



**CRITICAL ELEMENTS AND NEEDS FOR  
NUCLEAR WEAPONS MAINTENANCE: A  
DELPHI STUDY**

GRADUATE RESEARCH PAPER

Craig S. Bailey, Major, USAF  
AFIT/ILS/ENS/12-01

DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY

**AIR FORCE INSTITUTE OF TECHNOLOGY**

---

---

**Wright-Patterson Air Force Base, Ohio**

DISTRIBUTION STATEMENT A:  
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

The views expressed in this graduate research paper are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the United States Government.

AFIT/ILS/ENS/12-01

**CRITICAL ELEMENTS AND NEEDS FOR NUCLEAR WEAPONS  
MAINTENANCE: A DELPHI STUDY**

GRADUATE RESEARCH PAPER

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics

Craig S. Bailey, MS

Major, USAF

June 2012

**DISTRIBUTION STATEMENT A:  
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.**

AFIT/ILS/ENS/12-01

**CRITICAL ELEMENTS AND NEEDS FOR NUCLEAR WEAPONS  
MAINTENANCE: A DELPHI STUDY**

Craig S. Bailey, MS  
Major, USAF

Approved:

\_\_\_\_\_  
Dr. Alan Johnson (Advisor)

\_\_\_\_\_  
date

### **Abstract**

From the end of the Cold War in the early 1990s thru 2007, the focus and attention given to the Air Force's nuclear mission noticeably declined. The organizational changes, downsizing, and increased focus on conventional missions made the concerns of the nuclear forces less pressing as senior leaders became less involved in the Nuclear Enterprise. The nuclear readiness of organizations, personnel, policies, procedures and processes all gradually declined culminating in two high profile incidents which revealed the drastic state of degradation. These incidents led to numerous high level investigations and studies, and resulted in major changes for the Air Force.

While the investigations and studies following the incidents focused broadly on the entire Air Force Nuclear Enterprise, this study focused on the critical elements and needs of nuclear Munitions Squadrons. Nuclear weapons maintenance management experts from stateside nuclear Munitions Squadrons were surveyed in a three round Delphi Study. The expert panel of 54 maintainers identified a list of critical elements and needs for their units to accomplish the nuclear mission. This study highlights, that while much has been done to repair the Air Force Nuclear Enterprise, commitment and dedication to the needs of nuclear Munitions Squadrons are still required to ensure the Air Force nuclear arsenal remains safe, secure, and reliable.

## **Acknowledgments**

I cannot offer enough thanks to my wife and boys. Your patience, love, and support means the world to me. You've always stood by my side and made life easier for me through all of the moves and deployments. I would also like to express my sincere appreciation to my faculty advisor, Dr. Alan Johnson for his guidance and support during this graduate research effort. Finally, my gratitude goes to the members of the expert panel who took valuable time to participate in this study and provide me with thoughtful responses.

Craig Bailey

## Table of Contents

<b>Abstract</b> .....	<b>iv</b>
<b>Acknowledgments</b> .....	<b>v</b>
<b>List of Figures</b> .....	<b>viii</b>
<b>List of Tables</b> .....	<b>ix</b>
<b>I. Introduction</b> .....	<b>1</b>
<b>Background</b> .....	<b>1</b>
<b>Research Focus, Methodology and Investigative Questions</b> .....	<b>3</b>
<b>Assumptions and Limitations</b> .....	<b>4</b>
<b>Implications</b> .....	<b>4</b>
<b>II. Literature Review</b> .....	<b>5</b>
<b>Overview</b> .....	<b>5</b>
<b>Trinity and the Cold War</b> .....	<b>5</b>
<b>Nuclear Deterrence</b> .....	<b>6</b>
<b>Nuclear Surety</b> .....	<b>7</b>
<b>Strategic Air Command</b> .....	<b>8</b>
<b>Changing Times</b> .....	<b>9</b>
<b>Doom 99</b> .....	<b>11</b>
<b>Missile Components to Taiwan</b> .....	<b>13</b>
<b>The Response (Investigations and Studies)</b> .....	<b>14</b>
<i>Air Combat Command Commander Directed Investigation</i> .....	<b>14</b>
<i>Air Force Blue Ribbon Review of Nuclear Weapons Policies and Procedures</i> .....	<b>16</b>
<i>Defense Science Board (DSB) Permanent Task Force on Nuclear Weapons Surety, Report on the Unauthorized Movement of Nuclear Weapons</i> .....	<b>18</b>
<i>Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission</i> .....	<b>22</b>
<i>Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission</i> .....	<b>24</b>
<i>Admiral Kirtland Donald, Investigation into Shipment of, Sensitive Missile Components to Taiwan</i> .....	<b>25</b>
<i>Air Force Nuclear Task Force, Reinvigorating the Air Force Nuclear Enterprise</i> .....	<b>28</b>
<b>MUNS Management</b> .....	<b>29</b>
<b>III. Methodology: The Delphi Method</b> .....	<b>31</b>
<b>The Research Instrument</b> .....	<b>34</b>

<b>IV. Analysis, The Expert Panel.....</b>	<b>36</b>
<b>Round One.....</b>	<b>37</b>
<b>Round Two.....</b>	<b>39</b>
<b>Round Three.....</b>	<b>41</b>
<b>V. Discussion.....</b>	<b>43</b>
<b>Answers to Research Questions.....</b>	<b>43</b>
<b>Conclusions and Recommendations.....</b>	<b>55</b>
<b>Bibliography.....</b>	<b>58</b>
<b>Appendix A. Nuclear Munitions Requirements Survey Questionnaire, Round One.....</b>	<b>62</b>
<b>Appendix B. Nuclear Munitions Requirements Survey Questionnaire, Round Two.....</b>	<b>64</b>
<b>Appendix C. Nuclear Munitions Requirements Survey Questionnaire, Round Three.....</b>	<b>67</b>
<b>Appendix D. Quad Chart.....</b>	<b>70</b>
<b>Appendix E. Vita.....</b>	<b>71</b>

## List of Figures

Figure 1. Research Methodology .....	32
--------------------------------------	----

## List of Tables

Table 1: Kendall's W .....	<b>Error! Bookmark not defined.</b>	4
Table 2: Respondent Demographic Detail .....		36
Table 3: Kendall's W for Questions 6, 7, 8 .....		41
Table 4: Delphi Questions .....		44

# **CRITICAL ELEMENTS AND NEEDS FOR NUCLEAR WEAPONS**

## **MAINTENANCE: A DELPHI STUDY**

### **I. Introduction**

#### **Background**

As the Cold War ended in 1991 and the Strategic Air Command (SAC) was eliminated as a major command in the Air Force in 1992, the focus on nuclear weapons began to wane until things went very wrong in 2007. On August 30, 2007 a B-52 flew from Minot Air Force Base (AFB), North Dakota to Barksdale AFB, Louisiana loaded with Advanced Cruise Missiles (ACM) which inadvertently contained nuclear warheads. Shortly after this, it was also revealed that the Air Force shipped sensitive components for Intercontinental Ballistic Missiles (ICBM), which were mislabeled as aircraft batteries to Taiwan. These two incidents led to numerous investigations and studies to identify what caused the failures and what could be done to revive or reinvigorate the Air Force Nuclear Enterprise.

In their paper entitled, *The Unauthorized Movement of Nuclear Weapons and Mistaken Shipment of Classified Missile Components: An Assessment*, Spencer, et al. (2012) conducted a year-long review of the issue, as well as the related investigations and studies, and identified the following root causes for the decline in the Air Force Nuclear Enterprise:

1. Policy and Oversight Changes
2. Organizational Change and Operational Evolution

3. Institutional Focus
4. Failure of Leadership
5. Failure to Focus on Expertise

This same group also identified recommendation in the following areas:

1. Expertise
2. Management
3. Leadership
4. Culture

The studies, investigations and assessments that followed the Minot and Taiwan incidents provided great insight into the failures and shortcomings of the Air Force's Nuclear Enterprise. They provided the much needed, broad macro-view and identified causes and recommendations. In 2008, the Air Force Nuclear Task Force (AFNTF) developed a roadmap to chart a path to resolve the recurring themes identified by the investigations and studies, and reestablish a standard of excellence in the Nuclear Enterprise (USAF, AFNTF, 2008). They combined over 100 action items in five major focus areas to restore the culture of compliance, rebuild nuclear expertise, invest in nuclear capabilities, organize to enable clear lines of authority and provide sustained institutional focus, and reinvigorate the Air Force nuclear stewardship role.

In 2010, two years after the Air Force established the roadmap discussed above and made major changes to the structure and level of attention paid to the Nuclear Enterprise, the Secretary of the Air Force tasked the Defense Science Board (DSB) to assess the progress made towards reinvigorating the Air Force Nuclear Enterprise (DSB,

2011). The DSB reported that with few exceptions, Air Force leadership can be confident in their nuclear force and the progress they've made since changes were implemented. The DSB provided a thorough assessment and recommendations which included maintaining realistic expectations and direction to provide priority and funding to the Nuclear Enterprise. Another major recommendation was to return nuclear Munitions Squadrons (MUNS) to the Air Force Wings they support. The Nuclear MUNS units had been given to Air Force Materiel Command for oversight after the Minot and Taiwan incidents.

### **Research Focus, Methodology and Investigative Questions**

There is still a critical need to identify what is needed to improve the nuclear environment within the Nuclear MUNS units which provide the critical maintenance and caretaking of nuclear weapons. The motivation for this study was to identify critical elements and what is critically needed to improve nuclear munitions maintenance in the Air Force from the perspective of maintainer's within MUNS units. In an effort to investigate their needs, this study surveyed 54 nuclear weapons maintenance management experts from stateside Nuclear MUNS units in a three-round Delphi study. The guiding research question for this study was, "What do nuclear munitions maintenance units need to better meet mission requirements?" To narrow the scope, a consensus was sought from the expert panel on the critical elements of nuclear weapons maintenance, outside agency assistance and necessities. From there evolved a discussion regarding what the units currently need to better meet mission requirements.

## **Assumptions and Limitations**

As with any qualitative research, there are limitations to this study. First, the Delphi Method is a survey based on inputs and opinions of an expert panel. Due to the subjective nature of the questions, it is likely a different panel might yield different answers. It was also assumed that all participants would answer the survey honestly and without bias towards their selves or their units. Second, due to time and availability constraints, this research focused solely on experts from stateside nuclear MUNS units.

## **Implications**

The intent of this study is to expand the understanding of what the critical elements are, and what is needed to improve the Nuclear Enterprise in Nuclear MUNS units and add to the body of knowledge surrounding reinvigorating the Nuclear Enterprise in the Air Force.

The next chapter contains the literary review for this study. It provides in-depth discussion regarding the development of the nuclear enterprise from the advent of the nuclear bomb through the degradation of the Air Force Nuclear Enterprise. It also includes a review of the Minot and Taiwan incidents, as well as the investigations, studies and actions which followed those incidents.

## **II. Literature Review**

### **Overview**

This section establishes the foundation for understanding for nuclear weapons and explains the transformation that occurred throughout the Air Force Nuclear Enterprise. Specifically, a review of the Cold War and Strategic Air Command and the role they played in nuclear deterrence and surety. Additionally, an evaluation will be conducted regarding changes which led to deterioration of the Air Force nuclear mission. This will include discussion regarding the Minot and Taiwan incidents. Finally, a review of the investigations and studies conducted after the incidents including findings and recommendations will be discussed.

### **Trinity and the Cold War**

July 16, 1945 forever changed the history of the world when the first atomic bomb, code-named Trinity, was successfully tested in New Mexico. This was the birth of the “Age of Atomic Energy” (Nuclear Weapons Archive, 1999). Less than one month later, atomic bombs were dropped on the Japanese cities of Hiroshima and Nagasaki bringing an end to World War II. Since that time, no nuclear weapon has been expended against any nation.

In 1949, the Soviet Union successfully tested their first atomic bomb. Thus began the “Cold War” era. In the early stages of the Cold War, Americans enjoyed a superior nuclear force, an unchallenged economy, strong alliances, and a trusted President to direct his incredible power against the Soviets (Gaddis, 1982). Russian forces eventually achieved nuclear equality and each side had enough nuclear weapons to destroy the other

many times. This fact was officially accepted in military doctrine and known as Mutual Assured Destruction (Gaddis, 1982). During the Cold War, the principal function of nuclear weapons was to deter nuclear attack, this principle is also known as nuclear deterrence.

### **Nuclear Deterrence**

As long as any other country possesses nuclear weapons, the United States must maintain a credible nuclear capability to deter adversaries and protect itself and its allies. Maintaining a credible nuclear deterrent is essential to national security. Any degradation of our Nuclear Enterprise will negatively impact our nuclear deterrent capability and an even greater impact could result if deterrence fails (Spence et al., 2012). The importance of nuclear deterrence and control of these assets was summarized by Defense Secretary Robert Gates during testimony to Congress on June 5, 2008, “A credible nuclear deterrent has been essential to our security as a nation and it remains so today. The safety, security and reliability of our nuclear weapons and associated components are of paramount importance...our policy is clear. We will ensure the complete physical control of nuclear weapons and we will properly handle their associated components at all times. It is a tremendous responsibility, and one we must and will never take lightly.”

The foundation of nuclear deterrence in the United States rests on the nuclear triad, composed of Sea-Launched Ballistic Missiles (SLBM), ICBMs and Air Force Bombers. The Air Force maintains the nuclear warheads for cruise missiles carried by B-52 bombers, nuclear warheads for ICBMs, and the nuclear weapons carried by B-2

bombers. The Air Force is responsible by Congressional statute to organize, train, and equip nuclear forces to ensure effective nuclear deterrence and flawless nuclear surety (USAF, AFNTF, 2008). Everything that contributes to this effort is known as the Air Force Nuclear Enterprise. The special nature of nuclear weapons demands precise performance across the Air Force Nuclear Enterprise with zero tolerance for complacency or shortcuts (USAF, AFNTF, 2008).

### **Nuclear Surety**

While deterrence focusses on deterring enemies and protecting against attack, surety focusses on safety, security and reliability of nuclear weapons. Nuclear surety involves the materiel, personnel, and procedures which contribute to the safety, security, and reliability of the nuclear weapons, and to the assurance that there will be no nuclear weapon accidents, incidents, unauthorized weapon detonations, or degradation in performance at the target. The goal of Air Force Nuclear Weapons Surety stated in Air Force Instruction (AFI) 91-101 is to incorporate maximum nuclear surety and ensure personnel design and operate nuclear weapons and related systems to satisfy safety standards. To do this, positive measures are put in place to prevent nuclear weapons involved in accidents or incidents, or jettisoned weapons, from producing a nuclear yield. Furthermore, positive measures are also put in place to prevent both inadvertent and deliberate prearming, arming, launching, or releasing of nuclear weapons, unless under execution of emergency war orders or when directed by competent authority.

AFI 91-101 also directs Commanders at all levels to emphasize that safety, security, control, and effectiveness of nuclear weapons to their subordinates. Air Force

Policy Directive (AFPD) 91-1 describes nuclear surety as the centerpiece of the Air Force Nuclear Enterprise and directs leaders to ensure focus remains on nuclear surety and strengthening compliance. Air Force policy is clear and written to ensure nuclear weapons and systems receive special attention and consideration because of their importance, destructive power, and potential consequences of an accident, unauthorized act, or public perception of such (AFPD 91-1). The Minot and Taiwan incident were both inadvertent, unauthorized acts.

### **Strategic Air Command**

In 1947, when the Air Force was established as a separate service, the Strategic Air Command (SAC) was one of the original three commands. The creation of SAC was a response to the threat of the Cold War and it became an Air Force within the Air Force. SAC was chartered with the primary mission of strategic deterrence and its secondary mission was to prevail in conflict if deterrence failed (Spence, et al., 2012). In 1948, General Curtis LeMay assumed command of SAC and instituted a culture of accountability. His goal was to build such a strong and powerful force that it would deter enemies from attempting confrontation and in the event deterrence were to fail, SAC would be ready to immediately take war to the enemy and win through relentless strategic bombing (Worden, 1998).

Standardization became the trademark of SAC's ability to ensure the sustainability of the nuclear deterrent mission. Everyone followed standard operating procedures enabling them to quickly and precisely perform their jobs. SAC operated on a daily basis as if they were at war. General LeMay introduced regulations, policies, and

procedures to bring discipline to the command and ensure readiness. He reorganized maintenance functions for improved efficiency. General LeMay's efforts forged SAC into a highly effective, efficient, and prepared force (Worden, 1998).

SAC gave airmen enormous responsibilities and held officers accountable for any actions under their command. The accountability, responsibility, and authority for nuclear weapons were clear, as were the consequences of failure. They understood the nature of the work they were doing, and the command continually fostered a team ethic and a sense of community. SAC airmen knew they were part of an elite group and their mission was vital to national security.

The SAC way ultimately became the Air Force way when General LeMay was appointed Chief of Staff of the Air Force (CSAF). Given the importance of the nuclear mission and the high costs should the United States be unprepared, the Air Force remained steadfastly focused on the strategic issues related to this mission while SAC existed (Worden, 1998).

### **Changing Times**

In 1989, the Berlin Wall came down, borders opened, and free elections ousted Communist regimes everywhere in eastern Europe. In late 1991, the Soviet Union itself dissolved into its component republics. With stunning speed, the Iron Curtain was lifted and the Cold War came to an end. Following the Cold War, significant changes in the global security environment led to major restructuring within the Air Force, which included the elimination of SAC, which had dominated the Air Force for most of its

existence. These changes were also due to resource constraints caused by defense downsizing during the 1990s as well as national leadership priorities.

The task of fighting conventional wars in Afghanistan and Iraq, took away from the nuclear budgetary, operational, and doctrinal requirements (Spencer, et al., 2012). While in existence, SAC maintained a laser focus on the nuclear mission. However, many of today's Air Force leaders have little experience with the stringent culture of SAC and the requirements demanded by the nuclear mission. Spencer, et al. (2012), went as far as to say, "They are so far removed from the nuclear mission and its lack of technological advancement that it is difficult to place the strategic mission in a modern context given political, operational and budgetary realities."

With less national emphasis on nuclear weapons during this period, the Air Force failed to grasp the continued need to maintain a viable airpower based nuclear deterrent capability (USAF, AFNTF, 2008). At the same time the nuclear arsenal was being reduced, the emphasis shifted to conventional missions. To make matters worse, the Air Force failed to articulate the continuing value of nuclear deterrence (OSD, September 2008).

The Air Force Nuclear Task Force identified the primary cause of the systemic breakdowns in the Air Force's Nuclear Enterprise was the failure of leadership at many levels to provide proper emphasis on the nuclear mission. The Task Force discussed that further loss of focus stemmed from:

1. Changes in the operating environment at the end of the Cold War.
2. Changes in the security environment following the 9/11 terrorist attacks.

3. Massive Air Force organizational changes in 1992 which caused organizational and supervisory fragmentation of the Nuclear Enterprise.
4. 1995 Base Realignment and Closure decisions that dispersed depot support for nuclear systems and components.

As the Air Force's nuclear sustainment system became fragmented, the pool of nuclear experienced Airmen began to deteriorate, and nuclear expertise eroded as the focus turned from nuclear operational proficiency to conventional contingency activities. The Air Force failed to properly resource many nuclear mission areas effectively relegating the Air Force's Nuclear Enterprise to caretaker status with limited modernization or recapitalization (USAF, AFNTF, 2008).

### **Doom 99**

As part of an Air Force re-positioning program, B-52 flights were regularly scheduled to ferry ACMs from Minot AFB, North Dakota to Barksdale AFB, Louisiana. In preparation for one such move scheduled for August 30, 2007, MUNS personnel at Minot prepared two cruise missile pylons (Spencer et al., 2012). Prior to the planned shipment, the selection of ACMs to be ferried was changed, but the change was not properly coordinated and the nuclear warheads were not removed from the ACMs on one of the pylons. The handling crew transporting the pylons to the B-52 failed to perform the missile safe status check as required by technical orders. Had they done this, they would have noticed the ACMs contained nuclear warheads. The B-52 crew chief accepted the load and the weapons load crew loaded the two pylons of missiles for the flight to Barksdale.

The radar navigator and navigator for the transport mission were responsible for verifying the status of the each missile prior to flight, however only the radar navigator performed preflight inspections on the missiles. The radar navigator also only checked the status of one missile and it happened to be on the non-nuclear pylon (Spencer et al., 2012). The mission, with the call sign of Doom 99, eventually flew to Barksdale and the pylons of ACMs were removed from the aircraft. When the handling crew arrived to transport the missiles, they discovered the nuclear warheads in the missiles and immediately alerted leadership.

After conducting a thorough review of the studies, reports, policies, and procedures related to the August 30, 2007 incident, Spencer, et al. (2012) identified the mistakes made. Unfortunately, those involved in the incident all assumed that since the task was ordinary, no special effort was required. The mistakes from that day are listed below:

1. The trailer holding the pylon of ACMs loaded with nuclear warheads was not properly labeled. This mistake was tied to the loosening of procedures regarding the storage of nuclear and non-nuclear weapons together.
2. The scheduling error where the MUNS personnel did not coordinate with the maintenance shop to ensure that the correct weapons were chosen for transfer. The Airmen did not use the published MUNS maintenance schedule, ignored important details and failed to properly coordinate last minute changes.
3. MUNS personnel did not monitor the move.

4. MUNS personnel did not follow guidance to confirm the weapons were nonnuclear.
5. The B-52 crew chief signed off on the weapons without confirming their status.
6. The radar navigator checked only one of the nonnuclear missiles and considered that spot check acceptable for all weapons loaded on the plane.

### **Missile Components to Taiwan**

When discussing nuclear weapons, it's also important to understand Nuclear Weapons-Related Material (NWRM). The Air Force defines NWRM as select nuclear combat delivery system components that are design sensitive and needed to authorize, pre-arm, arm launch release, or target a nuclear weapon (Bruins, 2012). In March 2005, F.E. Warren AFB in Wyoming received a shipment of NWRM, which were 10 forward sections for MK-12 reentry vehicles used on Minuteman III ICBMs (Spencer et al., 2012). Four days later, an inexperienced Air Force Item Manager at Hill AFB, Utah determined F.E. Warren had too many MK-12 forward sections and notified them to ship four of the forward sections to Hill AFB, Utah. F.E. Warren personnel prepared the forward sections for shipment, but failed properly mark the exterior of the shipping containers with the stock number. The shipping containers arrived at the warehouse, but Hill AFB personnel did not open them, review the shipping documents, or return the receipt to F.E. Warren as required. The forward sections were also delivered to the unclassified warehouse instead of the classified storage area. When scanning the container to identify the contents, the scan failed to produce a stock number and warehouse personnel simply marked the unopened shipping containers as helicopter

batteries and placed them in the warehouse. In June 2006, Hill AFB shipped the mismarked MK-12 forward sections as helicopter batteries. The error was identified by the Taiwanese government in January 2007 and communicated to the United States, but was still not acknowledged by the U.S. government until 14 months later (Spencer et al., 2012). As with the unauthorized movement of nuclear weapons, Spencer et al. (2012) identified the mistakes leading to the incident, which are listed below:

1. Mismarking of the shipping containers by personnel at F.E. Warren.
2. When they arrived at Hill AFB, the containers were never opened so the paperwork could be examined and contents verified.
3. The bar code on the outside of the package could not be properly identified, and personnel simply determined the contents as helicopter batteries.
4. Personnel at F.E. Warren failed to follow up when the receipt of the forward sections was not acknowledged by Hill AFB personnel.
5. The error was confirmed only after numerous efforts by the Taiwanese government to rectify the situation.

### **The Response (Investigations and Studies)**

#### ***Air Combat Command Commander Directed Investigation***

The Commander of Air Combat Command directed Major General Douglas Raaberg to conduct an investigation immediately following the unauthorized movement of nuclear weapons, to determine how events transpired and to identify personnel who should be held legally accountable. The investigation found the following (Spencer, et al., 2012):

1. 5 MUNS unwritten nuclear weapons storage policy allowed co-mingling of nuclear and nonnuclear missiles in the same storage structure.
2. The storage management system used to differentiate nuclear from nonnuclear missiles was a simple piece of paper.
3. The tow team of weapons handlers was required to verify each missile-safe status but did not complete the verification.
4. Most weapons storage area handling, storage, and flightline delivery tasks at Minot were performed by conventional munitions technicians and not nuclear weapons maintenance technicians.
5. Training and exercise program at Minot had been changed and significant players were exempted from participation.
6. A series of mistakes occurred due to:
  - a. Poorly coordinated scheduling change led munitions control to give the weapon handlers/tow crew an incorrect trailer number, which had not been prepared for the mission.
  - b. The weapons handlers/tow crew selected the wrong missiles from storage because of scheduling, storage and mislabeling errors. They also did not check the missile-safe status as written directives require.
  - c. The aircraft crew chief signed for the two trailers of missiles without checking their serial numbers or the missile-safe status. There was no written guidance for the custody transfer of missiles without nuclear warheads, which the crew chief expected.

- d. The weapons load team loaded the pylons/missiles onto the B-52 aircraft without checking the serial numbers or missile-safe status verification because their checklist did not require such a check. This verification had previously been required in the loading checklist.
- e. The radar navigator failed to check each missile's status as required by the checklist.

***Air Force Blue Ribbon Review of Nuclear Weapons Policies and Procedures***

The Air Force Chief of Staff appointed Major General Polly Peyer to chair an Air Force Blue Ribbon Review (BRR) of nuclear weapons policies and procedures including an enterprise-wide look at Air Force nuclear responsibilities. Areas reviewed were organizational structure; command authorities and responsibilities; personnel and assignment policies; and education and training associated with the operation, maintenance, storage, handling, transportation, and security of USAF nuclear weapons systems. The team of 30 Airmen visited 29 locations and met with 54 organizations. Additionally, the team researched more than 250 books, periodicals, reports, papers, publications, and documents (USAF, BRR, 2008).

The BRR noted that as the United States reduced its nuclear stockpile following the end of the Cold War, emphasis on nuclear weapons declined and the forces assigned to operate, maintain, and support the nuclear capability reduced accordingly, especially in flying units. It further stated that the ongoing challenge was how to achieve a focused, dedicated nuclear capability with a smaller, but equally professional work force. The report contains five general conclusions (USAF, BRR, 2008):

1. Nuclear surety in the USAF is sound, but needs strengthening.
2. USAF focus on the nuclear mission has diminished since 1991.
3. The Nuclear Enterprise in the USAF works despite being fragmented.
4. Declining USAF nuclear experience has led to waning expertise.
5. USAF nuclear surety inspection programs need standardization.

The report also outlined 36 specific recommendations which led to 5 general recommendations (USAF, BRR, 2008):

1. Communicate senior USAF commitment to the nuclear mission.
2. Refocus and reinvigorate the USAF Nuclear Enterprise.
3. Energize USAF commitment to better organize, train, and equip the Nuclear Enterprise.
4. Develop a long-range Force Development strategy to support the USAF Nuclear Enterprise.
5. Consolidate the USAF nuclear surety inspection program.

The BRR concluded that previous reports and studies identified many of the same observations and recommendations but had not been as comprehensive. It also discussed the friction between the need for nuclear surety perfection and operating in an environment of tightly constrained resources, identifying that there was a need to refocus the commitment to the Nuclear Enterprise by improving advocacy and realigning priorities. The BRR advised that the Air Force undertake this endeavor, but also concluded that the Air Force has a sound nuclear surety program.

***Defense Science Board (DSB) Permanent Task Force on Nuclear Weapons Surety,  
Report on the Unauthorized Movement of Nuclear Weapons***

General Larry Welch, a retired Air Force Chief of Staff and a former Commander of SAC, was commissioned to lead a team of senior officials to re-examine and investigate the circumstances surrounding the unauthorized movement of nuclear weapons. General Welch led the Defense Science Board team that produced a report focusing on the organizational and institutional shortcomings. They identified that the process and systemic problems that allowed the Minot incident to happen developed over more than a decade and had the potential for more serious consequences. The event also helped reinforce the need for uncompromising processes and procedures, clear focus on the unique demands of the Nuclear Enterprise, and an environment that attracts, nurtures, and guides the right numbers of the best and brightest as stewards of nuclear weapons. Their report accompanied by findings and recommendations was focused on three major areas (DSB, April 2008).

*Procedures and Processes*

Findings:

1. Over time, nuclear weapons movement procedures for bomber weapons had been compromised for expedient work processes.
2. There was confusion over applicability of nuclear weapons handling procedures for nuclear weapons systems that did not contain nuclear warheads.
3. The practice of storing nuclear weapons/missiles in the same facility with nuclear training, nuclear-test, and nuclear-inert devices can led to confusion and unnecessary access to nuclear weapons.

4. The various levels of inspection activities had failed to detect changes in processes which compromised established procedures.

Recommendations: The Secretary of the Air Force should direct that Air Force directives be revised to provide clear direction to:

1. Re-establish that the Wing Commander is the approval authority for nuclear weapons movements outside the nuclear weapons storage area.
2. Re-establish formal change of custody requirements for any movement of nuclear-capable cruise missiles outside the weapons storage area.
3. Direct that nuclear weapons not be stored in the same facility with nonnuclear munitions/missiles.
4. Require that Nuclear Operational Readiness Inspections include comprehensive evaluations of all required tasks and supporting activities.

#### *Nuclear Enterprise Focus*

Findings:

1. The level of focus on the Nuclear Enterprise had been drastically reduced.
2. The Nuclear Enterprise had been dispersed and downgraded.
3. There was no headquarters above the wing that focused on the strategic nuclear mission.
4. The level of focus within major headquarters from Joint Staff to Air Force major command was drastically reduced with little consideration or understanding of the impact of such a reduction.

5. The conventional roles of the B-52 force dominated the nuclear role in such a way that there was minimum daily attention to the nuclear role.
6. The B-52 initial training and advanced weapons school both largely ignore the nuclear mission.
7. Over time, handling bomber nuclear weapons had come to be regarded as an exercise activity rather than a serious operational activity.

Recommendations:

1. The Secretary of Defense should:
  - a. Establish an Assistant Secretary of Defense for the Nuclear Enterprise, to assist the Secretary in ensuring continued attention to nuclear policy, acquisition, technology, surety, and command and control.
  - b. Direct that the Air Force dedicate the full rapid response commitment to the nuclear mission on a continuous basis.
2. The Commander, U.S. Strategic Command should establish a flag-level office whose daily focus is the Nuclear Enterprise and the conventional missions of strategic nuclear assets.
3. The Secretary of the Air Force should direct the consolidation of existing Air Force technical organizations into a single organization reporting directly to the Air Force Chief of Staff, which has full responsibility and accountability within the Air Force for nuclear systems and procedures.
4. The Air Force Chief of Staff should:

- a. Ensure that Task Force 204 has the needed authorizations and is fully manned to meet the full rapid response nuclear commitment.
  - b. Ensure that nuclear career fields, enlisted and officer remain viable and adequately manned to provide a continuing "no defects" culture within the Nuclear Enterprise.
  - c. Establish an Office within A-3/A5 in the Air Staff headed by a flag officer whose daily business is the Nuclear Enterprise.
5. The Chief of Naval Operations should establish an office within N31N5 headed by a flag officer whose daily business is the Nuclear Enterprise.
  6. The Commander, Air Combat Command should:
    - a. Ensure that the Air Force has the full resources, authority, and accountability for daily B-52 operations.
    - b. Direct that the B-52 initial training course at Barksdale and the B-52 Weapons School course include flight training in the nuclear mission.

### *Nuclear Enterprise Environment*

#### Findings:

1. Public debate about the nuclear deterrent, the long-term future of nuclear weapons, approaches to sustaining the deterrent, and related subjects can't be allowed to obscure the fact that we still have a large stockpile of nuclear weapons which require sustained, intense attention and robust nuclear weapons surety.
2. While the assessment was motivated by the Minot incident, there are a large number of reports commissioned by the Department of Defense on existing or

developing concerns with the Nuclear Enterprise that have produced few lasting course corrections.

Recommendations:

1. The national security leadership should declare, unequivocally and frequently, that a reliable, safe, secure, and credible nuclear deterrent is essential to national security, and is a continuing high national priority.
2. The Secretary of Defense should establish a mechanism to ensure that the lessons from this incident produce institutional and environmental change for lasting attention at the right levels to the Nuclear Enterprise.

***Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission***

In June 2008, Secretary of Defense Robert Gates appointed the Task Force on Nuclear Weapons Management to recommend necessary improvements and measures to enhance deterrence and international confidence in the U.S. nuclear deterrent. Secretary Gates asked the Task Force to provide a report on needed measures for the Air Force. The report focused on five main areas, discussed below, providing analysis and recommendations (OSD, Sep 2008).

1. *Atrophy of the Nuclear Mission* - The Task Force found that there had been a dramatic and unacceptable decline in the Air Force's commitment to perform the nuclear mission and little had been done to reverse it. It also found that nuclear concepts in national and defense policy documents were not generally understood by many of those involved in the Air Force nuclear mission. The major

- recommendation from this area was for the Air Force to update its nuclear deterrence doctrine to bring it into alignment with current nuclear concepts.
2. *Leadership and Culture* – This area was very hard hitting with a few of the general findings listed below.
    - a. Air Force leaders failed in their leadership responsibilities to shift priorities and adjust policies and resources in ways needed to maintain robust nuclear stewardship.
    - b. Air Force failed to establish adequate procedures and technical orders related to nuclear operations and support. Air Force streamlining efforts along with personnel reductions and allocation decisions led to significant degradation in the nuclear mission.
    - c. The Air Force needs to focus on developing and managing nuclear-experienced personnel, particularly in maintenance and security personnel.
    - d. Training and professional education are the key tools for generating a culture of nuclear excellence.
    - e. 18 recommendations were provided for Leadership and Culture ranging from policy and guidance to manning, training and mentorship.
  3. *Organization* – There were 11 recommendations for this area and the Task Force identified that significant organizational change was required to restore the Air Force’s attention to and readiness for the nuclear mission. They recommended assigning a major command the responsibility for all Air Force nuclear-capable forces. This was accomplished when the Air Force established the Air Force

Global Strike Command (AFGSC). Another major finding in this area was that Air Force leaders have failed to support appropriate resource allocation for the nuclear deterrence mission causing mission readiness to significantly degrade. This led to the recommendation to provide a centralized nuclear acquisition and sustainment community under the Air Force Materiel Command (AFMC). This ultimately led to the transfer of all stateside nuclear MUNS units and Weapons Storage Areas (WSA) to AFMC.

4. *Sustainment* - The Task Force identified four recommendations to address major issues with the Air Force system to maintain nuclear forces. These included a review of the adequacy of supply chain and proper responsibility for supporting ICBM maintenance operations.

***Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission***

This report was the second part of the initial tasking from Secretary Gates discussed in the previous section. In Phase II, the Task Force found that the lack of interest in and attention to the nuclear mission and nuclear deterrence went beyond the Air Force and was widespread throughout the Department of Defense (DoD). The report detailed policy, organizational, and procedural issues that need to be addressed across DoD in order to retain disciplined and effective nuclear forces. The Task Force also provided 82 recommendations for all areas reviewed to ensure a credible nuclear deterrent (OSD, Dec 2008). The main areas addressed in the Phase II report were: Deterrence, DoD Management and DoD Forces.

The Task Force identified that there had been a shedding of nuclear capabilities by the military services in order to free up resources to use elsewhere. They even found that the services had starved capabilities in order to justify shedding the associated missions (OSD, Dec 2008). Particular to the Air Force, the Task Force noted that the U.S. Air Forces in Europe (USAFE) nuclear weapons mission suffers from many of the same resourcing and expertise difficulties described in the Phase I report, but also found the commitment of USAFE Airmen to the safe and secure storage of nuclear weapons encouraging.

One of the main conclusions of the Phase II report was that strong DoD leadership was needed to develop and sustain nuclear deterrence capabilities (OSD, Dec 2008). This includes active engagement of senior officials in the nuclear weapons mission with the proper attention and oversight to ensure the motivation to sustain the deterrence remains strong. They suggest this will significantly contribute to maintaining high morale and competency for the nuclear mission.

***Admiral Kirkland Donald, Investigation into Shipment of, Sensitive Missile Components to Taiwan***

Secretary of Defense Robert Gates also appointed Admiral Kirkland Donald, who was the Director of Navy Nuclear Power and Nuclear Reactors, to lead the investigation into the shipment of sensitive missile components to Taiwan. He appointed Admiral Donald, because he held the most senior position in the military dedicated to the safe and effective employment of nuclear technology in defense of the nation (DoD, 2008). Admiral Donald used a Navy team of nuclear experts to investigate the incident. The Navy staff of officers and civilians was well seasoned with each averaging 20 plus years

of nuclear experience working together in the same organization (Spencer, et al., 2012). They had deep expertise, continuity, and strong credibility. Secretary Gates briefed the results of the Donald Investigation to Congress in 2008 and summarized the following findings (DoD, 2008):

1. The specific cause of this event was the Air Force and Defense Logistics Agency's sole reliance on and lack of compliance with existing supply system procedures to provide positive control of the four forward section assemblies.
  - a. The shipment of the four forward-section assemblies to Taiwan was a symptom of a degradation of the authority, standards of excellence and technical competence within the nation's ICBM force.
2. Similar to Minot, this incident took place within the larger environment of declining Air Force nuclear mission focus and performance. Both events involved a chain of failures that led to an unacceptable incident.
  - a. The investigation determined the Air Force does not have a clear, dedicated authority responsible for the Nuclear Enterprise and who sets and maintains consistent, rigorous standards of operation.
  - b. The investigation concluded that these shortcomings resulted from an erosion of performance standards within the involved commands and a lack of effective Air Force leadership oversight.
3. The failures that led to the mis-shipment could have been prevented, had the Air Force's inspection and oversight programs been functioning effectively.

- a. The lack of a critical self-assessment culture in the Air Force nuclear program, and inspection processes that diminish ownership at the command level, make it unlikely that systemic weaknesses can be discovered and addressed.
4. The investigation confirmed a declining trend in Air Force nuclear expertise.
    - a. The overall mission focus of the Air Force has shifted away from this nuclear mission, making it difficult to retain sufficient expertise.
    - b. The Air Force has not effectively compensated for this diminished expertise through training and active career management.
  5. Individuals in command and leadership positions failed to recognize systemic problems, failed to address those problems, and where beyond their authority to act, failed to call the attention of superiors to those problems.
  6. Action is required to fix the structural, procedural and cultural problems; and ensure accountability.

The Donald Report was very critical of the drastic decline in nuclear expertise within the Air Force. The investigation identified numerous instances of personnel with no nuclear experience holding leadership positions in the Air Force Nuclear Enterprise. The report also highlighted the lack of leadership involvement and visibility during critical nuclear weapons maintenance operations (Spencer, et al., 2012).

Admiral Donald concluded, "Senior leadership accountability also arises from the findings indicative of an overall decline in Air Force nuclear weapons stewardship, a problem that has been identified but not effectively addressed for over a decade. Both the

Minot-Barksdale nuclear weapons transfer incident and the Taiwan mis-shipment, while different in specifics, have a common origin: the gradual erosion of nuclear standards and a lack of effective oversight by Air Force leadership" (DoD, 2008). Immediately after briefing the Donald findings, Secretary Gates announced that he had accepted the resignation of the Secretary and Chief of Staff of the Air Force.

***Air Force Nuclear Task Force, Reinvigorating the Air Force Nuclear Enterprise***

After the Donald report was completed, the new Secretary and Chief of Staff of the Air Force directed the establishment of an Air Force Nuclear Task Force to develop a strategic roadmap to rebuild and restore capabilities and confidence in the stewardship of the Air Force Nuclear Enterprise (USAF, AFNTF, 2008). They developed a strategic plan and combined all of the recommendations to emerge from the investigations following the Minot and Taiwan incidents. The Task Force was led by Major General Donald Alston, who eventually became Director of the Air Force's A10 Directorate, which oversees Nuclear Matters. The Task Force found that all of the reports from the investigations and studies converged on six recurring themes:

1. Underinvestment in the nuclear deterrence mission is evident and no comprehensive process exists to ensure sustained investment advocacy.
2. Nuclear-related authority and responsibility were fragmented.
3. Processes for uncovering, analyzing, and addressing nuclear-related compliance and capability issues were largely ineffective.
4. Nuclear-related expertise had eroded.
5. A critical self-assessment culture was lacking.

6. Air Force Nuclear culture had atrophied resulting in a diminished sense of mission importance, discipline, and excellence.

The goal of the roadmap was not necessarily to chart a path to resolve the six recurring themes listed above, but to reestablish a recognized standard of excellence in the Nuclear Enterprise (USAF, AFNTF, 2008). This was to be done by developing over 100 action items in five major focus areas:

1. Restore the culture of compliance.
2. Rebuild nuclear expertise.
3. Invest in nuclear capabilities.
4. Organize to enable clear lines of authority providing sustained institutional focus.
5. Reinvigorate the Air Force nuclear stewardship role.

Major General Alston explained that the roadmap was a contract for change and the foundation for reinvigorating the Nuclear Enterprise. He reiterated the demands for precise performance with no tolerance for complacency or shortcuts. He concluded by stating, “The American people depend on the United States Air Force to deliver precise and reliable nuclear deterrence capabilities and have done so for over 61 years.

America’s Airmen accept this mission with pride, professionalism and a solemn commitment to the hallmark standards of excellence of the United States Air Force” (USAF, AFNTF, 2008).

### **MUNS Management**

Nuclear weapons maintenance, handling guidance and procedures are found in AFI 21-204. This is the basic guidance for nuclear MUNS units. The AFI provides

broad instruction for the management of nuclear weapons activities. It dictates that unit leadership should concentrate on the safe, secure, and efficient use of resources, while maintaining the highest degree of weapons capability and reliability. The AFI covers everything from specific responsibilities and management, to nuclear weapons training, qualification, and certification. The ultimate goal established in AFI 21-204 is that units maintain combat readiness capability commensurate with mission tasking.

This section discussed the rise of the Air Force Nuclear Enterprise through SAC during the Cold War and the critical role the Air Force has in nuclear deterrence and surety. Changes made after the end of the Cold War led to deterioration of the Air Force nuclear mission culminating in the Minot and Taiwan incidents. Many investigations and studies were conducted after the incidents focusing on the entire Air Force Nuclear Enterprise. They provided the much needed, broad macro-view and identified causes and recommendations. However, there is still a critical need to identify what is needed to improve the nuclear environment within the Nuclear MUNS units which provide the critical maintenance and caretaking of nuclear weapons. The next chapter outlines the methodology used to do this during this study. It contains a description of the different phases used for the research and explains how the Delphi Method is used to generate consensus from a panel of experts. The chapter also includes discussion regarding the development of the questionnaires and how they were used throughout the study.

### **III. Methodology: The Delphi Method**

The Delphi Method is an interactive forecasting method which relies on a panel of experts answering specific questions in two or more rounds. This method was used because it allows the experts to discuss problems, issues, solutions, and ultimately identify responses they feel best answers the questions. The same group of experts then ranks the pooled responses in multiple rounds until consensus is achieved. It is based on the principle that forecasts from a structured group of experts are more accurate than those from unstructured groups or individuals. The overall research question posed by the Delphi Method Study is: “What would assist your unit to more easily meet its mission requirements?” Other investigative questions used in the research included:

1. What critical elements does your unit need to accomplish its mission requirements?
2. What outside agencies or staff elements assist your unit to accomplish its mission?

The Delphi Method was used to produce a consensus between the nuclear weapons maintenance management field experts. The Delphi Method was developed to generate reliable consensus from a group of experts. As this method seeks input from experts, it is useful for cultivating and generating inputs to needs and requirements. The question of nuclear weapons maintenance needs and requirements is not easily measured as there are numerous opinions, options and solutions. As a result, this type of research benefits from subjective expert judgment which is successfully gathered using the Delphi Method (Linstone and Turoff, 2002).

To achieve panel consensus, the study used three phases of data collection which are: (1) study preparation, (2) the collection of relevant issues via Delphi rounds, and (3) the identification and ranking of reported issues. Figure 1 displays the three phases and related steps of the research methodology used in this study, which are also described.

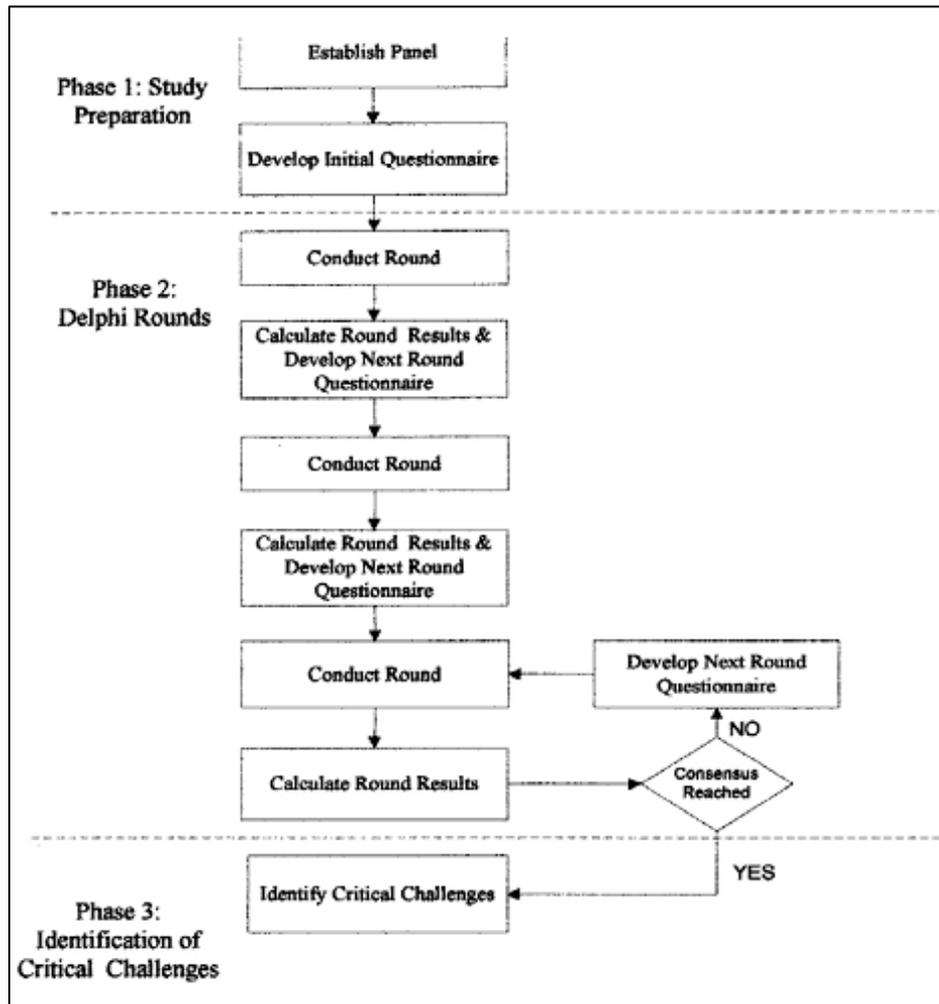


Figure 1. Research Methodology (Martin, 2009)

Phase one requires the selection of an expert panel and the development of the initial questionnaire. To obtain the best results from the Delphi Method, an established group of experts should be surveyed. The selection and use of experts is critical because

they should have the necessary information, judgment and experience to ensure their responses are appropriate and relevant. This body of expert knowledge helps bring objectivity to the answers generated (Helmer and Rescher, 1960). The experts in this study were selected by the researcher after obtaining permission from the Commander of the 498th Nuclear Surety Wing (NSW) and working with the sponsor. At the time of the study, all stateside nuclear Munitions Squadrons reported to the 498 NSW. The expert panel included 54 representatives, which will be more thoroughly described in the analysis section. To provide the best performance, an effort was made to ensure the panel size included more than 10 respondents.

Once the expert panel is identified, the next step of phase one is to develop the initial questionnaire. An open ended questionnaire was used in this research to solicit issues for future rounds of the survey as encouraged by research standards (Schmidt, 1997). The goal of the first round is for respondents to identify issues relevant to the study. In an effort to encourage participation and candid discussion, survey participants were assured their responses would remain confidential with no association between names, organizations and responses. The initial questionnaire was distributed and collected via e-mail in order to reduce turnaround and response times. Electronic media, such as e-mail, has been found to provide the same or slightly improved response rates and consistent validity in data compared to traditional paper survey methods (Griffis et al., 2003).

Phase two focused on multiple Delphi rounds and the collection of relevant issues. Once Round One responses were collected, the researcher consolidated the

responses into a single list. Content analysis was used to analyze responses and classify them into defined categories. This phase also included paring down the list of items resulting from the analysis so the data could be meaningfully ranked and ordered during subsequent rounds of the survey. The critical elements and needs identified in Round One were pared down by selecting only those that were identified by two or more respondents and randomly listing them for ranking in Round Two.

In phase three, a ranked list is developed by the researcher. Respondents then review the ranked list and make any needed adjustments. The Delphi Method uses an iterative approach (i.e., multiple rounds in phase two), which allowed respondents to revise their choices and ultimately reveal a consensus on the ranked list. Kendall’s Coefficient of Concordance (*W*) was used to provide a unique solution of consensus that is easy to interpret (Schmidt, 1997). Table 1 provides an interpretation of Kendall’s *W*. Once consensus was achieved at an interpretation level of “strong agreement,” the survey was considered complete.

**Table 1. Kendall’s *W* (Schmidt, 1997: 767)**

Interpretation of Kendall’s <i>W</i> .		
<i>W</i>	Interpretation	Confidence in Ranks
0.1	Very weak agreement	None
0.3	Weak agreement	Low
0.5	Moderate agreement	Fair
0.7	Strong agreement	High
0.9	Unusually strong agreement	Very High

### **The Research Instrument**

This Delphi Study was conducted via e-mail using an electronic questionnaire. Three rounds were completed. Each round used a questionnaire developed specifically

for that round of research based on the results of the previous round. The Round One questionnaire, designed to collect background information, identify critical elements and needs, and identify assistance from outside agencies and staffs is included as Appendix A. The Round Two questionnaire, which yielded initial rankings for responses to three Delphi questions, is included as Appendix B. The Round Three questionnaire, which established consensus among the expert panel, is included as Appendix C.

Chapter IV provides details of the analysis conducted as well as the data used in the research. It included detailed analysis of the demographics and climate of the participants in the study. It also contains detailed analysis of each of the Delphi Rounds and the subsequent results/rankings with the overall consensus of the panel.

#### **IV. Analysis, The Expert Panel**

The first round of the Delphi Study was delivered to 54 potential respondents. The list was identified after obtaining approval from the 498 NSW Commander to use officers and senior non-commissioned officers (SNCO) from his five Munitions Squadrons in the study. The researcher worked with the study sponsor and leadership in each of the participating squadrons to finalize the list of potential respondents. The Round One panel included 12 officers and 42 SNCOs. Once the list was generated, all potential respondents were contacted. All agreed to participate in the survey process. After the initial survey was sent, two reminder e-mails were sent in an effort to increase participation.

Of the 54 initial respondents, 35 completed the Round One questionnaire. The makeup of the 35 respondents included six officers and 29 SNCOs. Underscoring the expertise of this pool of experts was a combined 531 years of experience performing duties in nuclear MUNS units or on staffs dealing with nuclear weapons maintenance issues. Of the six officers included, all were Munitions and Missile Maintenance Officers. Of the 29 SNCOs included, 26 were Nuclear Weapons Maintenance Technicians/Managers and three were Missile Maintenance Technicians/Managers. More detailed experience levels are depicted in Table 2 below.

**Table 2. Respondent Demographic Detail**

Years of Nuclear	Less than 15 years	34%
Munitions Experience	More than 15 years	66%

In addition to the demographic information discussed above, the researcher asked the expert panel to assess the statement “my unit has everything it needs to meet mission

requirements,” on a Likert-type scale of 1 (strongly disagree) to 5 (strongly agree). The question was included to measure the overall climate of the panel. The responses ranged from 1 to 5 with a mean of 3.03, a mode of 4, median of 3, and a standard deviation of 1.175. The average responses and standard deviation indicate respondents neither agreed nor disagreed with this sentiment. However, the discussion surrounding the question demonstrated concern from the respondents regarding this issue. Further details will be presented in the discussion section.

The researcher also asked the expert panel to assess the following statement “my unit satisfactorily meets its mission requirements,” on a Likert-type scale of 1 (strongly disagree) to 5 (strongly agree). The question was included as a follow up to the previous question. The responses ranged from 1 to 5 with a mean of 4.51, a mode and median of 5, and a standard deviation of .818. The average responses and standard deviation indicate respondents strongly supported this sentiment.

### **Round One**

Round One of the Delphi Study was a seven question questionnaire (Appendix A). The first two questions were designed to collect background on the respondents and establish the expertise of the panel. Questions three and four (described above) were asked to determine the general mindset of the panel. The next three questions were used to uncover critical elements needed, what agencies and staffs provided assistance and what would be most helpful for the units. The intent of the survey was to determine what the maintainers considered to be critical elements for mission accomplishment and identify what they need to more easily meet mission requirements.

The first Delphi question (number five) asked respondents to list critical elements needed in their units to meet mission requirements. As described in the methodology, content analysis was used to categorize the responses. The content analysis resulted in the responses being filtered into 11 general categories: qualified personnel, sufficient manning, experienced/effective SNCOs, reliable technical data, effective/focused training, adequate funding, reliable supply, facilities/equipment, dedicated training facilities, solid quality assurance, and a single-integrated data system.

Question six asked respondents to identify which outside agencies and staffs assisted their units in mission accomplishment. Again, the answers resulted in 11 categories: 708 Nuclear Sustainment Squadron, Munitions Maintenance Groups, Host Units, Air Force Nuclear Weapons Center, Major Command Staffs, Air Staff, National Labs (Sandia/Lawrence Livermore), Air Logistics Centers, Defense Threat Reduction Agency, Air Force Safety Center and Air Force Inspection Agency.

Question seven required respondents to list what would assist their units to more easily meet mission requirements. The respondent's answers were aggregated into 14 distinct choices: qualified personnel, reliable technical data, more qualified SNCOs, sufficient manning, time/white space, facilities/equipment, reduced maintainer security requirements, reliable supply, effective training, consistent inspection standards, adequate funding, dedicated training facilities/equipment, retired asset inspection requirements, and a single-integrated data collection system.

## Round Two

Round Two was the first round that required respondents to rank order the list generated from the answer pool. Thirty five respondents were surveyed and 25 questionnaires were returned and included in the analysis. A description of how quickly rankings emerged is provided below (numbers following in parenthesis indicate the number of respondents who selected that ranking). In preliminary analysis, variation in answers existed, although patterns emerged in the initial ranking.

The answers to question five began to separate and came close to moderate agreement. There were five different selections for the number one answer: qualified personnel (12), sufficient manning (2), experienced/effective SNCOs (7), reliable technical data (2), adequate funding (1), and single-integrated data system (1). Rankings for numbers two thru five, and numbers six thru nine all pooled very close together. Like number one, ranks 10 and 11 stood out early with solid quality assurance and single-integrated data system clearly trailing with low number rankings. Question five concluded Round Two with a Kendall's W of .464, and a preliminary ranking of: qualified personnel, sufficient manning, experienced/effective SNCOs, reliable technical data, effective/focused training, adequate funding, reliable supply, facilities/equipment, dedicated training facilities, solid quality assurance, and single-integrated data system.

Question six also began to separate, however the agreement was between weak and moderate. There were six different selections for the number one answer: 708 Nuclear Sustainment Squadron (8), Munitions Maintenance Groups (6), Host Units (8), Air Force Nuclear Weapons Center (1), Major Command Staffs (1), and Air Logistics

Centers (1). Although two categories were tied, 708 Nuclear Sustainment Squadron was easily the overall number one. Rankings for numbers two thru five, and numbers six thru eight all pooled very close together. Like number one, ranks nine, ten and eleven stood out early with Defense Threat Reduction Agency, Air Force Safety Center and Air Force Inspection Agency clearly trailing with low number rankings. Question six concluded Round Two with a Kendall's W of .401, and a preliminary ranking of: 708 Nuclear Sustainment Squadron, Munitions Maintenance Groups, Host Units, Air Force Nuclear Weapons Center, Major Command Staffs, Air Staff, National Labs (Sandia/Lawrence Livermore), Air Logistics Centers, Defense Threat Reduction Agency, Air Force Safety Center and Air Force Inspection Agency.

Question seven proved to be the most problematic of the round, as it displayed weak agreement. There were 11 different selections for the number one answer: qualified personnel (8), reliable technical data (1), more qualified SNCOs (5), sufficient manning (1), time/white space (2), reduced maintainer security requirements (1), reliable supply (1), effective training (1), adequate funding (1), dedicated training facilities/equipment (1), retired asset inspection requirements (2), and a single-integrated data collection system (1). Rankings for numbers two thru three, and numbers four thru six, seven thru eight, and nine thru twelve all pooled very close together. Like number one, ranks 13 and 14 stood out early with retired asset inspection requirements, and a single-integrated data collection system clearly trailing with low number rankings. Question seven concluded Round Two with a Kendall's W of .290, and a preliminary ranking of: qualified personnel, reliable technical data, more qualified SNCOs, sufficient manning, time/white

space, facilities/equipment, reduced maintainer security requirements, reliable supply, effective training, consistent inspection standards, adequate funding, dedicated training facilities/equipment, retired asset inspection requirements, and a single-integrated data collection system.

### **Round Three**

Round Three was distributed to the 25 respondents who fully completed Round Two. Of the 25 respondents surveyed, 15 questionnaires were returned and included in the analysis. In Round Three, respondents reviewed the rankings produced by Round Two and adjusted items as needed. Round Three generated a high level of agreement for all questions. No further rounds were needed. Table 3 below lists the final rankings for questions five, six and seven as well as the Round Three W for each question. Numbers following categories in parenthesis indicate the number of respondents who selected that category for the number one ranking.

**Table 3. Kendall's W for Questions 6, 7, 8 (Final)**

<b>Rank</b>	<b>Question 5</b>	<b>Question 6</b>	<b>Question 7</b>
1	Qualified Personnel (15)	708 NSUS (12)	Qualified Personnel (14)
2	Sufficient Manning	MUNS Mx Groups (1)	Reliable Technical Data
3	Exp/Effective SNCOs	Host Units (2)	More Qualified SNCOs (1)
4	Reliable Technical Data	AFNWC	Manning
5	Effective/Focused Training	MAJCOM Staffs	Time/White Space
6	Adequate Funding	Air Staff	Facilities/Equipment
7	Reliable Supply	National Labs	Reduced Maintainer Security Rqmts
8	Facilities/Equipment	ALCs	Reliable Supply
9	Dedicated Training Facilities	DTRA	Effective Training
10	Solid QA	AFSC	Consistent Inspection Standards
11	Single/Int Data Collection Sys	AFIA	Adequate Funding
12			Dedicated Tng Facilities/Equipment
13			Retired Asset Inspection Rqmts
14			Single/Int Data Collection Sys
	<b>W = .923</b>	<b>W = .868</b>	<b>W = .745</b>

The next chapter summarizes the conclusions from this research. It provides in-depth analysis and discussion of the climate assessment questions, as well as the Delphi questions used for this study. It also includes current recommendations as well as a recommendation for future evaluations.

## V. Discussion

### Answers to Research Questions

*My unit has everything it needs to meet mission requirements.* This question was based on a Likert-type scale of 1 (strongly disagree) to 5 (strongly agree) and was included to measure the overall climate of the panel. The mean response of 3.03 indicated respondents neither agreed nor disagreed with this sentiment. Most respondents provided feedback to this question. The typical response can be best summarized by one Chief's input, "We must rob Peter to pay Paul in terms of equipment, certified personnel, replacement parts and supplies...It takes constant oversight, creative management and sacrifice by dedicated personnel to meet mission requirements."

Many respondents were concerned about the constant struggle to retain experienced/qualified personnel at all levels within the units from Airman thru Officer. Members from one unit commented that they had been without a Senior Master Sergeant for a year. Other personnel concerns included the discussion that the current force structure leaves little room for getting the job done, let alone for conducting Airman and Non-Commissioned Officer development and mentoring. Other discussions included finding ways to stem the wave of first and second-term Airman separations and cross training. Many commented on increased personnel requirements with one respondent commenting that the Air Force-wide "constant removal of mission support functions within the squadron; CSS cuts, computer support cuts, etc...pull people from their primary duties." Another commented that AFI's mandate new/increased requirements,

but the Air Force fails to provide manning for them. For example, a required training section at one of the larger units requires 10 people, which are all filled out-of-hide.

The majority of respondents also commented that they are working in aging infrastructure with comments, “falling apart,” “seriously crappy facilities,” “outdated, overpopulated,” “don’t provide adequate structural security to allow weapons storage,” and “furniture older than the maintainers.” Other concerns included the outdated and limited amounts of critical test and support equipment needed for nuclear weapons maintenance. Even more concerning was the discussion that weapon system components were not readily available or difficult to procure due to a lack of parts in the supply system. These concerns can be summarized by a Chief’s comments that, “We need to spend the nickels and dimes to maintain our infrastructure, facilities, equipment. Typically, something falls apart and we spend large sums of money to fix or replace it...with our current budget constraints, we can’t afford to go backwards in the nuclear arena. We cannot lean out nuclear weapons maintenance, training, etc...we’ve been short for several years, it’s time to get it right.”

***My unit satisfactorily meets its mission requirements.*** This question was also based on a Likert-type scale of 1 (strongly disagree) to 5 (strongly agree) and was a follow up to the previous question. The mean response of 4.51 indicated respondents strongly supported this sentiment. Most respondents provided feedback to this question explaining that while they felt that their units didn’t necessarily have everything they needed to meet mission requirements (discussed above), they were still able to satisfactorily meet mission requirements. Typical responses included statements like,

“we make it happen despite...,” “we always find ways to meet mission requirements,” “no matter what hurdles are thrown at us, we seem to meet mission requirements,” “only due to sheer determination...it comes at a great cost,” “even with our limited manning.”

***Delphi Questions Discussion***

The survey was set up to ask three separate questions of the expert panel. The Delphi questions are listed in Table 4 below.

**Table 4. Delphi Questions**

<b>Question #</b>	
5	List and describe the critical elements your unit needs to accomplish its mission requirements.
6	List outside agencies or staff elements that assist your unit in accomplishing its mission and describe the assistance they provide.
7	List and describe what, in your opinion, would assist your unit to more easily meet its mission requirements.

The questions were asked to identify what the panel felt were the critical elements needed by their units, who helped their units and what is needed now to help them more easily meet mission requirements. The purpose of this study was to look beyond the broad view provided by the numerous investigations and studies following the Minot and Taiwan incidents and identify the specific needs of the nuclear MUNS units.

Respondents’ answers to question five varied; from qualified personnel and sufficient manning, to training and technical data, to facilities and equipment. Most of the elements identified by respondents in question five were also identified by the investigations and studies discussed earlier. Discussion of the top five elements identified is discussed below.

1. **Qualified Personnel** – this is where the rubber meets the road. Without qualified personnel, the mission cannot be accomplished. The requirements for those working with nuclear weapons are stringent and it takes time to properly train and grow qualified personnel to maintain the various weapon systems.
2. **Sufficient Manning** – manning and qualified personnel are not the same. Manning is required not only to meet mission needs, but to also meet all of the ancillary taskings that have increased as the Air Force has downsized. Many requirements outside of primary duties continue to increase with no change or even decreased manning levels.
3. **Experienced and Effective SNCOs** – the SNCO corps within these units are the experts for nuclear weapons and missile maintenance. They have years of experience and are vital to steering maintenance in the right direction, identifying issues, and correcting problems. They are critical not only to the mission but also to the proper growth and mentoring of Airmen, NCOs and young Officers.
4. **Reliable Technical Data** – technical orders/guidance are used to perform maintenance on critical weapon systems/components and the nuclear mission requires strict adherence to them. The guidance must be correct, clear, unambiguous, and not conflict with other guidance.
5. **Effective and Focused Training** – training is needed to qualify individuals on the various weapon systems and changes. It must be stable, effective and focused. It is a critical piece of the foundation for providing qualified personnel. The

quality of training and personnel who conduct that training cannot be sacrificed without negatively affecting the quality of assigned personnel.

Other elements identified included: adequate funding; reliable supply system to provide needed parts and components; dependable facilities and equipment; dedicated training facilities separate from maintenance facilities; solid quality assurance program to identify trends and issues; and a separate type of integrated data collection system that can be used to simplify and integrate multiple products.

Question six was used to capture which outside agencies and staff elements assisted the units. Responses varied based on the units and particular mission requirements since all units don't need to interact with each of the various agencies/elements. Discussion of the top five agencies/elements identified by the respondents is below.

1. **708th Nuclear Sustainment Squadron** – many respondents commented on the great logistics support provided by this organization. The 708th is now the Nuclear Weapons Logistics Division at the AFNWC. They have many responsibilities, some of which include assisting in discrepancy resolution for nuclear weapons issues and publishing a monthly time change item/support schedule that identifies critical component/support kits needed and scheduled for delivery to each unit. One respondent also commented that most members of the 708th are retired nuclear weapons maintainers who understand the mission and work hard to help the units.

2. **Munitions Maintenance Groups** – at the time the survey was conducted there were two groups which oversaw the five MUNS units. Since then, four of the MUNS units have transferred from AFMC to AFGSC control. This occurred following a DSB recommendation to return nuclear MUNS units to the Air Force Wings they support. The Nuclear MUNS units had been given to Air Force Materiel Command for oversight after the Minot and Taiwan incidents. These units now report to the Maintenance Groups at their respective bases. Some of the groups responsibilities include: ensuring strict adherence to technical data and management procedures; ensuring maintenance is performed by qualified and certified personnel; and ensuring standardization of maintenance discipline and procedures. Many respondents praised group guidance and leadership, and appreciated the efforts the groups made to obtain critical resources and answers from outside organizations.
3. **Host Units/Wings** – as mentioned above, four of the MUNS units are now under AFGSC control and the Wings at their respective bases. Some of the support discussed included security from Security Forces Squadrons, facility repair and support from Civil Engineering Squadrons, large transport and support equipment maintenance provided by Maintenance Squadrons, and supply support and vehicle/fleet maintenance provided by Logistics Readiness Squadrons.
4. **Air Force Nuclear Weapons Center (AFNWC)** – some the AFNWC responsibilities include providing technical direction, engineering analysis, system integration, logistics sustainment and acquisition support. The AFNWC

acts as the office of primary responsibility for AF nuclear support procedures, and provides day-to-day logistics support for re-entry systems, gravity weapons, warheads and cruise missiles. The AFNWC also serves as the primary point of contact on matters pertaining to nuclear ordnance materiel management and weapons maintenance.

5. **MAJCOM Staffs** – as previously stated, when the survey was conducted, all MUNS units belonged to AFMC. Each MAJCOM with nuclear MUNS units provides similar support. Some of the staff directorates discussed by the respondents were Logistics (A4), Nuclear Integration (A10), Inspector General (IG), and Safety (SE). A4 provides maintenance policy, guidance and logistics support for weapon systems. They also provide functional management for the maintenance/munitions career fields. A10 helps develop nuclear weapons sustainment policy and force structure, and advocates for nuclear funding priorities. They also lead MAJCOM efforts for the Nuclear Surety Staff Assistance Visit (NSSAV) Program to help units improve and standardize nuclear surety programs. IG conducts Nuclear Surety Inspections (NSI) and Nuclear Operational Readiness Inspections (NORI) to assess the units. SE assists with NSSAVs/inspections and provides information to help units enhance their nuclear surety programs.

Other agencies identified included: Air Staff; National Labs (Sandia and Lawrence Livermore) that support nuclear weapon systems; Air Logistics Centers that provide

support to weapons delivery systems and other NWRM; Defense Threat Reduction Agency; Air Force Safety Center; and the Air Force Inspection Agency.

Question seven was the heart of the research and the respondents seemed excited to provide their assessment as to what would help them more easily meet mission requirements. Most of the needs identified by respondents in question seven were also identified by the investigations and studies discussed earlier. Discussion of the top five needs identified is below.

1. **Qualified Personnel** – it was a common theme that a large percentage of first and second term Airmen separate or cross train and the respondents found it “difficult to convince them to stay”. The operations tempo coupled with the relentless demands of working under the microscope of the nuclear mission come at a “high cost” for those working in the MUNS units. Nuclear weapons maintenance requires precision and exacting standards. It takes a great deal of time (sometimes six months or longer) to train and qualify technicians on the various weapon systems their units maintain. These units also adhere to a strict Personnel Reliability Program (PRP) to ensure maintainers are always 100 percent ready to perform their jobs on nuclear weapon systems. It becomes more difficult when the qualified individuals have minor, temporary issues that sometimes cause “as many as 25 percent” to be temporarily suspended from doing their jobs. Numerous respondents commented that there just weren’t enough qualified individuals to fill maintenance positions as team and bay chiefs, as well as fill

other critical roles in section leadership, accounting, quality assurance and training.

2. **Reliable Technical Data** – a developing theme among many of the respondents was that “vague, ambiguous and conflicting technical data prevents standardized maintenance practices” and makes their jobs harder. This also makes major inspections like NSIs and NORIs more difficult as units and even different Inspection Teams “interpret or view the technical data differently”. Many feel that getting “adequate technical guidance rests on the shoulders of the maintainers in the units” submitting recommended changes only to be frustrated when those responsible for reviewing the recommendations and making the changes are resistant.
3. **More Qualified SNCOs** – as one respondent said, “we need boots on the ground” to properly assess, identify and articulate issues and the needs of their units to leadership. Many responded that their SNCO’s have been “gutted” and many of the “best went to fill the staff positions” created after the Minot and Taiwan incidents. The SNCOs used to fill staff positions at Air Staff and MAJCOM staffs, as well as stand up AFGSC “came at a great cost to the field.” Many key positions that were vacant took as long as “nine months to a year to fill.” There was also frustration that many qualified “SNCOs retire instead of taking an assignment” to the busier units with the highest workloads while many other SNCOs report to units having never worked on their weapon systems. One Chief

reflected that all of these issues “are not new... we’ve been screaming about this for years...until we make a mistake, our concerns get pushed on.”

4. **Increased Manning** – there was universal consensus that the manning in units was still based on outdated manning studies. With the drastic drawdowns and elimination of support staffs in the units, many positions like PRP manager, Security Manager, Training, Mobility, Orderly Room, etc. are “filled out-of-hide” and “take manpower away from the maintenance mission”. One respondent said that when he arrived at his unit in 2007 “there were only seven people to perform maintenance.” There has been a massive influx of new (3-level) Airmen at most units since the Minot and Taiwan incidents, however there is still a struggle to fill 5, 7 and 9-level manning requirements within the units. Furthermore, since 2001, security requirements have dramatically increased causing maintainers to spend more time “securing” rather than “maintaining.” As a few respondents said, “we need maintainers dedicated to maintenance and security force dedicated to security.”
5. **Time** – this is also discussed as “white space” or time when the units are left alone to focus solely on their maintenance mission. The pace of visits and relentless inspections stop production and take a high toll on the units and personnel due to lost training and maintenance time. The 2011 DSB report indicated Minot AFB experienced 190 days of inspections/visits in 2008, 204 in 2009 and 168 thru August of 2010. As one commander said, “the current pace is not sustainable.” It’s not only visits and inspections but the drastic cuts in

resources over the years that also make time less expendable. As one respondent discussed “as resources decline, requirements should decline at a similar rate.”

Other requirements are also coming at a high cost of time. There was great discussion over the fact that changes regarding NWRM have made it more difficult and time consuming to ship NWRM than to ship actual nuclear weapons.

All of these things are “affecting morale, manpower, retention and experience.”

A commander reflected that there wasn’t time left to “focus on other things...dorm inspections, professional development, learning to be good supervisors, etc.” Another respondent replied “we consistently work 12 hour shifts and gladly do so to meet mission requirements... however, the constant pull from other resources drives the aggravation level higher.”

Many of the other needs listed by the respondents can be tied to other needs. For example, updating the antiquated facilities/equipment, readily available parts and supplies, and adequate funding will positively affect morale and nearly all other needs; the need to reduce maintainer security requirements was touched on while discussing manning; effective training with dedicated facilities and equipment affects/contributes to qualified personnel; consistent inspection standards are affected by ambiguous technical data which leads to differing interpretation; if retired asset inspections requirements were available and there was a single, integrated data system that could replace the numerous systems used by maintainers, precious time could be saved.

In 2010, the DSB conducted an independent assessment of the progress made towards reinvigorating the Air Force Nuclear Enterprise. They found that the policy,

inspection, organization, and leadership changes made by the Air Force have been effective, but also offered recommendations to further improve the Nuclear Enterprise. They found that the Nuclear Enterprise “priority one” declaration by Air Force leadership wasn’t reflected in (DSB, 2011):

1. An environment of trust on the part of leadership appropriate to the dedication and professionalism of the operating forces.
2. Budget and program priorities impacting fielded forces.
3. Replacement or upgrade of aging support equipment needed for the mission.
4. Directives and technical orders providing the appropriate level of detail for nuclear operations.
5. Personnel policies and actions tailored to special demands of the nuclear environment.

These can all be tied to the same needs identified by the Expert Panel. The DSB went on to recommend that the needs of the Nuclear Enterprise to sustain the forces be given priority. In particular, they recommended (DSB, 2011):

1. Replace aging maintenance support and test equipment.
2. Return to a normal inspection schedule.
3. Special attention from Air Force A1 (Manpower/Personnel) to provide the needed, qualified people to the nuclear mission.
4. Air Force A1 initiate a program to ensure nuclear MUNS units have their required SNCOs.

5. Immediate action to reestablish risk management and trust in the technician's judgment verses risk avoidance on cosmetic defects with the needed technical data.

## **Conclusions and Recommendations**

Airmen provide a significant contribution to nuclear deterrence while maintaining two critical pieces of the nuclear triad. This deterrence is used daily to deter a wide range of threats/attacks on the United States and its allies from adversaries, and provides the potential to quickly defeat adversaries if required. The dedicated professionals in the nuclear Munitions Squadrons play an essential role as the caretakers of nuclear weapons, which are the centerpiece of this strategy.

However, from the end of the Cold War in the early 1990s thru 2007, the focus and attention given to the Air Force's nuclear mission noticeably declined. The organizational changes, downsizing, and increased focus on conventional missions made the concerns of the nuclear forces less pressing as senior leaders became less involved in the Nuclear Enterprise. Furthermore, the Airmen dedicated to the nuclear mission suffered as there was a diminished appreciation for their efforts and the critical mission they supported as their manning, resources and funding were slashed. As the events slowly transpired over a 15 year period, organizations, personnel, policies, procedures and processes gradual declined culminating in the Minot and Taiwan events.

Since the Minot and Taiwan events, the Air Force has undergone many inspections and studies of the entire Air Force Nuclear Enterprise. The research in this paper focused particularly on the critical elements and needs of the nuclear Munitions

Squadrons. Reinvigorating the Nuclear Enterprise was given the highest priority by leadership and a roadmap was developed to get the Air Force back on track (USAF, AFNTF, 2008). The Task Force merged the recommendations of the investigations and studies which included over 180 corrective actions to address shortcomings (OSD, Sept 2008). Many of the corrective actions broadly addressed the same critical elements and needs identified by the Expert Panel for this study.

While the Air Force has made a great commitment to change including reorganization and establishment of new staffs and the AFGSC, the changes have yet to be fully felt at the unit level. As previously discussed, the most recent DSB report indicated many of the needs identified by the Expert Panel still require attention. It will take years to grow more qualified personnel, experienced SNCOs, and the “right” manning. It also takes time to obtain funding and work through the lengthy budget process to acquire much needed upgrades and equipment to replace the decades-old facilities and equipment the units contend with on a daily basis.

The Expert Panel identified the critical elements and what is needed to more easily meet mission requirements. The way ahead must continue to include commitment and dedication to the needs and requirements of nuclear Munitions Squadrons to ensure the Air Force nuclear arsenal remains safe, secure, and reliable. In particular, Air Force leadership should:

1. Reevaluate authorized manning levels at nuclear MUNS units. This must be done outside the traditional manning study “box” and take into account the increased

ancillary taskings and maintainer security requirements, as well as temporary PRP suspensions that affect these units on a daily basis.

2. Ensure nuclear maintenance technical data is clear and non-conflicting, and that recommended changes be evaluated and when approved, implemented at a faster rate.
3. Minimize the number of outside visits/visitors to the nuclear MUNS units.
4. Reevaluate the number and pace of inspections. Major inspections should also be combined when possible and focus on continuing areas of concern.

The Air Force must properly care for and maintain a professional cadre of nuclear maintainers, and leaders up and down the chain of command must understand the importance of their vital contribution and properly advocate for their needs. Long term maintenance and sustainment of the nuclear mission depends on costly and immediate investment in current and future requirements.

Drastic changes and investments have been made to the entire Nuclear Enterprise, but these changes and investments will take years to take full effect and be felt within the MUNS units. The dedicated personnel in these units will continue to meet mission requirements. At a minimum, senior leadership should brief them on the status of their needs and let them know when they can expect some relief. Much is being done to repair the Nuclear Enterprise and a status update would go a long way towards improving morale within these units. As improvements continue to be made and will be ongoing for the foreseeable future, it is also necessary to regularly evaluate the MUNS units and the status of their needs to verify the Air Force remains on track with revitalization efforts.

## Bibliography

- Brown, Bernice B. "Delphi Process: A Methodology Used for the Elicitation of Opinions of Experts," RAND Corporation, P-3925, September 1968.
- Bruins, Mieke D. "Logistics Perspective: Nuclear-Weapons Related Material," *The Exceptional Release* (Spring 2012).
- Caves, John P. "Avoiding a Crisis of Confidence in the U.S. Nuclear Deterrent," *Strategic Forum*, 252: 1-6 (January 2010).
- Dalkey, Norman C. "The Delphi Method: An Experimental Study of Group Opinion." Rand Corporation, RM-5888-PR, June 1969.
- Dalkey, Norman and Olaf Helmer. "An Experimental Application of The Delphi Method to the Use of Experts." RAND Corporation Memorandum, RM-727/1-Abridged, July 1962.
- Defense Science Board. *Report of the Defense Science Board Permanent Task Force on Nuclear Weapons Surety on Nuclear Weapons Inspections for the Strategic Nuclear Forces*. (December 2008).
- Defense Science Board. *Report of the Defense Science Board Task Force on Nuclear Capabilities Report Summary*. (December 2006).
- Defense Science Board. *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills*. (September 2008).
- Defense Science Board. *The Defense Science Board Permanent Task Force on Nuclear Weapons Surety Independent Assessment of the Air Force Nuclear Enterprise*. (April 2011).
- Defense Science Board. *The Defense Science Board Permanent Task Force on Nuclear Weapons Surety Report on the Unauthorized Movement of Nuclear Weapons (Revised)*. (April 2008).
- Defense Science Board. *The Nuclear Weapons Effects National Enterprise*. (June 2010).
- Department of Defense. "DoD News Briefing with Secretary Gates from the Pentagon". (5 June 2008). <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4236>. Accessed 15 January 2012.

- Expert Panel. Nuclear Munitions Requirements Survey Questionnaire, Round One. Questionnaire Responses. 7 October 2011.
- Expert Panel. Nuclear Munitions Requirements Survey Questionnaire, Round Two. Questionnaire Responses. 2 December 2011.
- Expert Panel. Nuclear Munitions Requirements Survey Questionnaire, Round One. Questionnaire Responses. 16 December 2011.
- Griffis, Stanley E., Thomas J. Goldsby, and Martha L. Cooper. "Web-base and Mail Surveys: A Comparison of Response, Data, and Cost," *Journal of Business Logistics* 24 (2): 237-258 (2008).
- Helmer, Olaf. "Systematic Use of Expert Opinion." RAND Corporation, P-3721, Nov 1967.
- Helmer, Olaf and Nicholas Rescher. "On the Epistemology of the Inexact Sciences." RAND Corporation, R-353, Feb 1960.
- The History Channel. "Cold War". <http://www.history.com/topics/cold-war>. Accessed 2 April 2012.
- Krippendorff, Klaus. *Content Analysis: An Introduction to its Methodology*, 2nd ed. Thousand Oaks, CA, Sage Publications, 2004.
- Linstone, Harold A. and Murray Turoff, eds. *The Delphi Method. Techniques and Applications*, 2002. 53.
- Martin, Margaret C. *The Pilot Staffing Conundrum: A Delphi Study*. Graduate Research Paper, AFIT/IMO/ENS/09-06, Air Force Institute of Technology (AU), Wright-Patterson AFB, OH, June 2009.
- Nuclear Files. "Mutual Assured Destruction". <http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/history/cold-war/strategy/strategy-mutual-assured-destruction.htm>. Accessed 2 April 2012.
- Nuclear Weapons Archive. "Trinity". <http://nuclearweaponarchive.org/Usa/Tests/Trinity.html>. Accessed 2 April 2012.

Office of the Secretary of Defense (OSD). *Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission*. (September 2008).

Office of the Secretary of Defense. *Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission*. (December 2008).

Schmidt, Roy C. "Managing Delphi Surveys Using Nonparametric Statistical Techniques," *Decision Sciences*. 28(3): 763-774 (Summer 1997).

Spence, D'anne E. "Zero Nuclear Weapons and Nuclear Security Enterprise Modernization," *Strategic Studies Quarterly*. 5(3): 121-133 (Fall 2011).

Spencer, Michelle, Aadina Ludin and Heather Nelson. "The Unauthorized Movement of Nuclear Weapons and Mistaken Shipment of Classified Missile Components: An Assessment," *The Counterproliferation Papers, Future Warfare Series*, No. 56: (January 2012).

United States Air Force (USAF). *Aircraft and Equipment Maintenance Management*. AFI 21-101. Washington, HQ USAF, 26 July 2010 (incorporates Change 1, 16 August 2010). <http://www.e-publishing.af.mil/shared/media/epubs/AFI21-101.pdf>. Accessed 8 April 2012.

United States Air Force, Air Force Nuclear Task Force. *Reinvigorating The Air Force Nuclear Enterprise*. (October 2008).

United States Air Force. *Air Force Nuclear Weapons Surety Program*. AFI 11-101. Washington, HQ USAF, 13 October 2010 (incorporating through Change 3, 28 September 2011). <http://www.e-publishing.af.mil/shared/media/epubs/AFI91-101.pdf>. Accessed 8 April 2012.

United States Air Force. *U.S. Air Force Blue Ribbon Review, Nuclear Weapons Policies and Procedures Executive Summary and Appendix H – Observations/Recommendation Matrix*. (February 2008). <http://www.airforce-magazine.com/SiteCollectionDocuments/TheDocumentFile/Current%20Operations/BRR020808ExecSummary.pdf>. Accessed 15 January 2012.

United States Air Force. *Nuclear Weapons and Systems Surety*. AAFP 91-1. Washington, HQ USAF, 13 December 2010. <http://www.e-publishing.af.mil/shared/media/epubs/AAFP91-1.pdf>. Accessed 8 April 2012.

United States Air Force. *Nuclear Weapons Maintenance Procedures*. AFI 21-204. Washington, HQ USAF, 30 November 2009 (incorporating through Change 3, 6 January 2012). <http://www.e-publishing.af.mil/shared/media/epubs/AFI21-204.pdf>. Accessed 8 April 2012.

Worden, Mike. *Rise of the Fighter Generals, The Problem of Air Force Leadership 1945–1982*. Air University, March 1998.

## Appendix A. Nuclear Munitions Requirements Survey Questionnaire, Round One

Sir/Ma'am,

You have been identified by your squadron leadership to participate in this survey.

Over the past few years, numerous panels and boards have published reports with their conclusions regarding the health of the Air Force nuclear mission. The purpose of this research is to gather input from experts currently working in CONUS Nuclear MUNS units to explore and identify the critical elements your unit needs to accomplish its assigned mission(s). This research is approved by the 498 NSW/CC, Col Lindsley, and is sponsored by AFMC/A10. Thank you for participating in this survey. I appreciate your time and candid responses. Please note the following:

1. Survey responses are confidential. Your identity (name or duty title) will not be associated with any response you give in the final research report. Summarized responses will be releasable under the Freedom of Information Act, but your identity and/or organizational information will not be associated with a questionnaire and will be known only to me.
2. Please complete this survey electronically and return it to: [craig.bailey@afit.edu](mailto:craig.bailey@afit.edu). If you have questions on the survey or the survey process, I can be reached via e-mail (preferred) or at DSN 785-3636. Written correspondence can be addressed to:

Maj Craig Bailey  
AFIT IDE Student  
Air Force Institute of Technology  
Department of Operational Sciences (AFIT/ENS)  
2950 Hobson Way, Bldg. 641, Suite 201E  
Wright-Patterson AFB, OH 45433-7765

3. Please complete this survey and return it electronically no later than **7 Oct 2011**.
4. There are 7 questions. The survey is “non-attribution”, so please feel free to elaborate fully on your answers. Once all survey responses are received, you will be asked to numerically revise your initial responses to questions 5-7 based on responses provided by the entire group. Subsequent rounds will be announced as needed and all research will conclude by December 2011.

Background:

1. Personal Information:
  - a. Name:

- b. Rank/Grade:
  - c. Current Duty Title:
  - d. Time in Current Duty Position:
  - e. Core AFSC:
2. How many total years have you performed duties, in MUNS units or on staff, dealing with nuclear weapons maintenance?
  3. On a scale from 1 to 5 (1-strongly disagree, 3-neither agree nor disagree, 5-strongly agree) assess the statement, “my unit has everything it needs to meet mission requirements.” Please feel free to clarify or elaborate on your response.
  4. On a scale from 1 to 5 (1-strongly disagree, 3-neither agree nor disagree, 5-strongly agree) assess the statement, “my unit satisfactorily meets its mission requirements.” Please feel free to clarify or elaborate on your response.

Please answer and elaborate on the following questions:

5. List and describe the critical elements your unit needs to accomplish its mission requirements. (for example, training, equipment, qualified personnel, etc.)
6. What outside agencies or staff elements assist your unit in accomplishing its mission? List the agency and describe the assistance they provide. (for example, Air or MAJCOM Staff agencies, IG, Safety, AFNWC agencies, etc.)
7. List and describe what, in your opinion, would assist your unit to more easily meet its mission requirements. (for example, training, equipment, personnel, time between inspections/visits, etc.)

Thank you for your participation.

**Appendix B. Nuclear Munitions Requirements Survey Questionnaire, Round Two**

Sir/Ma'am,

Thank you for participating in this survey. I appreciate your time and candid responses. This research is sponsored by AFMC/A10. The purpose of this research is to gather input to explore and identify the critical elements necessary for your units to accomplish its assigned missions. Please note:

1. Survey responses are confidential. Your identity (name, rank or duty title) will not be associated with any response you give in the final research report. Summarized responses will be releasable under the Freedom of Information Act, but your identity and/or organizational information will not be associated with a questionnaire and will be known only to me.
2. Please complete this survey electronically and return it electronically to: [craig.bailey@afit.edu](mailto:craig.bailey@afit.edu) by 2 Dec. If you have questions on the survey or the survey process, I can be reached at 937-490-1101.
3. This is round two of the survey. The purpose of this round is to rank the most repeated responses given by all respondents in order of importance. Please rank the responses by evaluating their importance from most to least important. Subsequent rounds will be announced as needed to refine the rankings.

Please rank order the responses given to the selected round one question below:

1. Original Question: List the critical elements your unit needs to accomplish its mission requirements.

Respondents' Answers	Rank (1-11, 1 being most important)
Qualified Personnel	_____
Sufficient Manning	_____
Effective / Focused Training	_____
Adequate Funding (parts / supplies)	_____
Reliable Supply (serviceable parts)	_____
Reliable / Clear Technical Data	_____
Updated / Serviceable Facilities and Equipment	_____
Dedicated Training Facilities and Equipment	_____
Experienced / Effective SNCOs	_____
Solid QA Program	_____

Single Classified Data Collection / Resource Planning System \_\_\_\_\_

2. Original Question: What outside agencies or staff elements assist your unit in accomplishing its mission?

Respondents' Answers	Rank (1-11, 1 being most important)
708 NSUS	_____
AFNWC	_____
MAJCOM Staffs (AFGSC/AFMC - A4, A10, SE, IG)	_____
Air Staff (HAF/A4/7, A10)	_____
Air Logistics Center Supporting Agencies (Hill / Tinker)	_____
MUMG	_____
DTRA	_____
AF Safety Center	_____
AFIA	_____
National Labs	_____
Host Unit Support / Security	_____

3. Original Question: List what, in your opinion, would assist your unit to more easily meet its mission requirements.

Respondents' Answers	Rank (1-14, 1 being most important)
More Time Between Inspections / Combine Inspections / Visits	_____
Increased Manning	_____
More Qualified Personnel	_____
Reliable / Sufficient Facilities and Equipment	_____
Reliable Supply (Serviceable Parts)	_____
Clear and Reliable Technical Data	_____
Dedicated Facilities and Equipment for Training	_____
Adequate Funding	_____
Effective Training / Standardized Lesson Plans	_____
More Qualified / Knowledgeable SNCOs	_____
Reduce Maintainer Security Responsibilities	_____

Consistent Inspection Standards (MAJCOM, AFIA, DTRA) \_\_\_\_\_  
Remove Inspection Requirements for Retired Assets \_\_\_\_\_  
Single Classified Data Collection / Resource Planning System \_\_\_\_\_

### Appendix C. Nuclear Munitions Requirements Survey Questionnaire, Round Three

Thank you for participating in this survey. I appreciate your time and candid responses. This research is sponsored by AFMC/A10. The purpose of this research is to gather input to explore and identify the critical elements necessary for your units to accomplish its assigned missions. Please note:

1. Survey responses are confidential. Your identity (name, rank or duty title) will not be associated with any response you give in the final research report. Summarized responses will be releasable under the Freedom of Information Act, but your identity and/or organizational information will not be associated with a questionnaire and will be known only to me.
2. Please complete this survey electronically and return it electronically to: [craig.bailey@afit.edu](mailto:craig.bailey@afit.edu) by 16 Dec. If you have questions on the survey or the survey process, I can be reached at 937-490-1101.
3. This is round three of the survey. The purpose of this round is to review the rank order developed by the group in an effort to reach consensus. Please review the group-determined rank and indicate your agreement, or re-rank the list as you determine necessary. The items are ranked from most important to least important. Subsequent rounds will be announced as needed to finalize the rankings.

Please review the group-determined rankings for each question. Indicate your agreement by selecting yes, or select no and re-rank as needed: 1. Original Question:

1. List the critical elements your unit needs to accomplish its mission requirements.

Group-Determined Rank:	Rank (1-11, 1 being most important)
I agree with the rankings as listed	___ Yes / ___ No
Qualified Personnel (1)	___
Sufficient Manning (2)	___
Experienced / Effective SNCOs (3)	___
Reliable / Clear Technical Data (4)	___
Effective / Focused Training (5)	___
Adequate Funding (parts / supplies) (6)	___
Reliable Supply (serviceable parts) (7)	___
Updated / Serviceable Facilities and Equipment (8)	___
Dedicated Training Facilities and Equipment (9)	___

Solid QA Program (10) \_\_\_\_\_  
 Single Classified Data Collection / Resource Planning System (11) \_\_\_\_\_

2. Original Question: What outside agencies or staff elements assist your unit in accomplishing its mission?

Group-Determined Rank: Rank (1-11, 1 being most important)

I agree with the rankings as listed \_\_\_\_\_ Yes / \_\_\_\_\_ No

- 708 NSUS (1) \_\_\_\_\_
- MUMG (2) \_\_\_\_\_
- Host Unit Support / Security (3) \_\_\_\_\_
- AFNWC (4) \_\_\_\_\_
- MAJCOM Staffs (AFGSC/AFMC - A4, A10, SE, IG) (5) \_\_\_\_\_
- Air Staff (HAF/A4/7, A10) (6) \_\_\_\_\_
- National Labs (7) \_\_\_\_\_
- Air Logistics Center Supporting Agencies (Hill / Tinker) (8) \_\_\_\_\_
- DTRA (9) \_\_\_\_\_
- AF Safety Center (10) \_\_\_\_\_
- AFIA (11) \_\_\_\_\_

3. Original Question: List what, in your opinion, would assist your unit to more easily meet its mission requirements.

Group-Determined Rank: Rank (1-14, 1 being most important)

I agree with the rankings as listed \_\_\_\_\_ Yes / \_\_\_\_\_ No

- More Qualified Personnel (1) \_\_\_\_\_
- Clear and Reliable Technical Data (2) \_\_\_\_\_
- More Qualified / Knowledgeable SNCOs (3) \_\_\_\_\_
- Increased Manning (4) \_\_\_\_\_
- More Time Between Inspections / Combine Inspections / Visits (5) \_\_\_\_\_
- Reliable / Sufficient Facilities and Equipment (6) \_\_\_\_\_
- Reduce Maintainer Security Responsibilities (7) \_\_\_\_\_
- Reliable Supply (Serviceable Parts) (8) \_\_\_\_\_
- Effective Training / Standardized Lesson Plans (9) \_\_\_\_\_

Consistent Inspection Standards (MAJCOM, AFIA, DTRA) (10) \_\_\_\_\_  
Adequate Funding (11) \_\_\_\_\_  
Dedicated Facilities and Equipment for Training (12) \_\_\_\_\_  
Remove Inspection Requirements for Retired Assets (13) \_\_\_\_\_  
Single Classified Data Collection / Resource Planning System (14) \_\_\_\_\_



# Critical Elements and Needs for Nuclear Weapons Maintenance

*The AFIT of Today is the Air Force of Tomorrow.*



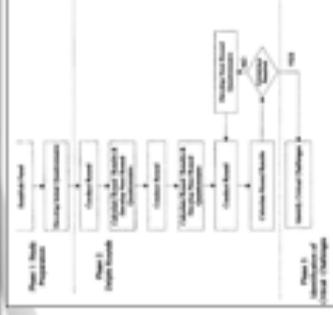
**Research Focus:**

Major Craig S. Bailey  
Department of Operational Sciences (ENS)

ADVISOR  
Dr. Alan Johnson

**Methodology: Delphi Study**





- Needs of the Nuclear MUNS
- Guiding research questions
  1. What critical elements do Nuclear MUNS need to accomplish mission requirements?
  2. What outside agencies/staff elements assist Nuclear MUNS in mission accomplishment?
  3. What do Nuclear MUNS need to better meet mission requirements?

**Results:**

INDEX	CRITICAL ELEMENTS	AGENCY/STAFF	MISSION
1	COMBAT OPERATIONS	DEFENSE	COMBAT OPERATIONS
2	SELF DEFENSE	DEFENSE	COMBAT OPERATIONS
3	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
4	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
5	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
6	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
7	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
8	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
9	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
10	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
11	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
12	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
13	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS
14	OPERATIONAL SUPPORT	DEFENSE	COMBAT OPERATIONS

**Recommendations:**

- Reevaluate authorized manning levels
- Ensure technical data is clear and non-conflicting
- Minimize outside visits
- Reevaluate the number/pace of inspections
- Brief personnel on status of needs and requirements

**Sponsor:**  
AFMC/A10

## **Appendix E. Vita**

### **Vita**

Major Craig Bailey enlisted in the Air Force in 1991 and served as an aircraft maintainer and space operator for nine years. He completed Officer Training School and was commissioned in August 2000 and is fully qualified in both aircraft, and munitions maintenance. Major Bailey has experience managing maintenance on fighter, bomber and rescue aircraft; as well as conventional and nuclear munitions. He led the first ever B-2 maintenance deployment to Diego Garcia in support of Operation IRAQI FREEDOM in 2003, and in 2006, he led his A-10 Aircraft Maintenance Unit on a deployment to Afghanistan in support of Operation ENDURING FREEDOM. Major Bailey has also served as a staff officer at Headquarters AFMC. He is married to the former Lori Bancroft and has two sons, Brandon and Brett.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.</small> <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b>					
1. REPORT DATE (DD-MM-YYYY) 06-14-2012		2. REPORT TYPE Graduate Research Project		3. DATES COVERED (From - To) June 2011 - June 2012	
4. TITLE AND SUBTITLE  Critical Elements and Needs for Nuclear Weapons Maintenance: A Delphi Study			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)  Major Craig S. Bailey			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 Hobson Street, Building 642 WPAFB OH 45433-7765			8. PERFORMING ORGANIZATION REPORT NUMBER  AFIT/ILS/ENS/12-01		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) HQ AFMC/A10 Attn: Colonel Thomas Fitch 4225 Logistics Avenue, Bldg 262 Rm N208 WPAFB, OH 45433-5759 DSN: 787-7850 email: thomas.fitch@wpafb.af.mil			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSORING/MONITORING AGENCY REPORT NUMBER		
12. DISTRIBUTION AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT From the end of the Cold War in the early 1990s thru 2007, the focus and attention given to the Air Force's nuclear mission noticeably declined. The nuclear readiness of organizations, personnel, policies, procedures and processes all gradually deteriorated culminating in two high profile incidents which revealed the drastic state of degradation. These incidents led to numerous high level investigations and studies, and resulted in major changes for the Air Force. While the investigations and studies following the incidents focused broadly on the entire Air Force Nuclear Enterprise, this study focused on the critical elements and needs of nuclear Munitions Squadrons. An expert panel of 54 Nuclear weapons maintenance managers from nuclear Munitions Squadrons were surveyed in a three round Delphi Study. The expert panel identified the critical elements and needs for their units to accomplish the nuclear mission. While much has been done to repair the Nuclear Enterprise, this study highlights that commitment and dedication to the needs of nuclear Munitions Squadrons are still required to ensure the Air Force nuclear arsenal remains safe, secure, and reliable.					
15. SUBJECT TERMS  Nuclear Weapons Maintenance, Munitions Squadrons, Delphi Method					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Dr. Alan W. Johnson (ENS)
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U	UU	82	19b. TELEPHONE NUMBER (Include area code) (937)255-3636, ext 4703; e-mail: alan.johnson@afit.edu