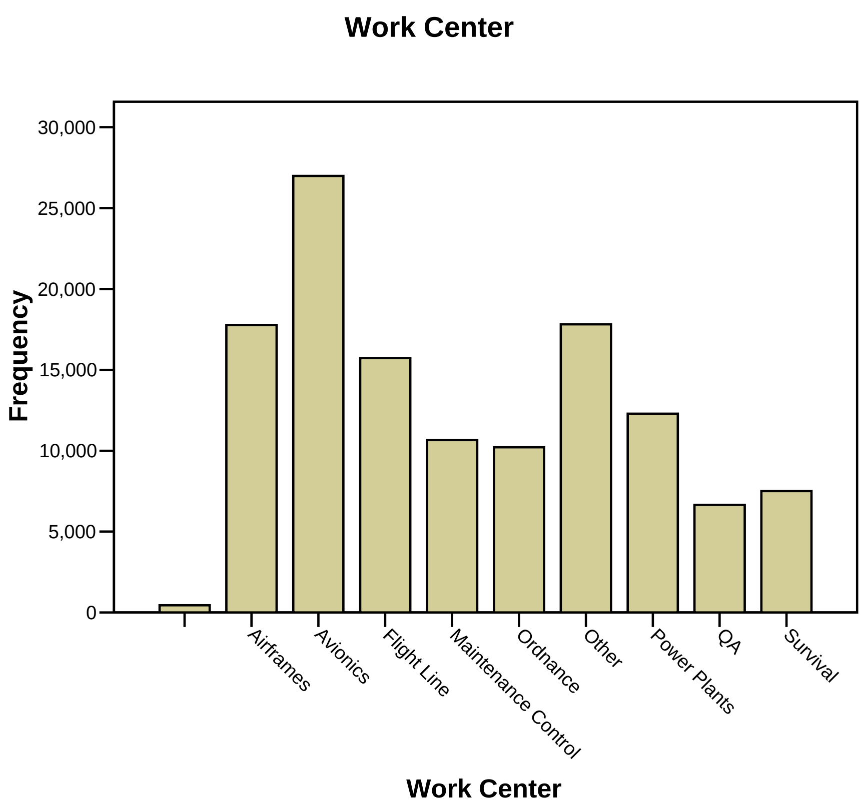
Total Yrs Aviation Maintenance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		450	.4	.4	.4
	<1	15650	12.4	12.4	12.8
	1-2	29565	23.5	23.5	36.2
	11-15	10848	8.6	8.6	44.8
	16-20	10349	8.2	8.2	53.0
	20+	3795	3.0	3.0	56.1
	3-5	37200	29.5	29.5	85.6
	6-10	18201	14.4	14.4	100.0
	Total	126058	100.0	100.0	



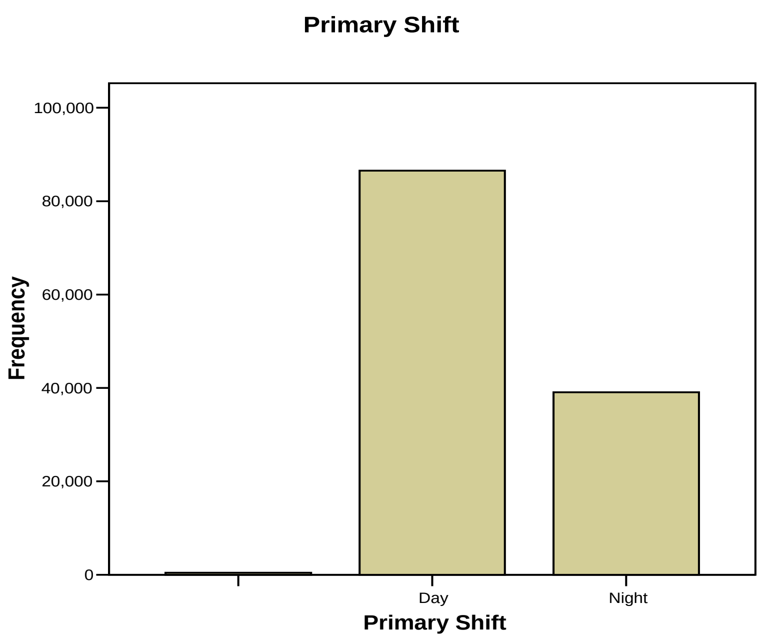
Work Center

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		450	.4	.4	.4
	Airframes	17769	14.1	14.1	14.5
	Avionics	26988	21.4	21.4	35.9
	Flight Line	15724	12.5	12.5	48.3
	Maintenance Control	10660	8.5	8.5	56.8
	Ordnance	10215	8.1	8.1	64.9
	Other	17813	14.1	14.1	79.0
	Power Plants	12286	9.7	9.7	88.8
	QA	6648	5.3	5.3	94.0
	Survival	7505	6.0	6.0	100.0
	Total	126058	100.0	100.0	



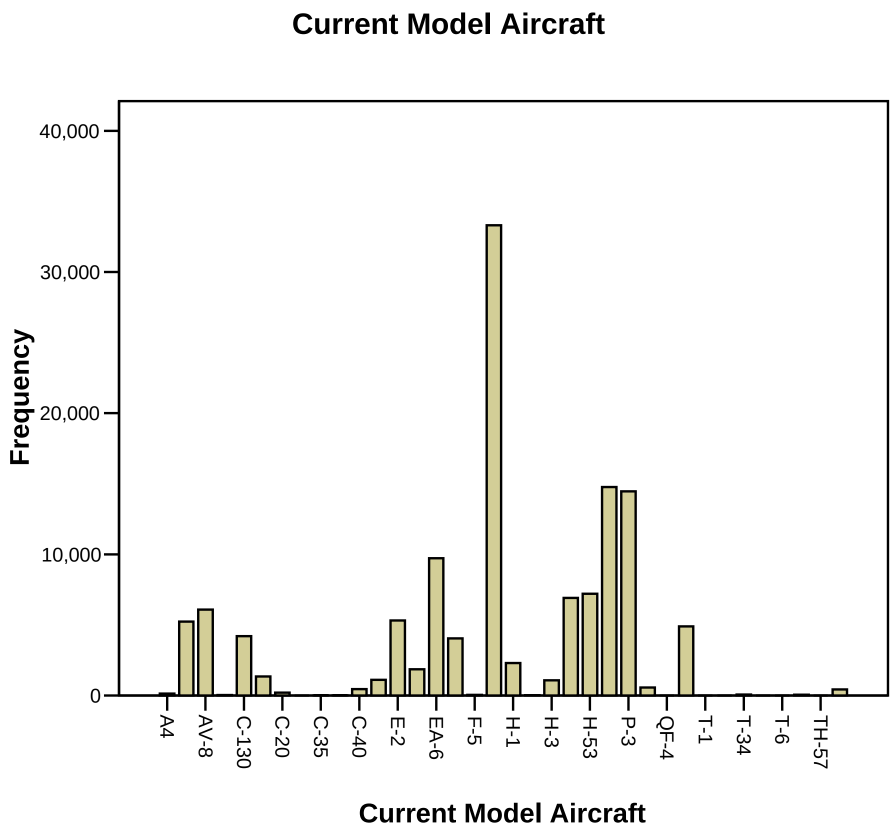
Primary Shift

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		450	.4	.4	.4
	Day	86523	68.6	68.6	69.0
	Night	39085	31.0	31.0	100.0
	Total	126058	100.0	100.0	



Current Model Aircraft

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A4	142	.1	.1	.1
	AH-1	5241	4.2	4.2	4.3
	AV-8	6085	4.8	4.8	9.1
	C-12	32	.0	.0	9.1
	C-130	4211	3.3	3.3	12.5
	C-2	1350	1.1	1.1	13.5
	C-20	211	.2	.2	13.7
	C-26	10	.0	.0	13.7
	C-35	14	.0	.0	13.7
	C-37	13	.0	.0	13.7
	C-40	453	.4	.4	14.1
	C-9	1116	.9	.9	15.0
	E-2	5324	4.2	4.2	19.2
	E-6	1865	1.5	1.5	20.7
	EA-6	9725	7.7	7.7	28.4
	F-14	4049	3.2	3.2	31.6
	F-5	55	.0	.0	31.6
	FA-18	33309	26.4	26.4	58.1
	H-1	2302	1.8	1.8	59.9
	H-2	27	.0	.0	59.9
	H-3	1082	.9	.9	60.8
	H-46	6919	5.5	5.5	66.3
	H-53	7210	5.7	5.7	72.0
	H-60	14769	11.7	11.7	83.7
	P-3	14468	11.5	11.5	95.2
	PIONEER	574	.5	.5	95.6
	QF-4	8	.0	.0	95.6
	S-3	4905	3.9	3.9	99.5
	T-1	4	.0	.0	99.5
	T-2	2	.0	.0	99.5
	T-34	73	.1	.1	99.6
	T-39	1	.0	.0	99.6
	T-6	2	.0	.0	99.6
	TA-4	63	.0	.0	99.6
	TH-57	10	.0	.0	99.7
	V-22	434	.3	.3	100.0
	Total	126058	100.0	100.0	



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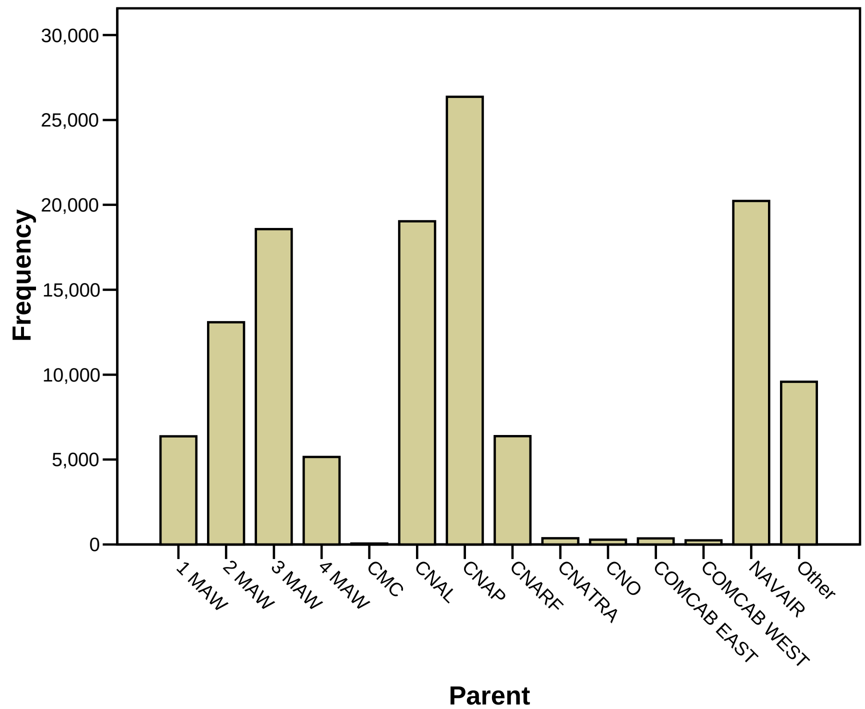
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 MAW	6364	5.0	5.0	5.0
	2 MAW	13083	10.4	10.4	15.4
	3 MAW	18570	14.7	14.7	30.2
	4 MAW	5155	4.1	4.1	34.2
	CMC	54	.0	.0	34.3
	CNAL	19035	15.1	15.1	49.4
	CNAP	26359	20.9	20.9	70.3
	CNARF	6375	5.1	5.1	75.4
	CNATRA	371	.3	.3	75.7
	CNO	281	.2	.2	75.9
	COMCAB EAST	358	.3	.3	76.2
	COMCAB WEST	241	.2	.2	76.4
	NAVAIR	20229	16.0	16.0	92.4
	Other	9583	7.6	7.6	100.0
	Total	126058	100.0	100.0	

Parent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20,000
15,000
10,000
5,000
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1 MAW
2 MAW
3 MAW
4 MAW
CMC
CNAL
CNAP
CNARF
CNATRA
CNO
COMCAB EAST
COMCAB WEST
NAVAIR
Other
Parent

LIST OF REFERENCES

Aaker, D. A., Kumar, V., & Day, G. S. (2004). *Marketing research*. Hoboken, NJ: Wiley & Sons.

Baker, R. (1998). *Climate Survey Analysis for Aviation Maintenance Safety*. Master's Thesis, Naval Postgraduate School, Monterey, CA.

Baugher, J.E., & Roberts, J.T. (1999). Perceptions and Worry about Hazards at Work: Unions, Contract maintenance, and Job Control in the U.S. Petrochemical Industry [Electronic Version]. *Industrial Relations, 38*(4), 522-541.

Carillo, R. A. (2004). Breaking the cycle of Mistrust to Build a Positive Safety Culture. *Occupational Hazards, 66*(7), 45. Retrieved March 5, 2006, from ProQuest Direct database.

Ciavarelli, A. & Crowson J. (2004). *Organizational Factors in accident Risk Assessment*. Safety Across High-Consequence Industries Conference, St Louis, MO.

Ciavarelli, A., Figlock, R., Schmidt, J., & Sengupta, K. (n.d.). *Command Safety Climate Surveys*. Retrieved March 4, 2006, from http://www.safetyclimatesurveys.org/pagesboth/co_access/cointro_detail.asp?GoBack=../survey_overview/default.asp

Cook, J. (1997). *The book of positive quotations*. Minneapolis, MN: Fairview.

Crystal Reference Encyclopedia (2006). Psychometrics. Retrieved 20 November 2006, from http://www.reference.com/browse/crystal/26125.

Department of the Navy. (2006, February). ALNAV 022/06 *2006 Department of the Navy Objectives*. Retrieved March 5, 2006, from http://safetycenter.navy.mil/mishapreduction/ 2006_Objectives.htm

Department of Energy, 2004-1 Implementation Plan to Improve Oversight of Nuclear Operations. (2004). *What are High Reliability Organizations?* Retrieved March 4, 2006, from http://2004-1.org/commitments/21/docs/hro.htm

Erickson, J.A. (2006). Survey Says: Uncovering Employees' Views about Safety. *Occupational Hazards, 68*(1), 45. Retrieved March 5, 2006, from ProQuest Direct database.

Evans, D.D., Michael, J.H., Wiedenbeck, J.K. & Ray, C.D. (2005). Relationship between Organizational Climates and Safety-Related events at Four Wood Manufactures [Electronic Version]. *Forest Products Journal, 55*(6), 23-28.

Figlock, R., & Schimpf, M. (2006, April). Issue Paper #20: Exploring Day Crew/Night Crew Relationships. Retrieved 10 May 2006, from http://www.safetyclimatesurveys.org/Issue_Papers. htm

Hernandez, A.E. (2001). *Organizational Climate and Its Relationship with Aviation Maintenance Safety*. Masters Thesis, Naval Postgraduate School, Monterey, CA.

International Atomic Energy Agency – International Nuclear Safety Advisory Group, (1991). Safety Series: Safety Culture. Retrieved 11Oct06 from http://www-pub.iaea.org/MTCD/ publications/PDF/Pub882_web.pdf#search=%22INSAG-4%22

Litwin, M.S. (2003). How to assess and interpret survey psychometrics. Thousand Oaks, CA: Sage Publications.

MCAS Sample Survey, School of Aviation Safety (2005). [On-line]. Available: http://www.safetyclimatesurveys.org/pagesboth/sample_survey

Oneto, T. (1999). *Safety Climate Assessment in Naval Reserve Aviation Maintenance Operations*. Master's Thesis, Naval Postgraduate School, Monterey, CA.

OPNAVINST 3500.39b (2004), Operational Risk Management. Department of the Navy.

OPNAVINST 3750.6R (2001). *The Naval Aviation Safety Program*. Department of the Navy.

Quessenberry, D. & Boyer S. (2004, March-April). Culture Workshops. *Approach*. Retrieved 5Mar06 from http://safetycenter.navy.mil/media/approach/issues/marapr04/ CultureWorkshops.htm

Roberts, K. (1990, Summer). Managing high-reliability organizations. *California Management Review, 32*(4), 101-113.

Schein, E. H. (1999). The corporate culture survival guide: sense and nonsense about culture change. San Francisco: Jossey-Bass.

Schwab, D. P. (1999). Research methods for organizational studies. Mahwah, NJ: Erlbaum.

Stanley, B. (2000). *Evaluating Demographic Item Relationships with Survey Responses on the Maintenance Climate Assessment Survey (MCAS)*. Master's Thesis, Naval Postgraduate School, Monterey, CA.

Stricoff, R. S. (2005). Understanding Safety's Role in Culture and Climate. *Occupational Hazards, 67*(12), 25. Retrieved March 5, 2006, from ProQuest Direct database.

Watson, T. W. (1997). *Guidelines for Conducting Surveys* (Report No. AL/HR-TR-1997-0044). Brooks Air Force Base, TX: USAF Armstrong Laboratory.

Wiegmann, D. A., Zhang, H., von Thaden, T., Sharma, G, & Mitchell, A. (2002, June). *A Synthesis of Safety Culture and Safety Climate Research*. University of Illinois Institute of Aviation Technical Report (ARL-02-3/FAA-02-2. Savoy, IL: Aviation Res. Lab.

Wuensch, K. L. (2004). *Factor Analysis*. Retrieved June 17, 2006, from East Carolina University, Department of Psychology, Karl Wuensch's Statistics Lessons website at http://core.ecu.edu/psyc/wuenschk/MV/FA/FA.doc

Zacharatos, A., Barling, J., & Iverson, R.D. (2005). High-Performance work systems and Occupational Safety. *Journal of Applied Psychology*, *90*(1), 77-93.

Zortman, VADM. (2004). *CNAF Commanders Training Symposium Safety Wrap-up*. Unclassified General Administrative Naval Message: R 240054Z NOV 04.

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