
# Process Improvements in Missile Combat Crew Member Pre- and Post-alert Activities

**Graduate Research Paper**

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## Abstract

This research study explored pre- and post-alert activities among Missile Combat Crews. These nuclear professionals brave the northern-tier bases of Malmstrom Air Force Base, Francis E. Warren Air Force Base, and Minot Air Force Base as they sit watch at remote launch control centers in support of the Minuteman III missile system. This paper looks for process improvements to shorten duty days for these missile crews by finding tasks that can be eliminated or offloaded as they prepare for alert duty and subsequently return from the missile field. This study found that process improvements can save missile crews over 100 minutes per alert duty.

*To my amazing wife and children for their support of my military career. To Dr. William Cunningham for his assistance and mentorship during this capstone.*

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# I. Introduction

## Background

As the 2014 scandal that decertified 92 Missile Combat Crew Members (MCCM) at Malmstrom Air Force Base demonstrated, grueling standards and low morale can have a major negative impact on the nuclear mission (Cooper, 2014). The subsequent Force Improvement Program (FIP) in the Nuclear & Missile Operations community addressed many concerns regarding morale and mission effectiveness, but the overall procedures to and from the missile field remained largely unchanged.

By analyzing the activities involved to uncover possible time efficiencies, Missile Combat Crews (MCCs) could shorten their pre- and post-alert activity times, gaining valuable time off following their alert shifts. This is particularly important because time saved anytime throughout the process shortens the critical path, getting the MCCMs, the Facility Manager, and the chef home earlier.

## Shortened duty hours

Shorter work periods should provide MCCMs greater time off, since they are permitted to leave following alert duty travel days. They also have the following day off or are compensated for that day later. However, some efficiencies could make the process easier for MCCMs by offloading the tasks to others or reordering the tasks. The Facility Manager, who maintains the Missile Alert Facility (MAF), and the chef, who prepares meals for the members at the MAF, have a vested interest in the return time because it will allow them to get home earlier as well because they traditionally share transportation with MCCs, whereas Security Forces members drive separately. Additionally, arriving to site earlier could be beneficial beyond morale.

“Because of the long distances between the support base and the launch control center (LCC), much of a crew member's productive work hours are spent in transit going to and from alert” (Sikorra, 1987:16-17). A more efficient process to arriving from base would get the crew to site earlier in the day.

**Broad view of missile alert**

Missile crews are nuclear professionals who brave the northern-tier bases of Malmstrom Air Force Base, Francis E. Warren Air Force Base, and Minot Air Force Base, as they sit watch at remote launch control centers in support of the Minuteman III missile weapons system (Chapman, 2017). Missile alert duty has changed lengths and forms over the years. This study looks at 24-hour alerts. “This period of duty, called an ‘alert tour’ or an ‘alert,’ runs from approximately noon of the first day, when the crew assumes responsibility for the control center from the off-going crew, until noon of the following day when they are relieved by a fresh crew. An important aspect of Minuteman operations is the fact that the control centers are located some distance from the main base. The crews drive long distances (over 200 miles in many cases) in military vehicles from the main base to their assigned control centers. The elapsed time from the predeparture briefing at the beginning of the alert day to the debriefing following their return usually ranges from 30 to 36 hours” (Ebbs, 1988:10). The account from Ebbs highlighted the long drive time, though that study glossed over pre-alert activities. “Once the crew arrives at their launch control facility, they perform security and identification procedures. If these procedures are accomplished correctly, the crew will be permitted access to the elevator for the trip down to the launch control center” (Ebbs, 1988:10). The lack of attention remained consistent throughout the literature, some of which described in Section II. The dearth of

attention on pre- and post-alert activities might be the result of pre- and post-alert activities being simply getting there and returning, not as key phases of the alert duty cycle.

**Research questions**

This study focuses on the investigative question of whether missile crews could save significant time by streamlining pre- and post-alert activities. Using a phenomenological approach, the following research questions are explored:

How much time can be reasonably saved?

Which tasks can be offloaded or eliminated?

## II. Literature Review

This section is divided into five parts. The literature review first explores several studies that examine the Nuclear & Missile Operations Career Field, as they relate to Missile Combat Crews. Many of these are more macro in their scope compared to this study, as they explore alert length, forward operating bases, and driving alternatives. Still, these studies help provide a context for the more micro elements found in this study. Second, fatigue with other long-hour Air Force duties is reviewed. Knowledge of how longer duty hours impact crew member fatigue and morale provides impetus to find pre- and post-alert process efficiencies. Third, other jobs that include pre- and post-duty tasks are reviewed, which provides additional terminology and context for this study's pre- and post-alert activities. Fourth, missile field regulations for required pre- and post-alert activities are cited to differentiate required tasks from performed tasks. Finally, factors that impact team cohesion are discussed.

### Missile Combat Crew studies

#### *Alert Length*

Gray (1980) studied 48-hour alert lengths instead of 24-hour alerts. This construct reduced the number of alerts crew members performed each month through extending their duration. As a result, the overall time crew members spent on pre- and post-alert activities was halved because they had fewer alerts. Gray found the main physiological difference to be an extra half hour of sleep with the 48-hour experimental group compared to the 24-hour control group, "a small price to pay in order to obtain the economic and other gains offered by the 48-hour work schedule" (1980:39). However, Sikorra (1987) portrayed 48-hour alerts differently: "Fatigue and 'being closed in' are common complaints lodged against performing double alert duties. These feelings have been, on occasion, validated, as some crews have actually experienced 48-hour alerts due to

weather conditions which prevented crew travel" (52). Rather than examine alert tour lengths, which can have many individual factors that influence scheduling preferences in addition to the physiological factors, this study will look at other process factors.

*Transportation*

Jacques & Woolley (1980) analyzed crew vehicle fuel efficiency, as they had the highest mileage accumulation in the command. The researchers did not consider the crew members' preferences, rather sought the optimal fuel savings. Some of the considerations involved an "arrive and wait" construct that added two hours of field time for returning crews, as the vehicles took multiple crews to various Missile Alert Facilities. Sikorra (1987) found routine helicopter usage unfeasible, since they would need to visit multiple sites, which would be slower than the current practice of each crew taking a vehicle to its site. Without significant investment into considerably larger helicopter squadrons, transportation solutions to shorten alert lengths are not practical.

*Forward Operating Bases*

Previous literature has also explored more robust changes, such as a forward operating base. Sikorra (1987) discussed building a "mini-base" in Lewistown to serve part of the Malmstrom Air Force Base missile crews, a construct that could be replicated at other missile bases. Still this concept requires large reworking of housing and services. The concept would decrease pre- and post-alert times, as the drive time would be significantly shorter; nevertheless, the remote towns would increase drive times for goods and services while off-duty.

**Comparable long-hour Air Force duties**

Storm & Gray found with Missile Crews, "If no sleep is acquired during a typical 24-hour alert and an extension of the alert is required without sleep, performance impairments are likely to occur at 36-48 hours" (1978:7). Adding pre- and post- alert activities to the 24-hour alert period has the potential to leave crew member awake for an unsafe length. Some platforms allow for GO pills. For example, Schultz and Miller (2004) described the use of GO pills (5 mg of dextroamphetamine) for F-16 pilots on long sorties. This option is not available to Missile Crews, so an inability to drive following a longer than average alert period coupled with prolonged requirements for two members to be awake could require members to sleep topside before departing the Missile Alert Facility, lengthening their tour even more.

The more typical total 32 hours for all alert processes compares to an E-4B study. Storm (1980) found, "During the 30-hour E-4B mission, the subjective fatigue levels reported were moderate and not of a magnitude associated with compromises in performance and safety. Although not of the best quality, the sleep acquired inflight in the bunks, in the passenger seats, and even on the floor was of restorative value and contributed to the general absence of severe fatigue and negative mood states during the mission" (17). Efforts to keep duty periods shorter through efficiency impact morale but also safety.

**General activities**

Taking a wider view of pre- and post-alert activities, a 2014 Supreme Court case involved Amazon warehouse workers, in which the justices considered the merits of requiring workers to wait without pay for end-of-day security screening (Liptak, 2014). The Court found that the activity required no extra pay for the workers, as the check was not an "integral and indispensable" part of their job. Certainly, Missile Crews are not demanding extra pay for

departing and returning on alert periods, but process changes should consider whether a task is "integral and indispensable."

Additionally, longer or shorter alert duty hours do not save or cost either the members or the Air Force anything in financial terms. Instead, more appropriate is a view such as from Kaplan & Cooper (1998), whose cost and performance management system describes timeliness as a nonfinancial measure, which can be measured through cycle time. Cycle time refers to the total time between the start of production until completion.

However, activity phases with industrial uses can create too many categories, as in Bruner (2017). In that review, donning and doffing of equipment were used as demarcations, which created five periods to organize activities (pre-donning, donning, assigned work, doffing, post-doffing). This study used a simpler construct with three phases of activities (pre-alert, alert, post-alert).

Finally to note in this section, Bruner discussed four tests that have emerged through the courts while examining activities: (1) The "unique versus non-unique gear" test; (2) The "exertion" test; (3) The "benefit to the employer versus employee" test; and (4) various hybrid models (2017:430). These categories influenced the methodology for this study when weighing tasks and whether they should be offloaded to other members or eliminated entirely.

**Team Cohesion**

Powell, Galvin & Piccoli (2006) compared collocated and virtual teams to examine their level of trust. The authors found "team work processes and member effort have a significant, positive relationship with trust in collocated teams" (299). Additionally, collocated teams are more apt "to provide members with the feedback and information necessary to establish trust"

than virtual teams (Powell et al, 2006:304). Eliminating or offloading tasks has a potential to decrease interaction between MCCs and other Missile Alert Facility members. An exact threshold of interaction is difficult to develop but process changes that completely remove in-person communication should be further developed before implementing.

Communication is key to cohesion. Crew members need to set expectations with different personnel each trip to the field shortly arriving to site. A key component of creating this environment is clear and candid communication. "Candor means that participants apply directness and sincerity in their communications and actively attempt to avoid impression management and facade. This is accomplished in a safe environment in which embarrassment and harm are minimized" Berkovich, 2014:10). Therefore, the way tasks are eliminated and offloaded must also keep in mind the potential impacts to the work environment and team cohesion.

Similarly, Fung (2014) found team cohesion to directly predict team satisfaction, which in turn increases team effectiveness. A previous study at Francis E. Warren Air Force Base (AFB) regarding morale did not look at MCCMs specifically. Pflanz & Ogle found a "concerning picture of the impact of work stress on the military" after analyzing job stress at the 90th Missile Wing and Twentieth Air Force, both housed at Francis E. Warren AFB (2006:863). Changes to pre- and post-alert processes could impact morale by shortening duty hours, giving more time off and therefore more time to mentally and physically recover from long shifts.

**Applicable Air Force regulations**

Air Force Global Strike Command Instruction 13-5301 Volume 3, *Rapid Execution and Combat Targeting (REACT) Crew Operations* includes requirements on mission planning, departure, scheduling, and crew force management.

*Mission planning and departure*

To prepare for mission planning, crews gather data from a variety of sources, with the most coordination from the crew that serves as mission lead. At this stage, crews solicit information on weather, road conditions, forecasted maintenance, communication system status, scheduled tests, potential visits, etc. After crews gather relevant information, they discuss the mission as a squadron. This process has already been streamlined in recent years, especially with the cultural change that "[e]very effort should be made to avoid having non-mission related briefings prior to departure for posting crews (e.g., roadshow briefs, etc.)" (13-5301v3, 2018:6). Prior to departure, missile crews must also check out their respective vehicle. "Personnel will inspect the vehicle and complete/sign applicable sections of the AF Form 1800, *Operator's Inspection Guide and Trouble Report*. Conduct an additional vehicle inspection anytime the vehicle is left unattended outside a secure area (e.g., Missile Support Base (MSB), MAF, etc.)" (13-5301v3, 2018:7). The vehicle inspection is a requirement, though exact procedures are not stipulated, which could allow for vehicle maintainers or other members to perform phases of the checks that verify periodic maintenance for the crew members.

*Scheduling and force management*

Missile crews during their first operational tour have eight alerts per month and second tour crew members should expect four alerts per month (13-5301v3). A typical alert period is 24 hours, though the actual time varies based on early or late departure of crews due to extenuating circumstances on base and hazardous weather (13-5301v3, 2018:18). "For field pay purposes, an alert will count as 32 hours," as these additional hours factor in pre- and post-alert activities (13-5301v3, 2018:18). Schedules follow an Alert (A), Travel (T), O-day (O) construct, in which

"[t]here will be no alert or mandatory training events directed during a crew member's O-day" (13-5301v3, 2018:15).

## III. Methodology

### General approach

This study examined pre- and post- alert processes to determine their requirement and duration. Through a process flow-chart, activities that are not required at a specific time or even not required at all are easier to identify (Anupindi et al., 2018:83). Those that are not required could be eliminated, and ones that can change time sequence might move off the critical path (Anupindi et al., 2018:91). This study developed tables incorporating the author's experience and Air Force regulations to arrange the activities in sequential order.

### Data collection method & rationale

The study used a phenomenological approach, as the data collection method involves the researcher's own subjective, lived experiences (Creswell & Creswell, 2018). His years of experience were used to construct a notional view of the pre- and post-alert duration periods. As a result, the timing did not provide exact real-world equivalents. A more intrusive study of a given unit (or even across all missile wings) would provide a more accurate picture of the times, as each missile crew would have a degree of variation for many of the activities.

The reason for this approach was twofold. First, COVID-19 measures made it difficult to accompany crew members and gather data throughout their time period. Also, even if accomplished, the adjustments to current alert practices do not exactly mirror the previous norms, around which this case study measured. An advantage of this approach was that it gives light on the recent way missile crews handled pre- and post-alert processes to provide units ways to improve their approach without unnecessary disclosure of any potential recent changes considering COVID-19. Second, exact times averaged among hundreds of crew members for

each activity were not necessary to explore process changes. Nominal data provide value and could give insights. Subsequent studies could then explore instances where more focused study with clearer time values have potential benefit, rather than casting an initially larger net now with sizeable data that provide little additional understanding.

**Assumptions**

The study assumes that at least one MCC will nominally engage in all tasks as the nominal control form of the process pathway. In reality, some members do not order food while on site, having brought their own. Chefs do not typically change out every day as another example. However, from an overall process improvement standpoint, the study incorporated all normal, potential tasks as part of the framework.

**Limitations**

Some pre- and post-alert activities are required by regulation, as described in Section II, which precluded modification or elimination.

As mentioned earlier, COVID-19 created severe limitations on data collection and the ability to create control and experimental groups to gain insights on the impact of the changes on crew morale.

# III. Results

## Summary of Results

The study found that MCCs could notionally save up to 102 minutes (52 pre-alert and 50 post-alert) through process changes. This section will analyze pre-alert activities and then post-alert activities.

## Pre-alert activities

14 of the 21 pre-alert activities capable of being either eliminated or offloaded. Based on regulations and operational requirements, mission planning, pre-departure briefings, material collection, arrival procedures, and on-site briefings were required tasks that could not be eliminated or effectively offloaded. Physical movement on-site and driving to site are inherent requirements, given the prohibitive cost of other transportation means.

Using experience to form notional durations, vehicle checkout took 10 minutes. Another member could perform this task, but the MCC would still need to perform a simple checkout involving a walk-around of the vehicle and basic function check. Still, at least 7 minutes could be removed from the process. Activities related to missile feeding (drive to chef, load rations/linen and notify/load chef/baggage) accounted for 23 minutes. Supply tasks took 10 minutes. On-site tasks for materiel movement, food orders, and item collection accounted for 20 minutes.

Although the total pre-alert activities capable of modification or elimination total 62 minutes, the vehicle check as described along with small remnants of other tasks after offloading for coordination made 52 minutes a more feasible outlook.

These tasks are shown below in Table 1. To note, all processes with the ability to be offloaded completely were also marked as being able to be offloaded in part, even if the task would be illogical to do so. Duration for required tasks is variable based on the particular site and day's operational requirements, so no times are given for those tasks, as modifying them fall outside of the scope of this paper.

Table 1: Pre-alert Activities

| Task | Duration (minutes) | Eliminate | Offload (Complete) | Offload (Partial) |
|---|---|---|---|---|
| Vehicle Checkout | 10 | N | N | Y |
| Mission Planning | Required | N | N | N |
| Other Briefings | Required | N | N | N |
| Material Collection | Required | N | N | Y |
| Drive to Chef | 4 | Y | Y | Y |
| Load Rations | 8 | Y | Y | Y |
| Load Linen | 5 | Y | Y | Y |
| Notify/load chef/baggage | 5 | Y | Y | Y |
| Drive to supply | 5 | Y | Y | Y |
| Retrieve Supply | 5 | Y | Y | Y |
| Drive to site | Required | N | N | N |
| Arrival procedures | Required | N | N | N |
| Unload bags | 3 | N | Y | Y |
| Food order | 3 | N | Y | Y |
| Provide personal devices/card | 2 | N | Y | Y |
| Linens | 2 | Y | Y | Y |
| Utensils/Water | 4 | Y | Y | Y |
| Briefings topside | Required | N | N | N |
| Personnel move | Required | N | N | N |
| Gear transport initial | 3 | N | N | Y |
| Gear transport secondary | 3 | N | N | Y |

**Post-alert activities**

17 of the 19 pre-alert activities are capable of being either eliminated or offloaded. As with pre-alert activities, all post-alert processes with the ability to be offloaded completely were also marked as being able to be offloaded in part, even if the task would be illogical to do so. These tasks are shown on the following page in Table 2.

Innate personnel movement and driving from the missile site to base were inherently required tasks that could not be eliminated or effectively offloaded.

On-site/near-site activities notionally accounted for 27 minutes total in activities (gear transport, dishes/water pitcher drop-off, linen drop-off, bag/trash loading onto the vehicle, chef payment for food in cash, chef/FM departure notification, personal electronic devices/access card retrieval, trash disposal to dumpster), given the researcher's experiences. On-base post-alert activities (driving to supply and dropping off the tub; driving to Missile Feeding and dropping off the chef, coolers, and used linens; and vehicle turn-in) took 28 minutes.

Although the total post-alert activities capable of modification or elimination total 55 minutes, small remnants of tasks after offloading made 50 minutes a more feasible outlook.

Table 2: Post-alert Activities

| Task | Duration | Eliminate | Offload (Complete) | Offload (in part) |
|---|---|---|---|---|
| Personnel movement | Required | N | N | N |
| Gear transport initial | 3 | N | N | Y |
| Gear transport secondary | 3 | N | N | Y |
| Dishes/water pitcher drop-off | 3 | Y | Y | Y |
| Linen drop-off | 3 | Y | Y | Y |
| Bag/trash loading | 3 | N | Y | Y |
| Chef payment (cash only) | 5 | Y | Y | Y |
| Chef/FM departure notification | 3 | Y | Y | Y |
| Personal devices/card retrieval | 2 | N | Y | Y |
| Trash | 2 | Y | Y | Y |
| Return from site | Required | N | N | N |
| Drive time to supply | 5 | Y | Y | Y |
| Supply tub drop-off | 5 | Y | Y | Y |
| Drive to Missile Feeding | 4 | Y | Y | Y |
| Chef drop-off | 2.5 | Y | Y | Y |
| Cooler drop-off | 2.5 | Y | Y | Y |
| Linen drop-off | 5 | Y | Y | Y |
| Material drop-off | Required | N | N | Y |
| Vehicle turn-in | 4 | N | N | Y |

## V. Conclusion and Recommendations

### Conclusion

Missile crews have the potential to save a significant amount of time through modifying pre- and post-alert processes. Offloaded tasks need a member to assume them. This section will give recommendations on a suggested way forward, explore the feasibility, and provide areas for future research.

### Recommendations

Vehicle maintainers assigned to missile squadrons could verify vehicle readiness in the morning and prepare them for the next crew in the afternoon. This could save 15 minutes per crew or 225 minutes wing-wide per day. Adding regular maintenance (oil changes, new windshield wipers, washing, etc.) would further offload tasks that other members have as additional duties.

Force support services (FSS) owns linen and food services. Chefs traditionally ride with the MCCs. They wait for the crews to arrive to pick them up, and load the coolers, linen, and the chef's luggage. If chefs met the crews at the operations group building and loaded their luggage and any other FSS supplies (linen, coolers, oil, etc.) as well as took care of all requirements on the back end, then each crew would notionally save up to 36 minutes (or 9 hours between the 15 crews).

Finally, MCCs can use already available manpower and resources to make smaller fixes, such as 1) calling ahead or writing down food orders, rather than writing them down on the form upon arrival to site; 2) employing the chef to send utensils, extra dishes, and water pitchers when he/she brings the crew their food; 3) meeting the FM at a more centralized location to receive the

briefing and give their personal electronics; 4) moving toward individual linen use, removing the need to gather and drop-off linen; 5) allow the FM to assist with moving crew bags once the crew has accounted and vouched for them; 6) use an electronic money system to avoid having to pay the chef in cash or at a minimum coordinate what amount of money each crew member will give them to have change pre-staged.

**Feasibility**

Assigning vehicle maintainers is the least feasible recommendation because it requires new billets and manning. The tasks are currently being performed by other individuals, which is the reason for crews needing to do them. Still, the greater safety factor of having dedicated, more adequately trained members for these tasks could help implement this change.

FSS has buses and other vehicles to transport chefs and materials to the Operations Group building. The change would come down to culture and willingness for the units to work together to improve this process. Since chefs are not performing other tasks while awaiting crews, they would not have to report earlier to base in order to achieve this.

The third, smaller grouping of changes are all highly feasible. With proper implementation explaining the rationale, particularly with shared transportation allowing the chefs and FMs to have shorter return days as well, strong buy-in is likely.

**Future Research**

Future research could explore the logistics of pre-staging all FSS personnel, equipment, and rations at the Operations Group building to allow for faster departure. Also, varying approaches to solve the current cash-only payment for food on-site is worth exploration. If a future researcher wanted to consider larger and more costly changes, constructing new routes or

improving pavement might increase efficiency and safety. However given the rural nature of the missile fields, these costs would need to be paid mostly with Air Force funds and on-base infrastructure already poses high costs.

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**14. ABSTRACT**

This research study explored pre- and post-alert activities among Missile Combat Crews. These nuclear professionals brave the northern-tier bases of Malmstrom Air Force Base, Francis E. Warren Air Force Base, and Minot Air Force Base as they sit watch at remote launch control centers in support of the Minuteman III missile system. This paper looks for process improvements to shorten duty days for these missile crews by finding tasks that can be eliminated or offloaded as they prepare for alert duty and subsequently return from the missile field. This study found that process improvements can save missile crews over 100 minutes per alert duty.

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