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Analysis and Evaluation of the Macroscopic Organizational Structure of Red Horse

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ANALYSIS AND EVALUATION OF THE MACROSCOPIC ORGANIZATIONAL STRUCTURE OF RED HORSE

THESIS

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AFIT/GEE/ENV/01M-01

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THESIS

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Abstract

The primary contingency engineering capability within the United States Air Force is provided by Rapid Engineer Deployable, Heavy Operations Readiness Squadron, Engineer (RED HORSE). This thesis examines the macroscopic organizational structure of RED HORSE; that is, the manner in which RED HORSE resources (personnel and equipment) are organized collectively, above the unit (squadron or flight) level. It builds on the findings of the Air Combat Command – sponsored RED HORSE 2010 Strategic Study, and focuses on issues of geographic location and chain of command above the unit level, as the study found these two topics were found to be vital to the accomplishment of the RED HORSE mission. Working in direct cooperation with ACC, this research uses value focused thinking and multi-attribute preference theory to create a hierarchical structure depicting the goals and objectives of a qualified decision maker (ACC/CEX). The research effort generated and evaluated 20 alternatives. The decision analysis model recommends an optimal macroscopic organizational structure whereby RED HORSE units are assigned to different theater commands as the most preferred alternative. Extensive sensitivity analysis showed that the model is very reactive to changes in objective and evaluation measure weights, indicating that further research is required.

ACRONYMS

ACC – Air Combat Command
ACC/CEX – Chief, Readiness Division, Directorate of The Civil Engineer, Headquarters Air Combat Command
ACSC – Air Command and Staff College
ADCON – Administrative Control
AEF – Expeditionary Aerospace Force
AEW – Air Expeditionary Wing
AFB – Air Force Base
AFCESA – Air Force Civil Engineering Support Agency
AFT – Alternative-Focused Thinking
AFTL – Air Force Task List
AFRC – Air Force Reserve Command
AGE – Aircraft Generating Equipment
AMC – Air Mobility Command
ANG – Air National Guard
APOD – Aerial Port of Debarkation
APOE – Aerial Port of Embarkation
ARC – Air Reserve Component
CCD – Camouflage, Concealment, and Deception
CE – Civil Engineering
CENTCOM – Central Command
CESS – Civil Engineer and Services School
ConOps – Concept of Operations
CONUS – Continental United States
DA – Decision Analysis
DFP – Defensive Fighting Position
DoD – Department of Defense
DPG – Defense Planning Guidance
EIC – Emergency Information Center
ERC – Exercise Related Construction
ESSO – Executive Support Staff Officer
ESU – Engineer Support Unit
EUCOM – European Command
GPS – Global Positioning Satellite
HCA – Humanitarian/Civic Assistance
ILE – Installation and Logistics, Engineers
JCS – Joint Chiefs of Staff
JEPES – Joint Engineer Planning and Execution System
MAJCOM – Major Command
MECE – Mutually Exclusive, Collectively Exhaustive
METL – Mission Essential Task List
MODA – Multiple Objective Decision Analysis
MTW – Major Theater War
NAF – Numbered Air Force

NBC – Nuclear, Biological, and Chemical
OCONUS – Outside of the Continental United States
OIC – Officer In Charge
OOTW – Operations Other Than War
OPCON – Operational Control
PACAF – Pacific Air Forces
PCA – Permanent Change of Station
POE – Port of Embarkation
POL – Petroleum, Oil, and Lubricants
Prime BEEF – Prime Base Engineer Emergency Force
Prime RIBS – Prime Readiness In Base Services
QDR – Quadrennial Defense Review
RED HORSE – Rapid Engineer Deployable, Heavy Operations Readiness Squadron, Engineer
RHF – RED HORSE Flight
RHS – RED HORSE Squadron
RRR – Rapid Runway Repair
SCARWAF – Special Category Army Units With the Air Force
SOUTHCOM – Southern Command
TAG – The Adjutant General
TBM – Theater Ballistic Missiles
UAV – Unmanned Aerial Vehicle
USAF – United States Air Force
USAFE – United States Air Forces in Europe
UTC – Unit Type Code
VFT – Value-Focused Thinking
WMD – Weapons of Mass Destruction

ANALYSIS AND EVALUATION OF THE MACROSCOPIC

ORGANIZATIONAL STRUCTURE OF RED HORSE

I. Introduction

General Issue

The United States Air Force (USAF) has long recognized the requirement to possess a contingency engineering capability to meet the demands of global force projection. To satisfy this contingency engineering requirement, a military structure within Civil Engineering has been established. The primary element of this structure is RED HORSE (Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer), and it possesses a heavy construction capability not available in other Air Force engineering units. Because of its capabilities, RED HORSE is the USAF organization called upon to establish the initial presence of US military forces.

RED HORSE is comprised of active duty, Air National Guard (ANG), and Air Force Reserve (AFRES) units (squadrons and flights), totaling seven squadron equivalents and nine equipment sets. Together, these units possess a three-fold mission, including: Providing initial response in Multi-Theater War (MTW) scenarios, supporting the newly established Air Expeditionary Force (AEF), and offering Operations Other Than War (OOTW) support as required.

As with all organizations, the way that RED HORSE is organized plays a vital role in allowing it to achieve its objectives. The internal organizational structure of RED HORSE units has remained relatively constant since its inception. Similarly, its macroscopic organizational structure has not experienced substantial changes during that time either, despite its increasing and diverse contingency engineering responsibilities (MTW, AEF, and OOTW). The macroscopic structure is defined as the overarching organizational hierarchy that employs the RED HORSE force as a whole; that is, the command and control structure above the unit level that manages all existing RED HORSE units (active duty, guard, and reserve squadrons and flights) and their accompanying resources (personnel, equipment, vehicles, etc). For example, the macroscopic organizational structure of a USAF CE squadron is depicted in Fig 1.1. The squadron falls under the command of the Support Group Commander; the Support Group, along with three other groups, fall under the command of a Wing Commander; the Wing Commander, along with other Wing Commanders, fall under the command of a Numbered Air Force (NAF); the NAF, along with other NAFs, falls under the command of a Major Command (MAJCOM). Note this macroscopic structure does not include any of the internal workings of the CE squadron itself.

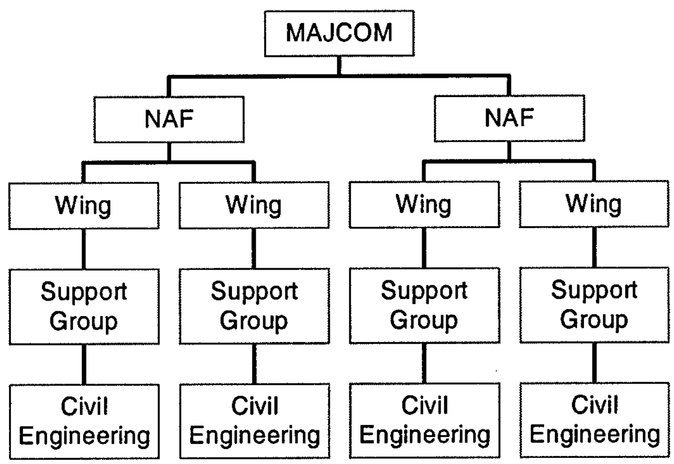


Fig 1.1 – CE Squadron's Macroscopic Organizational Structure

RED HORSE's existing macroscopic organizational structure is confusing at best. In an attempt to become more flexible and enable it to support its three missions, RED HORSE's active duty units have been placed under the administrative control (ADCON) of different Numbered Air Force (NAF) commanders during peacetime, while maintaining their operational control (OPCON) at the MAJCOM level. However, this has created conflicting chains of command, and raised questions as to the boundaries of responsibility and authority over the utilization and employment of RED HORSE units.

The Air Reserve Component (ARC) of RED HORSE, comprised of its ANG and AFRES units, also encounters differing chains of command. This component forms over half of RED HORSE's total force, and has experienced numerous difficulties during attempts to integrate them into the contingency support picture. These units report to both state and federal agencies, and also suffer from split ADCON and OPCON authorities once activated to federal service.

Air Combat Command recently commissioned the RED HORSE 2010 Strategic Study, aimed at identifying and improving upon deficiencies within RED HORSE. Among its findings were the shortcomings inherent in RED HORSE's existing macroscopic organizational structure. The changing and unpredictable global environment in which it operates, an aging vehicle and equipment fleet, and a crippling reliance on transportation were also found to detract from RED HORSE's ability to continue to provide the critical contingency support for which it was founded.

Research Objectives

This research effort builds on the findings and propositions posited by the RED HORSE 2010 Strategic Study, addressing one of the specific uncertainties arising out of the study; the adequacy of the existing macroscopic organizational structure prevalent in RED HORSE. This thesis identifies the goals and objectives contributing to the macroscopic organizational structure of RED HORSE, as defined by RED HORSE experts (ACC/CEX). It investigates the importance and impact of each of these objectives in the macroscopic organizational decision process. Finally, this study suggests potential changes to the current macroscopic structure employed among active duty and Air Reserve Component (Guard and Reserve) RED HORSE units. Specifically, this research effort serves to answer the following queries:

- What organizational structure is most suitable for the heavy construction and contingency engineering capabilities provided by RED HORSE?
- What criteria are most important in developing an optimal organizational structure for RED HORSE?

Overview

The Literature Review (Chapter 2) of this thesis documents the history behind RED HORSE. It discusses the organization's inception during the Vietnam War, as well as the evolution of its current structure. This chapter also presents the findings of the Air Combat Command – sponsored RED HORSE 2010 Strategic Study, specifically identifying those findings that spawned this research effort. Finally, this chapter provides an introduction to decision analysis (DA) and the value-focused thinking (VFT) process that was used to accomplish this study.

The Methodology section (Chapter 3) of this document provides a defensible, transparent, and quantitative methodology to assist USAF decision makers in appropriately structuring RED HORSE. It presents an in-depth discussion of the DA theory and VFT process used in this thesis, applying them directly to the decision opportunity at hand; namely analyzing and evaluating the macroscopic organizational structure of RED HORSE.

The Results and Analysis portion of this thesis (Chapter 4) discusses precisely how the methodology was applied to the decision opportunity. It identifies a qualified decision maker or decision maker's representative (in this case the ACC/CEX), and solicits the different (and oftentimes conflicting) values that contribute to his decision. It quantifies the values and preferences of the decision maker, permitting the generation of twenty alternatives aimed at addressing those specific values. These alternatives are then ranked based on the degree to which they achieve the objectives of the decision maker. Further, the chapter discusses the sensitivity analysis performed on the model, providing insight into the fluctuation in the ranking of alternatives as the decision maker's degree of preference changes.

Finally, the Recommendations and Conclusions section (Chapter 5) of this document presents the most preferred alternative, as posited by the hierarchical model. It provides a summary of the research conducted and the limitations inherent in this study, as well as opportunities to expound upon the findings provided in this thesis.

Scope

This research effort is concerned with the macroscopic organizational structure of RED HORSE. It only addresses those issues of geographic location and chain of command above the unit level. It does not address unit level issues such as the personnel skills mix, vehicle replacement, and unit training. A list of assumptions used to further hone the scope of this thesis are provided in Chapter 4.

Limitations

Due to the complexity of the RED HORSE organizational structure, it is impossible to conceive and account for every little subtle nuance that contributes to the decision-making process. Logical assumptions had to be made to simplify and guide the modeling process. However, these assumptions limited that ability of the model to address each relevant topic.

In addition, this research was concerned with only macroscopic issues of structure; it did not address microscopic, unit level matters. These topics include the unit type code (UTC) distribution within a unit, the adequacy of the training regimen within a unit, or the state of the vehicle fleet existing within a RED HORSE unit. These unit-level issues often dictate manning and resource requirements however, and any discussion of organizational structure must account for these essential microscopic level matters.

Finally, the VFT process is one that relies heavily on the inputs of a single group or individual. The solicitation of objectives and sensitivity analysis are designed to identify and minimize the impact of any biases inherent in the obtained inputs. Due to the initially subjective nature of this process however, not all of the biases may have been accounted for and/or eliminated, and may have affected the results posited by this study.

II. Literature Review

This chapter provides the foundation for this research effort, presenting information that documents the history of RED HORSE and the theory behind its employment. The current structure of RED HORSE, its mission, and its chain of command is discussed. This chapter also presents the threats to which RED HORSE must be able to respond, and the future trends impacting RED HORSE's employment. These aspects of RED HORSE provide an evolutionary roadmap of its current organizational structure and dictate the requirements of any future RED HORSE macroscopic organizational structure. Therefore, it is important to understand these facets prior to developing an effective macroscopic organizational structure.

Finally, this chapter includes an introduction to decision analysis, presenting the basic concepts of value-focused thinking (VFT) that will be applied in this research effort.

History of United States Air Force (USAF) Combat Engineers

The heritage of USAF combat engineers is one that outdates the Air Force itself, beginning prior to the Air Force's existence as an independent service. Originating as a small unit within the Army Signal Corps, the role of USAF combat engineers continued to expand through the first and second World Wars, and into the Korean Conflict era [10:1]. Although the USAF was broken out as a separate service in 1947, it did not possess an organic engineering capability until the mid-1960's [10:3]. Beginning in the post-WWII era, Special Category Army With the Air Force (SCARWAF) units were responsible for accomplishing all contract and troop construction engineering requirements for the USAF [31:17]. These requirements specifically included, "rehabilitation and repair of Air Force bases and facilities...and ... construction or improvement of airfields...[9:1]." Although these units were placed under the operational control of the USAF, they were organized, trained, and supplied by the Army, and remained categorized as Army assets under the 1947 joint services agreements [31:17].

During the Korean Conflict, it became evident that the USAF required an organic combat engineering capability. In his analysis of the role of engineers in Korea, Col R. I. Millberry (an engineering field commander during the conflict) stated:

> "The Air Force has vital need for the Engineer Aviation Forces. They are not combat engineers, and not construction engineers, but specialists in the art of building airfields... a critical support element... rich in equipment which, if operational, provides a tremendous construction potential... They need to be integrated into the Air Force ... They should be building all of the peacetime construction of the Air Force as training for wartime construction [23:114]."

The lessons learned from the Korean Conflict, combined with the Lebanon Crisis of 1958, the Berlin Crisis of 1961, and the Cuban Missile Crisis of 1962, vividly demonstrated the USAF's need for an organic combat engineering capability [10:3].

In response to this new requirement, the USAF developed Prime Base Engineer Emergency Force (BEEF) Teams. The theory behind these organizations was to train and equip the engineers that operated and maintained bases in peacetime to respond to contingency situations in support of air power around the world. These units possessed both recovery and mobility teams; recovery teams to maintain essential operation and maintenance services during and immediately following enemy attack, natural disasters, and other emergencies, and mobility teams to respond to unforeseen contingencies or special warfare operations around the world [10:3]. Although these teams were effective, they provided the USAF neither the heavy repair nor the construction capability it required [6:2].

During the early stages of the Vietnam Conflict, President John F. Kennedy encouraged the Joint Chiefs of Staff (JCS) to use the US presence in South Vietnam as an opportunity to test counter-insurgency equipment and strategies in a guerrilla environment [24:11]. At the same time, Secretary of Defense Robert S. McNamara inquired as to the USAF's ability to construct an operating airfield within enemy territory [30]. In response, Secretary of the Air Force Harold Brown requested permission to stand-up two active duty squadrons to provide the same heavy repair capabilities currently supplied by Army engineers and Navy Seabees [8:7]. Upon approval in the fall of 1964, the 554th and 555th Rapid Engineer Deployable, Heavy Operations Repair Squadron, Engineer (RED HORSE) squadrons were activated in Oct 1965, and deployed to the Southeast Asian Theater in Feb 1966 [31:29]. By the end of the Vietnam War, 6 RED HORSE units had been created and deployed to the Southeast Asian Theater [31:33].

Today, the USAF maintains a military structure within Civil Engineering designed to respond to and satisfy its contingency engineering requirement. This structure consists of two distinct units (Prime BEEF and RED HORSE), each possessing unique qualifications and accompanying resources. Current doctrine dictates the use of Base Engineer Emergency Force (Prime BEEF) squadrons as the primary means of supporting the continued presence of forward-located USAF units. In contrast, doctrine calls upon Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer

(RED HORSE) squadrons to establish the initial presence of US military forces, as they possess a heavy construction capability not available in Prime BEEF.

Current RED HORSE Posture

The USAF currently supports 7 RED HORSE squadron equivalents in order to accomplish its current mission (discussed in the following section). Table 2.1, reproduced from the RED HORSE 2010 Strategic Study [1:Section 7.4.2.1], summarizes these existing RED HORSE units, their sizes, and their locations. These units are comprised of Air Combat Command (ACC), United States Air Forces in Europe (USAFE), and Pacific Air Forces (PACAF) active duty forces, as well as Air Reserve Component (ARC) forces. The ARC consists of Air National Guard (ANG) and Air Force Reserve Command (AFRC) units. These forces (active duty and ARC) are located both in the Continental United States (CONUS) and out of the CONUS (OCONUS). In addition, the ANG and AFRC units are divided into geographically separated flights and paired with another ANG or AFRC sister flight. These sister

Table 2.1 - Demographics of Current RED HORSE units

Unit	Status	Squadron Equivalent	Location
31 RHF	Active Duty	0	Italy
554 RHS	Active Duty	0.4	Korea
254 RHF	ARC (ANG)	0.3	Washington
354 RHF	ARC(AFRC)	0.3	Washington
819 RHS	Active Duty	0.7	Montana
219 RHF	ARC (ANG)	0.3	Montana
820 RHS	Active Duty	1	Nevada
823 RHS	Active Duty	1	Florida
Det 1, 823 RHS	Active Duty	0	Florida
200 RHS	ARC(ANG)	0.5	Ohio
201 RHF	ARC(ANG)	0.5	Pennsylvania
202 RHS	ARC(ANG)	0.5	Florida
203 RHF	ARC(ANG)	0.5	Virginia
307 RHS	ARC(AFRC)	0.5	Texas
Det 1, 307 RHS	ARC(AFRC)	0.5	Louisianna
Total Squadron Equivalents		7	

RHS - *RED HORSE Squadron*
RHF - *RED HORSE Flight*
ARC - *Air Reserve Component*
ANG - *Air National Guard*
AFRC - *Air Force Reserve Command*

flights can be morphed together to provide all of the capabilities of a fully staffed and equipped RED HORSE squadron.

As indicated in Table 2.1, Det. 1, 823 RHS and 31 RHF do not possess a squadron equivalent. Det. 1, 823 RHS is the 69 personnel assigned to the ACC Silver Flag Exercise Site at Tyndall AFB, FL, responsible for the training of active duty and ARC Civil Engineers and Services personnel assigned to Prime BEEF and Prime Readiness in Base Services (RIBS) units. 31 RHF, located in Camp Darby, Italy, is classified as an Engineer Support Unit (ESU). It consists of 41 military personnel charged with maintaining the 2 vehicle and equipment sets pre-positioned in the European Theater [1:Section 10.2.6.1].

Figure 2.1, taken from the RED HORSE 2010 Strategic Study [1:Section 4.3.4], further illustrates the geographic separation between units, and the pairings between ANG and AFRC units. It also points out the collocation between many of the existing units – specifically 254 and 354 RHFs, and 819 RHS and 219 RHF.

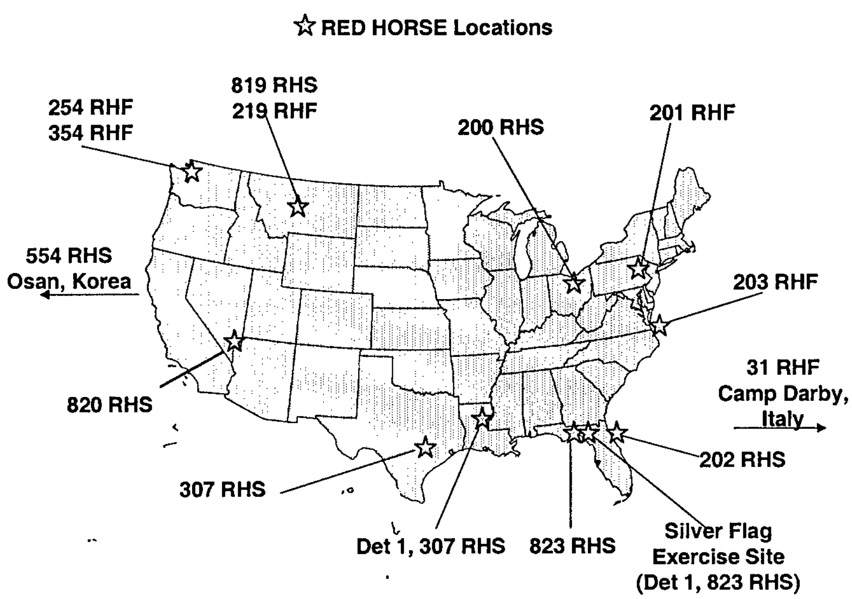


Figure 2.1 RED HORSE Unit Locations (ACC, PACAF, USAFE, AFRC & ANG)

Current RED HORSE Mission

According to the ACC sponsored RED HORSE 2010 Strategic Study, the RED HORSE mission is:

> To provide the Air Component Commander a theater-level combat engineering force delivering highly mobile, rapidly deployable, self-sufficient heavy engineering operations and special capabilities not available from any other Air Force source [1:Section 4.1.1].

To further quantify the tasks encompassed in this mission, RED HORSE maintains a Mission Essential Task List (METL), reflecting its core capabilities in "...a format consistent with the Air Force Task List (AFTL) [1:Section 4.2.1]." The five core tasks identified by the RED HORSE METL are as follows [1:Section 4.2.1]:

- Provide heavy construction operations (horizontal and vertical)
- Provide bare base development (beddown, utilities, and water production)
- Perform batch plant and quarry operations (explosive and mechanical aggregate production)
- Provide asphalt and concrete batch plant operations
- Provide base denial (explosive and non-explosive)

These METLs reflect the tasks that a RED HORSE unit must be able to perform in a contingency situation. The two contingency scenarios that RED HORSE is called upon for support are a Major Theater War (MTW) and Operations Other Than War (OOTW). Although the actions taken in these two environments can appear extremely similar, they are characterized by key differences; namely, war "...encompasses large-scaled, sustained combat operations to achieve national objectives or to protect national interests

[1:Section 5.4.1]," while OOTW "...is conducted to deter war, resolve conflict, promote peace, or support civil authorities [1:Section 5.4.1]."

Major Theater War

The Defense Planning Guidance (DPG) states that the US Armed Forces should be postured in such a manner to support two simultaneously occurring Major Theater Wars. The 2-MTW scenario currently identified for the US military encompasses operations in Southwest Asia (SWA) and on the Korean peninsula. As such, plans are focused on these two theaters to project requirements and develop support plans for use in a MTW contingency. RED HORSE's mission, as it relates to the 2-MTW scenario, is defined by a deployment timeline designed to provide the maximum support to deploying units, and a prioritization of its contingency tasks according to their degree of necessity.

To adequately develop operational plans for a 2-MTW scenario, the requirements of the deploying forces and their resources must be identified. Support forces in a wartime environment require adequate ports, lines of communication, safe communication sites, logistical frameworks, airfields, bases of operation, etc. Installations in forward areas require protection from enemy forces, including the ability to rapidly recover from damage inflicted as a result of enemy attacks. In addition, mobile forces require continual preparation of defensive fighting positions (DFPs) and support bases. These requirements dictate the deployment timeline, identifying the tasks RED HORSE must be able to support. The most critical characteristic in supporting these requirements is responsiveness. As stated by the RED HORSE 2010 Strategic Study:

> The most essential key to wartime construction is speed. Because of rapidly changing situations and the time necessary to make decisions and gather

resources, actual construction work must proceed with extraordinary rapidity to meet mission requirements on time [1:Section 5.5.5.2.2].

To meet the 2-MTW requirements, RED HORSE units must arrive in theater quickly and accomplish heavy construction tasks in the most expedient manner possible. Obviously, construction cannot begin until adequate personnel and assets arrive in theater and at the identified work sites. To ensure the appropriate number of personnel and equipment arrive expediently, CE planners have established a deployment timeline. In reference to the SWA and Korean theaters (the most probable MTW arenas), Table 2.2, taken from the RED HORSE 2010 Strategic Study [1:Section 5.5.4], shows the expected flow of RED HORSE units into each theater for the 2-MTW scenario. As 819 RHS and 219 RHF have just recently been stood up, their deployment timelines have yet to-be-determined (tbd).

Table 2.2 Expected Flow of RED HORSE Units for 2-MTW Scenario

RED HORSE Squadron Equivalent	SWA First		Korea First	
	SWA	KOREA	SWA	KOREA
819 RHS & 219 RHF	tbd	tbd	tbd	tbd
820 RHS	Day 65		Day 3	
823 RHS	Day 65		Day 3	
200 RHS & 201 RHF		Day 9		Day 20
202 RHS & 203 RHF	Day 999			Day 40
307 RHS & Det 1		Day 3		Day 55
554 RHS		In-Place	In-Place	

RED HORSE's construction requirements in a MTW scenario consist primarily of beddown tasks. These tasks allow deploying units to establish operations in a contingency environment. Although standard beddown tasks can be accomplished by both Prime BEEF and RED HORSE units, RED HORSE has been identified specifically to complete the following tasks [1:Section 5.5.5.1]:

- Erecting unsheltered aircraft revetment
- Placing concrete or laying asphalt for aircraft parking
- Constructing earth berms and dikes for fuel bladders

- Erecting Harvest Falcon aircraft hangars (ACH), Frame Supported Tension Fabric Shelters (FSTFS), and dome shelters
- Erecting Harvest Falcon general purpose, extra-large, and large shelters
- Erecting revetment for mission critical vehicles – e.g. fire and crash rescue vehicles; petroleum, oil, and lubricant (POL) vehicles, etc.
- Constructing earth berms and access roads for bomb dumps
- Installing expeditionary aircraft arresting systems
- Constructing aircraft wash racks
- Constructing Aircraft Generating Equipment (AGE) and vehicle wash racks
- Constructing K-span and Super K-span shelters (with or without asphalt or concrete pads)

RED HORSE's beddown tasks can be further prioritized by classifying them according to their overall importance relative to the success of the mission. The classifications of these requirements are those dictated by the Joint Engineer Planning and Execution System (JEPES) – the fundamental system that formally addresses contingency engineer requirements. These classifications are as follows:

- Critical – these are the tasks that are required in direct support of air operations that ensure the launch and recovery of tactical type aircraft within 72 hours after the arrival of engineers. These tasks include the following:

    - Installing airfield lighting systems
    - Installing expeditionary and mobile aircraft arresting systems
    - Constructing aircraft POL bladders and berms
    - Providing temporary power to mission critical facilities (command posts, control tower, aircraft squadron operations, water purification points, etc.)

  Accomplishment of these requirements does not imply that beddown tasks are completed; instead it assumes that the minimum requirements of runway, taxiway, water, communications, fueling and arming capabilities, and parking ramp are available [1:Section 5.5.5.2.4].

- Essential – tasks in direct support of the flying mission and typically required to complete the beddown phase of the deployment qualify as essential tasks. Failing to accomplish these tasks will adversely impact sortie generation. Essential tasks include [1:Section 5.5.5.2.4]:
  - Erecting aircraft and vehicle revetments
  - Constructing ammunition open storage pads and berms
  - Constructing aircraft and AGE wash racks
  - Providing Army Patriot Missile Battery support
- Necessary – all other combat support and combat service support tasks required during the actual period of the conflict are classified as necessary tasks. Although these tasks would be required in any regional conflict, they are given a lesser importance due to various reasons including work-arounds, host nation support, and execution versus deliberate planning force flow. Although this work is identified for RED HORSE accomplishment, it could be completed utilizing other resources (contract, host nation support), or just counted as negligible due to its lesser impact on the overall mission [1:Section 5.5.5.2.4].

Operations Other Than War (OOTW)

Although the concept of OOTW has existed for a generation, it was not established explicitly as a military mission until the 1997 Quadrennial Defense Review (QDR) [1:Section 5.4.1]. OOTW can be basically defined as all operations other than war that encompass the use of military capabilities across the whole range of military operations short of war [1:Section 5.4.1]. Table 2.3, taken from the RED HORSE 2010 Strategic Study [1:Section 5.4.1], reflects the range and types of activities encompassed in OOTW, per AFDD 2-3, Military Operations Other Than War. The right column

Table 2.3 Representative Examples of OOTW from an Air Force Perspective

Typical Combat Operations		Typical Noncombat Operations
Enforcement of Sanctions	Combating Terrorism	Arms Control Support
Enforcing Exclusion Zones	Counterdrug Operations	Domestic Support Operations
Protection of Shipping	Ensuring Freedom of Navigation	Foreign Humanitarian Assistance
Strikes & Raids	NonCombatant Evacuation Operations	Nation Assistance*
	Peace Operations	Show of Force
	Recovery Operations	Support of Insurgency*

displays exclusive OOTW activities, while the left column indicates those activities solely under the label of "combat operations." The middle column lists those activities that can be construed as either combat operations or OOTW, depending on the environment in which they occur.

The theory behind the accomplishment of OOTW is to maintain US interests in foreign territories and preserve the level of daily tensions between nations below the threshold of armed conflict [1:Section 5.4.1]. According to the RED HORSE 2010 Strategic Study, the use of the military "...in non-traditional roles is a proactive approach predicated on the belief that inaction can be costly over the long term or unacceptable to US ideals, broad interests, and public opinion [1:Section 5.4.1]."

Over the past five years, RED HORSE units have been deployed in support of OOTW more than 122 separate times [1:Section 5.4.3]. Although these deployments have been largely concentrated in the Southern Command (SOUTHCOM) and Central Command (CENTCOM) theaters, RED HORSE's presence has been felt in all major theaters around the globe [1:Section 5.4.3], as shown in Figure 2.2. It should be noted that data characterizing the operations in support of the Kosovo Conflict have not yet been made available, but could significantly increase the amount of support provided by RED HORSE to the European Command (EUCOM) theater. Historically, RED HORSE is employed 39% of the time to accomplish Critical Construction, 30% of the time to support Humanitarian/Civic Assistance (HCA) ventures, and 11% of the time to complete Exercise Related Construction (ERC) projects [1:Section 5.4.3]. Figure 2.3, taken from the RED HORSE 2010 Strategic Study [1:Section 5.4.3], illustrates the full range of RED HORSE deployments, as categorized by mission types.

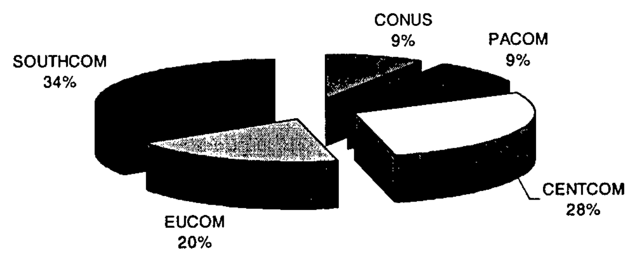


Fig 2.2 RED HORSE OOTW Deployments by Theater

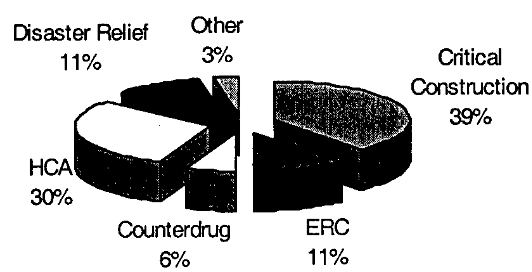


Fig 2.3 RED HORSE Deployments by Mission Type

Historically, the type of OOTW mission has not played a major role in determining the capabilities required by a RED HORSE unit [1:Section 5.4.3]. Rather, OOTW deployments emphasize the imperative ability of RED HORSE to be highly responsive – to all parts of the world [1:Section 5.4.3]. Future projections for RED

HORSE OOTW missions include responding quickly to national disasters and military threats, mandating that units are light, lean, and self-sufficient, with heavy assets pre-positioned in various locations around the world [1:Section 5.4.3].

Expeditionary Aerospace Force (AEF)

With the fall of the Soviet Union and the fragmentation of its components into independent countries, the US no longer has an identified adversary for which to prepare. As such, the threats faced by today's military are more nebulous than at any other time in history. In addition to the general military and conventional threats prevalent throughout the latter half of the 20th century, there are now numerous asymmetrical threats for which the US military and the USAF must be prepared. As the RED HORSE 2010 Strategic Study states:

> This has caused an evolution in strategy that now requires a more global response capability, one that relies less on a permanent presence on foreign soil and more on a CONUS-based agile response that projects lethal force anywhere in the world on short notice [1:Section 5.3.1].

In an effort to provide this global response capability in a manner that provides consistency and flexibility in meeting its contingency requirements, the Air Force has implemented the AEF concept. The AEF is the Air Force's initiative to "organize, train, equip, and sustain itself to provide rapidly responsive, tailored aerospace forces for the 21st Century military operations [1:Section 5.3.1]." This approach has resulted in the reorganization of the Air Force's mobility forces to meet ongoing and unforeseen contingencies on a predictable, rotational basis. AEFs are pre-determined sets of forces (aircraft, equipment, and personnel) from which tailored force packages can be employed in support of theater commanders [1:Section 5.3.2]. It consists of a lead wing from a base that is augmented as required with additional weapons systems, personnel, and resources from other bases. Together, the identified units from these various bases form an AEF comprising over 150 aircraft and 10,000 - 15,000 personnel. As part of each AEF, Prime BEEF personnel – sourced from the bases of the lead wing and augmenting units – are assigned to support any generic contingency engineering requirements that may arise during the deployment of any AEFs.

Having established 10 AEFs, the Air Force is able to implement a 15-Month rotational schedule whereby predetermined forces are capable of responding to any contingencies that may arise. Figure 2.4, taken from the RED HORSE 2010 Strategic Study, illustrates this rotational schedule [1:Section 5.3.3]. This rotational schedule occurs by placing two AEFs on "stand by" for a three-month period, after which they stand down and resume normal training and exercises while the next two AEFs stand by.

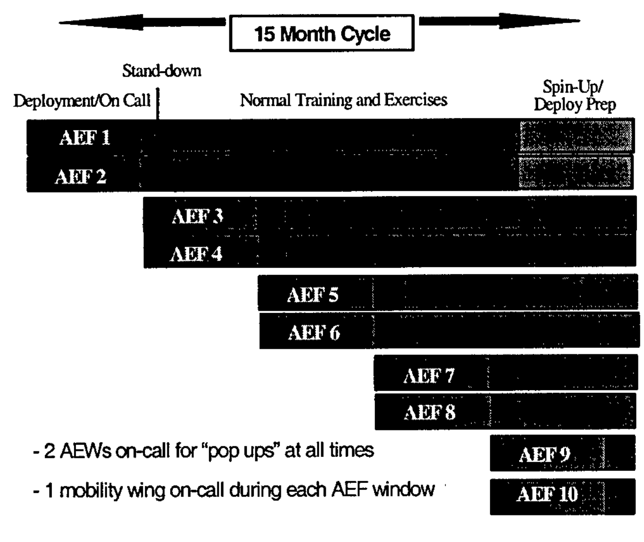


Figure 2.4 AEF 15-Month Rotational Cycle

In addition to those forces identified as part of an AEF, two Air Expeditionary Wings (AEW) exist to provide composite wing support as needed to the deployed AEFs.

These AEWs are based at Mountain Home AFB, ID and Seymour Johnson AFB, NC, and are comprised primarily of strike and support aircraft [1:Section 5.3.3]. These AEWs obtain engineering support from their respective Prime BEEF units, similar to AEFs.

Also as part of the AEF concept, five separate mobility wings have been established. These mobility wings (a.k.a. enablers) are not tied to any particular AEF; instead they provide support during operations other than war (OOTW) scenarios where combat aircraft would not be required. In this manner, enablers are able to provide on-call support to deployed AEFs or AEWs as required. Finally, non-deploying personnel (civilians, strategic withholds, etc.) are identified to provide support from their home stations locations to those forces deployed worldwide.

Since Prime BEEF forces assigned to the AEF or AEW are capable of providing the typical level of engineering support required in a contingency, RED HORSE's purpose in the AEF is to fulfill any potential heavy engineering requirements that are beyond the capabilities of deployed Prime BEEF forces [1:Section 5.3.4]. Unlike Prime BEEF units however, there are not enough RED HORSE units to assign one per AEF. Therefore, RED HORSE supports the AEFs and AEWs as an enabler, providing the reach back, on-call capability to support contingencies as required. This role is depicted in Figure 2.5 below.

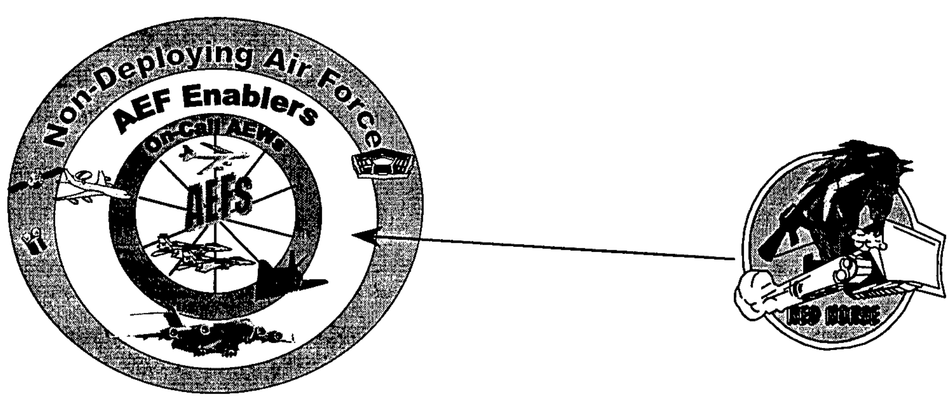


Figure 2.5 RED HORSE and The Expeditionary Air Force

To provide this on-call contingency support, substantial portions of a RED HORSE unit are always on standby to furnish the reach-back heavy construction capability. This standby responsibility is rotated among the three active duty ACC RED HORSE squadrons and the three ARC RED HORSE squadron equivalents [1:Section 5.3.4]. Once solicited for support, these standby units are required to respond anywhere in the world with a 16-person advance team within 16 hours, followed by a 148-person self-sustaining construction team within 96 hours [1:Section 5.3.4]. (The advance team is responsible for preparing the deployed location for the arrival of the construction team). Standby units are also used to support "pop-up" requirements throughout the world, similar to the mobility wings identified in the AEF concept. Finally, the standby RED HORSE has the flexibility to assign personnel as required to support priority requirements – i.e. placing troop training projects on hold to support an AEF, re-deploying personnel early from a lesser priority deployment, etc [1:Section 5.3.4].

Other Mission Parameters

Aside from these aspects of the RED HORSE mission that govern the employment of its units, the following are four additional parameters that govern the theory behind RED HORSE employment as put forth by the RED HORSE 2010 Strategic Study [1:Section 4.1.2]:

- Deployed RED HORSE squadrons are theater assets and support air component commander's priorities as the order of battle dictates

- Personnel and equipment are primarily planned as air transportable. Although sealift is a common mode of transportation, logistics detail in the Unit Type Code (UTC) database is based on an airlift configuration
- Deployed squadrons are self-sufficient and capable of independent operations in remote, austere environments. This self-sufficiency includes organic medical support, services, vehicle maintenance, logistics, and contracting. RED HORSE is dependent on availability of fuel, a water source, construction materials, and other inherent resources, but possesses many capabilities which allow them to use local raw resources for self-sufficiency (e.g. water well drilling, quarry operations, etc.)
- Deployed squadrons are capable of operating in elevated security threat environments. While RED HORSE units will not generally operate independently in more than a Level 1 threat environment, the mission may require operating in locations where little or no protective security force is present. Hence, deployed squadrons are equipped and trained in ground defense measures, organic convoy, and work-party security. Level I exposure includes small-scale threats conducted by agents, sympathizers and partisans, and agent supervised or independently initiated terrorist activities.

The theory behind RED HORSE employment is not without its flaws though. In order for RED HORSE to accomplish its "critical" mission requirements, it must be on site with all required equipment from the beginning of the contingency. However, RED HORSE does not possess an in-house airlift capability, nor has it been assigned dedicated airlift. The employment of RED HORSE units, like most all other military units, is extremely dependent upon logistics and transportation systems external to its own organization. As stated in the RED HORSE 2010 Study,

> The fundamental vulnerability of this concept [RED HORSE employment] has been its reliance on timely air and sealift or sufficient lead-time to move CONUS based equipment packages into theater when needed [1:Section 4.7].

This dependence upon logistics and transportation systems make RED HORSE susceptible to circumstances beyond its control. As such, RED HORSE cannot guarantee that it will arrive in theater with all resources required to accomplish the mission, according to the timeline designated by doctrine.

Chain Of Command

Currently, there is no uniform chain of command for RED HORSE units during peacetime. Rather, most RED HORSE units are called to serve two masters, falling under the *administrative control (ADCON)* of one organization, and the *operational control (OPCON)* of another. In order to understand how these control functions are subdivided, the functions themselves must be understood. Abridging the definitions put forth for these hierarchical terms from Joint Publication 1-02, DoD Dictionary of Military and Associated Terms, the RED HORSE 2010 Strategic Study states that ADCON pertains to that organization exercising control over "...organizing, training and equipping the unit or personnel, as well as who accomplishes disciplinary and administrative actions [1:Section 4.5.2]." Conversely, it summarizes OPCON as applying to the organization that "... exercises overall authority over mission requirements, assignments, movement, and all other aspects of the mission [1:Section 4.5.2].”

Table 2.4, taken from the RED HORSE 2010 Strategic Study [1:Section 4.5.2], depicts the various reporting agencies for RED HORSE active duty and reserve units. As can be seen, the associated Numbered Air Force (NAF) has ADCON over active duty and ARC RED HORSE units, while the parent major command (MAJCOM) maintains OPCON.

Table 2.4 - RED HORSE reporting agencies

Unit	Location	ADCON	OPCON
820 RHS	Nellis AFB, NV	12 AF	HQ ACC
823 RHS	Hurlburt Field, FL	9 AF	HQ ACC
Det 1, 823 RHS	Tyndall AFB, FL	9 AF	HQ ACC
819 RHS	Malmstrom AFB, MT	9 AF	HQ ACC
219 RHF	Malmstrom AFB, MT	MT ANG	MT ANG
554 RHS	Osan AB, ROK	7 AF	7 AF
254 RHF	Camp Murray, WA	WA ANG	WA ANG
354 RHF	McChord AFB, WA	10 AF	HQ AFRC
307 RHS	Kelly AFB, TX	10 AF	HQ AFRC
Det 1, 307 RHS	Barksdale AFB, LA	10 AF	HQ AFRC
200 RHS	Camp Perry, OH	OH ANG	OH ANG
201 RHF	Ft. Indiantown Gap, PA	PA ANG	PA ANG
202 RHS	Camp Blanding, FL	FL ANG	FL ANG
203 RHF	Camp Pendleton, VA	VA ANG	VA ANG
31 RHF	Camp Darby, IT	31 FW	HQ USAFE

NOTE: 7 AF headquartered at Osan AB, ROK
9 AF headquartered at Shaw AFB, SC
10 AF headquartered at NAS Fort Worth JRB, TX
12 AF headquartered at Davis-Monthan AFB, AZ

The peacetime chain of command is much more bureaucratic for ANG RED HORSE units however. As the RED HORSE 2010 Strategic Study summarizes, these units

> “…typically answer directly to the Assistant Adjutant for Air at the respective State Military Departments. However, since the Assistant Adjutant for Air is

> normally a traditional "guardsperson," the fulltime Executive Support Staff Officer (ESSO) for air provides command management for routine and daily functions. The ESSO fulfills the policies and decisions of the Assistant Adjutant for Air. The Assistant Adjutant for Air in turn reports to The Adjutant General (TAG) of the respective state. Depending on the state, the TAG may or may not have a direct link to the Governor. In many cases, the State Military Departments answer to a Department of Public Safety which is headed by one of the governor's cabinet members. The actual title of this department may vary from state to state, but its function remains constant. The Department of Public Safety provides a central focal point and political command functions for agencies that deal with public safety interests... [1:Section 4.5.2]."

Further, all peacetime readiness functions of the ANG are managed under the direct guidance of the National Guard Bureau in Washington D.C. Among those functions included are "...providing facilities (construct and maintain), training areas, material acquisition, budget management, equipment maintenance, legal management, training and ultimately activation [1:Section 4.5.2]." Although guard training is technically a federal activation procedure, the management of this function remains under state control [1:Section 4.5.2]. For purposes other than training, either the state or federal government may invoke activation of the ANG. Although state activation procedures vary, they are typically administered through the respective Department of Public Safety or an Emergency Information Center (EIC) that is managed either out of the Department of Public Safety or State Military Department. Once activated, the guardsperson essentially becomes a state employee for the duration of the activation period [1:Section 4.5.2].

During times of war, the command relationships discussed thus far do not hold. Instead, air component commanders have OPCON of deployed RED HORSE units.

Oftentimes, these units combine to form a composite RED HORSE group when two or more units are deployed in support of the same theater of operations. The command of such a composite group is assigned to the air component command engineer or the designated RED HORSE squadron commander [1:Section 4.5.2].

Current Threats

With the United States remaining as the lone world superpower, the U.S. military has experienced a "...major paradigm shift from the bipolar Cold War mentality to a post-Cold War reality [1:Section 5.3.1]." In doing so, the United States can no longer prepare for a single, known, and tangible opponent; instead, we must now operate in an unpredictable environment that encompasses a number of possible enemies who have the potential to threaten regional stability, international interests and values, or even national defense at various levels of engagement – ranging from global nuclear conflict to regional conventional attacks. As such, U.S. forces must be prepared to not only provide support in response to two separate MTWs, but also to meet general threats (any action against US positions and aircraft), conventional threats (theater ballistic missiles, cruise missiles, and unmanned aerial vehicles), and asymmetrical threats (chemical and biological weapons, radiological weapons, toxic industrial chemical agents, terrorists, and special operations forces). These threats will mandate the capabilities required of US forces in the future, thereby defining the future Concept of Operations (ConOps) for USAF CE forces, including RED HORSE. As such, these threats could impact the most effective way to organize RED HORSE from a macroscopic perspective. Hence, each of these threats must be accurately defined in order to understand how they will specifically affect RED HORSE.

General Threat

General threats can be described as those directed against US airpower and its support elements anywhere in the world. As air power is most vulnerable while concentrated on the ground, AF Civil Engineers must be prepared to meet the full spectrum of enemy threats, and recover from any damaged inflicted on US assets [1:Section 5.2.2]. Although these threats can be minimized (pest control), most will have to be met actively – airbase ground defense – or passively – i.e. hardened shelters; camouflage, concealment, and deception (CCD); chemical and biological defense ensembles. These threats can surface in both MTW and OOTW scenarios. For RED HORSE, the general threat necessitates that it is postured to effectively accomplish expedient heavy construction operations prior to and after an attack.

Conventional Threat

Currently there is no single country in the world capable of preventing the US from achieving and maintaining air superiority in any conventional situation [1:Section 5.2.3]. However, conventional weapons such as theater ballistic missiles (TBMs) and unmanned aerial vehicles (UAVs), carrying conventional payloads, pose a direct threat to US bases worldwide. These delivery systems are cheaper to obtain and maintain than full-scale air forces, making their proliferation in the future most likely. Although these adversarial weapons systems are currently incapable of accurately targeting and eliminating pivotal friendly assets, the introduction of global positioning satellite (GPS) systems will soon upgrade their capabilities. Technological improvements will also improve these delivery systems, allowing for larger payloads, longer ranges, and lower detection signatures [1:Section 5.2.3]. These improvements will increase the threat to friendly assets substantially, providing the ability for adversaries to accurately target critical resources.

Similar to general threats, conventional threats can occur in either of the primary contingency scenarios (MTW or OOTW). Despite the scenario, USAF CEs must be able to support against the entire spectrum of conventional threats (either actively or passively), as well as provide expedient damage recovery operations. For RED HORSE, its mission currently remains the same in response to a conventional threat as to a general threat – accomplishing expedient heavy construction operations in a threat environment.

Asymmetrical Threat

Threats not falling within the definition of general or conventional are termed as asymmetrical by the RED HORSE 2010 Strategic Study [1:Section 5.2.4]. Asymmetrical threats are primarily weapons of mass destruction (WMD) – i.e. nuclear, biological, and chemical (NBC) weapons – but they also include attacks from terrorists and special operations forces [1:Section 5.2.4]. These weapons can be delivered by conventional (combat aircraft or artillery) or unconventional (terrorists or UAVs equipped with asymmetrical payloads) means. Should they be delivered unconventionally, friendly forces will have minimal, if any, warning. Further, these weapons are capable of striking any target at any location. As such, enemies will most likely seek these less expensive alternatives to counter USAF superiority [1:Section 5.2.4].

Although Air Mobility Command (AMC) is tasked with air operations and NBC defense missions, they are not organized, equipped, or manned to accomplish the latter of these missions. It was proposed to utilize the current capabilities of Prime BEEF teams, however the RAND and Pope/Bragg studies proved that the capabilities of these units were insufficient [1:Section 5.2.4]. Another option to meet these threats is to task RED HORSE. Currently RED HORSE is able to provide required heavy construction capability, but possesses sufficient NBC capability for short-term self-sustainment only. If RED HORSE was chosen to provide NBC defense, its capabilities must be expanded significantly beyond those currently existing [1:Section 5.2.4].

Future Trends

Analyzing future trends to determine their effect on military operations has long been a custom in the US military. In his Air Command and Staff College (ACSC) dissertation, Maj. James T. Ryburn points our this ancient custom

> The great airpower strategist, Giulio Douhet wrote, "He who intends to build a good instrument of war must first ask himself what the next war will be like [29:9]."

In addition to the posture, mission, and threats for which RED HORSE is currently designed to operate, there are several emerging trends that will impact RED HORSE's future capabilities and ConOps. These trends could have an impact on the most effective way to organize RED HORSE units from a macroscopic perspective. The primary future trends are jointness and force protection.

Jointness

In any future role, CE and RED HORSE will be increasingly expected to work with joint and coalition forces, but must be prepared to operate independently [1:Section 5.2.5]. From a military perspective, there are currently several means to accomplish contingency engineering requirements. Included among these are AFCAP, LOGCAP, Army Construction Battalions, Navy SEABEES, 49 Munitions Maintenance Squadron, Prime BEEF, and RED HORSE. It is imperative not only that RED HORSE's role with respect to comparable capabilities in other services is defined, but that its role relative to the CE capabilities present within the USAF is defined as well [25:3]. Further, it is essential that the roles of each of the military CE units can be employed effectively and jointly, without compromising the capability of any individual unit.

Force Protection

Other trends that are emerging have the potential to pose significant threats to the safety of US personnel at home and abroad. Out of necessity, force protection considerations have become of the utmost priority in any deployment scenario. Previously, RED HORSE was able to rely on its assigned force protection specialist and the weapons, convoy, and personal security training undergone by all unit personnel. However, certain emerging trends have the potential to increase the threat to U.S. personnel beyond the level to which RED HORSE is currently capable of meeting. If these trends continue, they could significantly affect the manner in which RED HORSE is structured. The trends directly contributing to the increased emphasis on force protection can be quantified as global trends and general military trends.

Global Trends – these include factors such as overpopulation, cultural clashes, lack of natural resources, and increasing presence of non-national entities [1:Section 5.2.6.1]. These conditions will directly contribute to an increase in the number of humanitarian projects undertaken by US forces (i.e. Somalia, Kosovo, etc.). It is imperative that military roles in such engagements are clearly defined, as troops will be armed for self-defense purposes. Training must be accomplished to provide US troops the ability to employ non-lethal means of self-defense to avoid turning the local populace into enemies [1:Section 5.2.6.1]. In the CE community, RED HORSE stands to incur an increase in its operations tempo as a result of increased humanitarian projects. As such, they must be equipped with the self-defense skills to sufficiently protect themselves while not impacting the host nation any more than necessary.

General Military Trends – military-specific factors that could affect future missions deal primarily with advances in technology [1:Section 5.2.6.2]. It can be assumed that technology and weapons will be developed and introduced at the same rate as technology growth. This exponential growth of technology combined with the likelihood of national foes to exploit non-traditional vulnerabilities will require thorough intelligence monitoring and continual communications security [1:Section 5.2.6.2]. Deployed forces must be able to work with both of these services to ensure their intelligence is current and their systems are secure. These issues directly affect RED HORSE as it is the initially deployed engineering unit for most contingencies and possesses the greatest chance of encountering these latest threats. As such, RED HORSE must ensure that its personnel possess the proper training and equipment to counter any such attacks. Currently, four emerging military trends exist [1:Section 5.2.6.2]:

Lasers – available now, the capabilities of these weapon are increasing to cause blindness, damage sensors, and track firing positions. It is very likely that these systems will become smaller (human portable and vehicle mounts), less expensive, and more difficult to detect (with little to no warning). Laser eye protection will be required by deploying troops, requiring new equipment and training

Radio Frequency Radiation – also available now, the capabilities of these weapons are increasing to damage electronics and injure people. Currently technology to combat this threat is cost-prohibitive, but needs to be explored to provide sufficient protection to friendly personnel and assets. At a minimum, RED HORSE units should undergo awareness training to prepare them for this possible threat.

Infectious Disease – dangerous flora and fauna, weather, and climate significantly contribute to the threat of infectious diseases facing deploying US forces. With an increase in humanitarian missions, AF units (including RED HORSE) will be deployed to underdeveloped parts of the world more frequently, increasing the susceptibility of personnel to infectious diseases. Deploying units must be able to deploy with qualified medical technicians who can quickly identify these threats and respond effectively. In addition, deploying units should undergo medical safety training that has been tailored to address the specific deployed environment prior to deployment.

Culture – as humanitarian missions increase and US units operate in underdeveloped regions of the globe, cultural differences will become greater. These differences will affect the manner in which work is accomplished in the region – contract negotiation, religious sensitivies, acceptable/unacceptable behavior, etc. RED HORSE and other units must receive adequate cultural training to ensure accomplishment of mission objectives.

Recommendations of the RED HORSE 2010 Strategic Study

In response from MGen Robbins' (current HQ AF/CE, previously ACC/CE) directive to analyze RED HORSE from the perspectives of "Relevant, Ready, and Right Sized," The RED HORSE 2010 Strategic Study generated 13 hybrid proposals [1:Section 7], listed the 11 most prevalent strategic improvements [1:Section 9], and identified two specific areas of further study [1:Section 10]. These recommendations put forth by the RED HORSE 2010 Strategic Study provide direction and guidance for further research into matters pertaining to RED HORSE, including this thesis.

Hybrid Proposals

Of the 13 hybrid proposals developed, eight addressed unit-specific issues such as increasing manpower authorizations, adjusting authorized UTCs (the skills mix present within a RED HORSE squadron), and changing the vehicle fleet makeup within a unit. The remaining five proposals specifically addressed reorganization topics from a macroscopic perspective. The first addresses the "Relevant" aspect of the study, aimed at improving RED HORSE's core capabilities to fulfill its customer's demands. This proposal is:

- **Proposal #3: Reorganize RED HORSE into a joint setup, while maintaining its existing UTC setup**. This proposal mandates that RED HORSE should be organized in peacetime as it is in wartime. As RED HORSE is involved in joint operations with increasing frequency, it should maintain a joint organizational structure to alleviate the transition period currently required when deploying to a joint contingency. It further suggests that RED HORSE should adopt an organizational structure similar to those of its Army (Army Construction Battalions) and Navy (Seabees) counterparts [1:Section 7.4.1.3].

The remaining four hybrid proposals all addressed the "Ready" criterion of the study, aimed at improving the responsiveness and flexibility of RED HORSE. These proposals are as follows:

- <u>Proposal #4</u>: **Forward stage 55% of RED HORSE vehicle and equipment sets overseas to support MTW and OOTW theaters.** There are two primary advantages of this proposal: reducing the weight of CONUS RED HORSE units and decreasing the time required for vehicles and equipment to arrive at a contingency location. Historically, RED HORSE has been very heavy and difficult to transport due to the vehicles and equipment it requires to accomplish its mission. This has resulted in its under-utilization in contingency situations. Forward locating vehicle and equipment sets in various global theaters would reduce RED HORSE's transportation requirement to personnel only. This would drastically decrease the weight of RED HORSE, currently the limiting factor in scheduling airlift, allowing for faster response. In addition, vehicle and equipment sets would already be located in the contingency theater, dramatically reducing the time required to transport the vehicle and equipment sets to the contingency location [1:Section 7.4.2.1].
- <u>Proposal #5</u>: **Relocate one ACC and one AFRC CONUS RED HORSE unit to establish more co-located units and partnerships for improved training and efficiencies.** This proposal advocated the relocation of 823 RHS from its current location at Hurlburt Field, FL to Barksdale AFB, LA to co-locate with Det 1, 307 RHS. It also proposed relocating 307 RHS from Kelly AFB, TX to Nellis AFB, NV to co-locate with 820 RHS. These relocations would allow CONUS

units to pool vehicle and equipment resources. Currently, RED HORSE does not possess a full contingent of vehicle and equipment assets; those they do possess are in extremely high demand. Co-locating units would allow active duty units to take advantage of the AFRC resources that are not fully utilized, while providing additional training opportunities to AFRC personnel. In addition, these proposed relocations would position all units closer to major transportation hubs (air, land, and sea), increasing the transportation options for movement of RED HORSE resources. Increasing the availability of equipment and decreasing the distance it must travel would both increase RED HORSE's readiness [1:Section 7.4.2.2].

- **Proposal #6: Establish RED HORSE forward operating presence in SWA, EUCOM, and SOUTHCOM theaters for a permanent TDY presence**. This proposal is similar to proposal #4; that is, forward locating RED HORSE assets in contingency theaters to decrease the time it takes to arrive and begin operations at a contingency location. In addition to this basic premise, this proposal advocates forward-locating personnel along with vehicle and equipment assets. This would further reduce RED HORSE's response time by pre-positioning all required resources (personnel, vehicles, and equipment) in global theaters. This would significantly improve the familiarity of RED HORSE personnel to operate in the various contingency theaters around the globe, increasing its effectiveness in contingency environments [1:Section 7.4.2.3].

- **Proposal #7: Realign 31 RHF from USAFE to ACC**. Implementing this proposal would align the RED HORSE resources existing in EUCOM with the MAJCOM tasked with identifying and supporting MTW requirements for the EUCOM and CENTCOM theaters. This realignment would streamline the chain of command, forming a single force provider of RED HORSE capability (ACC) for all unified commands. In addition, it would improve the ability to fund 31 RHF requirements [1:Section 7.4.2.4].

Strategic Improvements

The RED HORSE 2010 Strategic Study also posits eleven strategic improvements for enhancing RED HORSE's capabilities and missions. These suggestions are overarching approaches to improving RED HORSE's ability with respect to "Relevant, Ready, and Right Sized." Of the eleven suggestions, seven deal with internal organizational issues such as increasing manpower authorizations, adjusting authorized UTCs, and changing the vehicle fleet makeup within a unit. The remaining four pertain directly to macroscopic organizational issues, most of which have already been discussed elsewhere in this chapter. All four of these strategic improvements pertain to the "Ready" perspective of the study, attempting to improve RED HORSE's responsiveness and flexibility [1:Section 9]. These suggestions are:

- Forward stage more vehicle and equipment assets to support both MTW and OOTW theaters of operation
- Create co-located active duty and AFRC relationships
- Establish a RED HORSE forward operating location in CENTAF for ACC RED HORSE personnel to provide a permanent presence (similar to the Navy Seabee's concept)
- Improve ACC's ability to provide RED HORSE forces and necessary assets to multiple theater CINCs by realigning 31 RHF from USAFE to ACC

Areas of Further Study

Finally, the RED HORSE 2010 Strategic Study identifies two specific areas of further study that could potentially enhance RED HORSE's ability to perform. One of these areas of study specifically addresses a macroscopic organizational issue of RED HORSE; namely, the reorganizing of active duty RED HORSE units to streamline its peacetime and/or wartime command structures (i.e. ADCON and OPCON). This scenario also includes the realignment of 31 RHF under ACC, as discussed in the previous two sub-sections. Within this proposition, the study puts forth three organizational options:

- **<u>Organizational Option #1</u>: Stay the same**. This is the status quo alternative that maintains the current chains of command for active duty units; that is, OPCON held by ACC, and ADCON held by two different NAFs [1:Section 10.2.5.1].

- **<u>Organizational Option #2</u>: Realign 820 RHS to 9th AF**. This alternative reorganizes all active duty units so that each falls under the ADCON of 9th AF (CENTAF). This option streamlines the peacetime chain of command by centralizing all three active duty units under one NAF. In addition, it maintains NAF influence in the employment of RED HORSE. This alternative does not alleviate the differing wartime and peacetime chains of command however, as ACC would maintain OPCON [1:Section 10.2.5.2].
- **<u>Organizational Option #3</u>: Establish an ACC RED HORSE Group Under HQ ACC**. This organizational option entirely streamlines the command of active duty units, by bequeathing ADCON and OPCON to HQ ACC. Although this is the ideal situation from a command perspective, it removes any influence over RED HORSE employment that the NAFs (and their respective theater commands) currently have. [1:Section 10.2.5.3].

<u>Decision Analysis and Value-Focused Thinking</u>

Decision analysis (DA) is a prescriptive approach to decision-making. It provides the structure and guidance that allows imperfect people to think systematically in difficult situations, thereby reaching good decisions. It aids decision makers not only in structuring complex decisions, but also in identifying sources of uncertainty, representing that uncertainty in a systematic way, and in providing a framework, models, and tools for handling decisions where there are multiple and sometimes conflicting objectives [3:4].

Figure 2.6 best represents the typical DA process [14:2-2]. This process depiction is modified from the original one put forth by Clemen, whereby he further classifies the third step (Decompose and Model the Decision Opportunity) into three sub-modeling steps [3:6]. The flowchart in Fig 2.6 illustrates the iterative process characteristic of DA. It posits a method to identify, structure, and analyze any DA dilemma. Once insight is gained from initially accomplishing the process, this method then offers the decision maker an opportunity to revisit the objectives, alternatives, and model that comprise the decision opportunity. This iterative process allows for continuous improvement throughout the analysis [17].

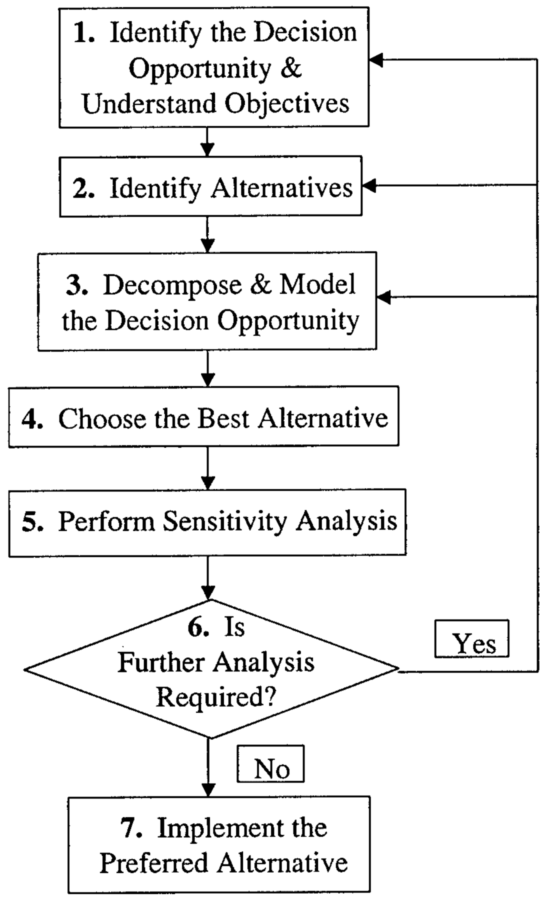


Figure 2.6 – Modified DA Process Flowchart

Within DA, there are two possible methods of approach, Alternative-Focused Thinking (AFT) and Value-Focused Thinking (VFT). These two approaches are illustrated in Figure 2.7 [16]. AFT, termed by Keeney, is the standard decision making approach. It identifies potential alternatives and evaluates those alternatives based upon the merits of each alternative. According to Keeney, this traditional approach "is reactive, not proactive. Furthermore, it is backward; it puts the cart of identifying alternatives before the horse of articulating values" [13:33]. Moreover, this approach fails to clearly define a procedure of how to identify and structure the objectives of the decision maker, nor does it indicate how to utilize the objectives to guide the decision maker's thinking [12:4].

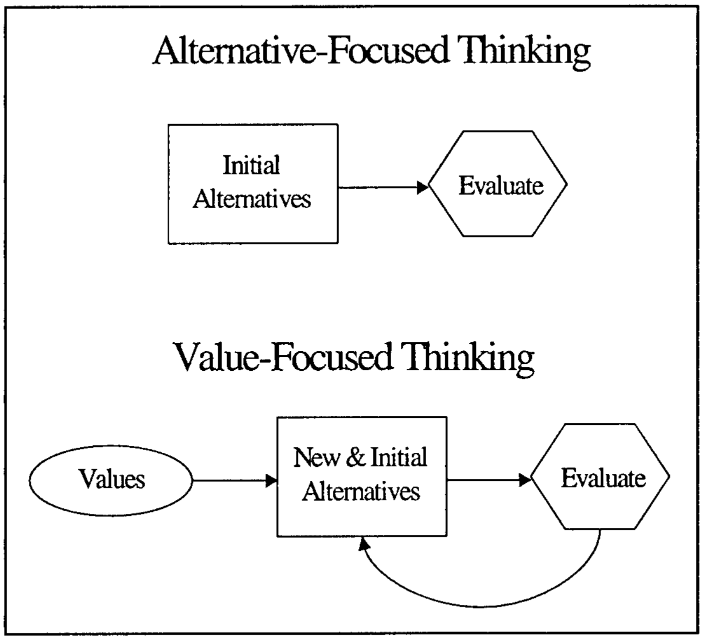


Figure 2.7 – Alternative and Value Focused Thinking Approaches

Conversely, VFT (also termed by Keeney) is a proactive approach, focusing on the values of the decision maker rather than generating alternatives [13:33]. This approach challenges the decision maker to consider the purpose in making his or her decision. Challenging the decision maker in such a way oftentimes uncovers hidden objectives not yet considered. VFT improves communication among decision makers, leads to more productive information gathering, enhances coordination of interconnected decisions, facilitates involvement of multiple stakeholders, generates better alternatives, and identifies more appealing decision opportunities [13:33]. In addition, the creative nature of VFT to generate new alternatives that did not exist previously, allows it to best meet the needs of the decision maker by expanding the spectrum of possible solutions beyond those that currently exist [3:200].

This chapter summarized the history of RED HORSE and the theory behind its employment. RED HORSE's current structure, mission, and chain of command were discussed, and the threats to which RED HORSE must be able to respond, as well as the future trends impacting RED HORSE employment were presented. Finally, this chapter included an introduction to decision analysis, presenting the basic concepts of value-focused thinking (VFT). The next chapter will provide a detailed review of the DA and VFT processes, directly applying them to the decision opportunity at hand; namely, suggesting the best macroscopic organizational design for RED HORSE.

III. Methodology

This chapter describes the DA and VFT processes in more detail, applying them directly to the decision opportunity at hand; namely suggesting the best macroscopic organizational structure for RED HORSE. It will employ the modified DA process flowchart (Fig 2.6) to outline the proposed methodology to be used in accomplishing this research. Throughout this chapter, the decision process of purchasing a car will be used to further illustrate each step of the DA procedure.

Identify the Decision Opportunity and Understand Objectives

As illustrated in the DA flowchart presented in chapter 2, the first step in any DA process is to accurately identify the decision opportunity, and understand the objectives that contribute to that decision opportunity.

1. Identify the Decision Opportunity & Understand Objectives

Figure 3.1 – Step 1 in the DA process

Identifying the Decision Opportunity

Identifying the decision opportunity consists of three separate steps. The first is to isolate and define the specific decision that needs to be made. The second is to determine the decision maker; that is, the most appropriate person to make that decision. The third is to posit a value function; that is, the compelling reason for which a decision maker would be interested in the analysis [16]. In purchasing a car, the decision opportunity would be deciding which car to buy, the decision maker would most likely be the person purchasing the car, and the value proposition would be "to select the best vehicle for me."

Isolating the decision for this research opportunity was based upon issues identified during the ACC-sponsored RED HORSE 2010 Strategic Study. Several of the queries in the study raised the question of whether or not RED HORSE was effectively organized from a macroscopic perspective [25:3-5]. The study addressed these issues and suggested an alternative organizational structure based primarily upon a Delphi method of decision making [1:Section 10.2]. In addition, the study posited four strategic improvements and five separate proposals that addressed altering RED HORSE's macroscopic organizational structure. However, the approach taken in the study only accounted for the operational objectives of a RED HORSE unit; it did not take into account the entire range of objectives of a potential decision maker faced with the opportunity to define the macroscopic organizational structure of RED HORSE. As such, a decision opportunity was identified to suggest the best macroscopic organizational structure for RED HORSE, based on the findings of the study and taking into account all of the objectives a decision maker would employ in making this determination.

The decision maker for any decision opportunity must be qualified to resolve the specific query identified as the decision opportunity. He/she must be knowledgeable about the subject encompassing the decision opportunity, and have sufficient influence in the area of the decision opportunity to express qualified opinions and accurate statements about the subject. The decision maker for this research focus, and for any organizational matters involving USAF CE units, is Civil Engineer (AF/CE), currently a Major General. However, a combination of the time consuming, iterative nature of the DA process and the AF/CE's exhaustive schedule made it impractical to continually work with him throughout the duration of this study. Therefore, a decision maker's representative was required; this person must be qualified to provide insight into the opinions and attitudes of the decision maker. For this study, the decision maker's representative will be the Chief, Readiness Division, Directorate of The Civil Engineer, Headquarters Air Combat Command (ACC/CEX), currently LTC Brent Chubb. The ACC/CEX is the person tasked with the OPCON of all active duty RED HORSE units, and traditionally been the person to set RED HORSE policy. As such, the ACC/CEX is qualified to speak for the decision maker on matters pertaining to RED HORSE and its macroscopic organizational structure. As a bonus, the current ACC/CEX was also the person tasked by ACC/CE with overseeing the RED HORSE 2010 Strategic Study. The ACC/CEX is adequately qualified to fill the role of the decision maker's representative, and will be referred to as such throughout the remainder of this presentation.

Identifying the decision opportunity also includes defining a value proposition. As discussed previously, this study addresses the macroscopic organizational issues raised by the ACC/CE, and the value proposition should reflect the priorities of the decision maker and the RED HORSE 2010 Strategic Study. Once the value proposition is established, the objectives can be defined.

Fundamental and Means Objectives

The next step in the VFT process is to identify the objectives of the decision maker. When purchasing a car, the decision maker (consumer) would have to determine what he/she desires in a vehicle in order to identify his/her objectives. Perhaps the decision maker is only concerned with safety, performance, and price. These would be his/her fundamental objectives. Further categorization of safety could include the accident survival rate of that particular make of vehicle, and the existence of safety features in the vehicle such as seatbelts, airbags, and child-safety locks. These would both be means objectives, as they further classify the fundamental objectives of the decision maker. Means objectives for performance could be acceleration, handling, and the "smoothness" of the ride. The fundamental objective of price would not have any means objectives, as it is already adequately quantified.

To adequately identify objectives, initial assumptions must first be made to refine the scope of the identified decision opportunity, because it will not be feasible to address all aspects of a decision opportunity within the confines of this thesis. Once these assumptions are developed and validated by the decision maker's representative, objectives can be identified. These objectives are first identified through discussions and interviews with the decision maker's representative, and then further classified as either fundamental or means objectives.

The identification process is accomplished by soliciting from the decision maker (or decision maker's representative) the factors that contribute to his/her decision – i.e. asking "what is important?" Throughout this process, Keeney's eight suggestions for identifying objectives must be applied: develop a wish list; identify alternatives; consider problems and shortcomings; predict consequences; identify goals, constraints, and guidelines; consider different perspectives; determine strategic objectives; and determine generic objectives [13:35].

Once a list of objectives is developed, they must be identified as either fundamental or means objectives. Means objectives are those that contribute to other objectives, while fundamental objectives are those that are important because they indicate what the decision maker is actually trying to accomplish [3:44]. To assist in identifying means and fundamental objectives, two questions can be posed with respect to each objective: "Why is that important?" and "What does that mean?" If the answer to the former question is important only because of how it impacts another objective, then that objective is a means objective. If the answer to the former question is because the objective is one of the primary reasons of interest in the decision opportunity, then it is a fundamental objective. Similarly, if the answer to the second question entails additional objectives, then those additional objectives are means objectives [17].

The decision maker's fundamental objectives are the cornerstone for any decision model as they are the central factors contributing to the decision maker's verdict in a particular situation [3:532]. These objectives comprise the foundation for the value hierarchy, and provide overarching guidance when considering possible alternatives in the decision making process. The following are essential guidelines for identifying fundamental objectives, as presented by Clemen [3:533-534]:

- The set of objectives must be complete, including all relevant aspects of a decision.
- The set of objectives should be independent of one another; that is, attributes should not be closely related such that each objective can be easily defined and evaluated without considering the other attributes.
- Each objective should differentiate between available alternatives.
- The set of objectives should be as small as possible and accurately defined, keeping them manageable and easy to understand.
- The set of objectives should not be redundant.

- The set of objectives should be independent; that is, the decision maker should be able to easily think about each attribute without considering others.

As Keeney indicates, if the fundamental objectives do not meet all of these criteria, the objective should be defined differently, or it should be considered a means objective [13:34]. Once the list of fundamental objectives has been ascertained, they can be organized in a value hierarchy. The upper levels of this hierarchy are comprised of the decision maker's fundamental objectives, while the lower levels are comprised of the means objectives that further describe the fundamental objectives. It is imperative that this structure accurately reflects the perspectives of the decision maker, as the lowest levels of the hierarchy will serve as the basis for developing evaluation measures. These evaluation measures are then used to score or evaluate alternatives. The value hierarchy is discussed more in-depth later on in this chapter.

The fundamental and means objectives presented in this research will be solicited from the decision maker's representative. A series of interviews will be conducted with the decision maker's representative, at Langley AFB, in order to discern those things of value that contribute to his decision in setting policy for RED HORSE, including the macroscopic organizational structure of its units. Since aspects of the RED HORSE 2010 Strategic Study addressed issues pertaining to RED HORSE's macroscopic organizational structure, a strawman value hierarchy will be constructed to guide the objective solicitation process with the decision maker's representative. In addition to guidance, a strawman also provides a starting point for the objective solicitation procedure. This particular strawman will reflect potential fundamental and means objectives based upon the discussions and findings contained within the RED HORSE 2010 Strategic Study.

Identifying Alternatives

The next step in the DA process is to identify alternatives, shown in Fig 3.2. Since the value hierarchy is comprised of the fundamental objectives defining the goal of the decision maker, it can be used as a basis for designing good alternatives for the decision opportunity [15:23]. Commensurate with the principles of VFT, understanding the objectives first allows the generation of better alternatives. Further, it allows the design of alternatives such that they specifically address the fundamental objectives of the decision opportunity.

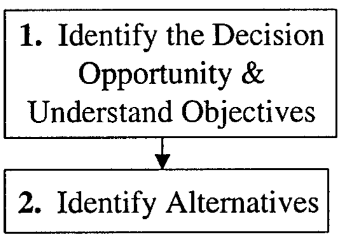


Fig 3.2 – Step 2 in the DA Process

Alternative generation is a vital part of the analysis process; simply put, "If you want better decisions, find better alternatives [18]!" To find better alternatives, several alternative generation techniques will be used in support of this research effort. These techniques include developing strategy generation tables, maximizing of fundamental objectives, and using creativity approaches.

Howard posits that the best approach to alternative generation involves the creation of a strategy generation table [11:684]. This technique is particularly useful when "…alternatives are made up of 'bundles' of characteristics [15:48]." Strategies are defined by selecting from among the available characteristics in each of many areas. Possible outcomes (characteristics) of each objective in the hierarchy are listed in separate columns, each column headed by the appropriate objective. Combining all of these columns creates the strategy generation table; choosing from among the various possibilities of each objective generates different strategies. These strategies do not provide exact alternatives, but instead provide an overall direction for an alternative [15:48]. As such, not all of the possibilities need to be listed underneath each objective. Rather, the strategy generation table identifies those alternatives that have the most potential and would benefit from more in-depth analysis [15:47].

Keeney indicates that focusing on the fundamental objectives can provide a start to the process of alternative generation. He suggests concentrating on one particular objective and developing an alternative that maximizes the value of that objective, without taking into account any of the other fundamental objectives. This process is then repeated for each objective, providing an initial range of potential alternatives. Keeney then recommends expanding the bounds of this technique by focusing on two objectives at a time, and then three, and then four, each time attempting to generate alternatives that satisfy each of the objectives taken into account. This process continues until all of the objectives have been considered simultaneously. All the generated alternatives should then be assessed to determine if it is possible to combine any of them into a single alternative [13:39].

Clemen recommends the use of creativity techniques to develop alternatives. Among those he suggests are fluent and flexible thinking, idea checklists, brainstorming, and metaphorical thinking. He posits that creativity is essential in developing alternatives, as the alternatives themselves define the bounds of any decision opportunity [3:203-206].

Finally, the status quo and "maximum" alternatives should always be included in any decision opportunity [18]. The status quo is the way things are currently operating. The "maximum" alternative is one in which all of the fundamental objectives are set at their highest levels (i.e. maximized). Once this ideal alternative has been determined, it can be analyzed to determine which constraints are preventing its employment in the real world [12:221].

Recalling the car example, the alternatives would be comprised of the different available vehicles on the market. Obviously, a consumer would have many makes and models of vehicles from which to choose – i.e. a Chevrolet Silverado truck, a Nissan Sentra, Ford Windstar minivan, and a Plymouth Prowler would all be feasible alternatives

Decompose and Model the Decision Opportunity

Decomposing and modeling the decision opportunity will be accomplished in this study by utilizing a value hierarchy, evaluation measures, multi-attribute preference theory, objective and evaluation measure weights, and the overall value function. These methods and concepts, discussed in this section, provide the tools required to logically model and mathematically evaluate which organizational structure is the best for RED HORSE.

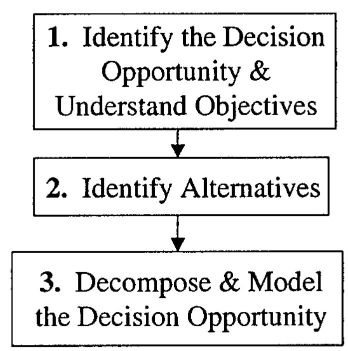


Fig 3.3 – Step 3 in the DA Process

Value Hierarchies

Value hierarchies are the structure that reflects the decision maker's objectives, as solicited in the first step of the DA process. The upper levels of the value hierarchy are comprised of the decision maker's fundamental objectives. Although the fundamental objectives identify the overall issues of importance to the decision maker, they are not specific enough to allow for an accurate assessment of alternatives. Lower levels of the hierarchy are required to explain what is meant by the higher, more general levels [3:532]. The lower levels of the hierarchy are comprised of the means objectives that further describe the fundamental objectives. These lower levels can be obtained by asking the question "What is meant by that?" When a distinct response can no longer be obtained, that objective can safely be assumed to be the lowest level of the hierarchy – actually serving as an evaluation measure [17]. (Evaluation measures are discussed more in-depth in the "Evaluation Measures" section). In this manner, value hierarchies serve to decompose the decision maker's fundamental objectives into practical evaluation measures, ensuring that each fundamental objective is capable of being logically assessed. This logical decomposition of the value hierarchy provides a pictorial representation of the structure of the decision maker's objectives and evaluation measures [17].

Kirkwood remarks that value hierarchies must be complete, non-redundant, independent, operable, and small in size [15:16-19]. Completeness occurs when each level of the hierarchy, when assessed as a group, covers all of the issues required to evaluate the overall decision objective. Non-redundancy means that each objective and evaluation measure is exclusive; none of them share the same (or parts of the same) definition. These two aspects of value hierarchies, completeness and non-redundancy, are also known as mutually exclusive and collectively exhaustive (MECE) [15:17]. Independence implies that the preference for the score of one evaluation measure is not dependent on the score of any other evaluation measure. Operable indicates that the user understands and concurs with the value hierarchy. The small in size consideration expresses that a smaller value hierarchy is more easily understood and communicated.

To validate the structure of the value hierarchy, the same two questions posed previously should be asked: "Why is that important?" and "What does that mean?" Asking the first question of any objective in the hierarchy should allow the analyst to proceed downward through the structure; conversely, asking the latter question of any objective in the hierarchy should allow the analyst to ascend through the structure [17]. Once the decision maker concurs that the value hierarchy accurately reflects his/her objectives, the value hierarchy is considered complete.

For this research effort, a strawman value hierarchy will be developed, based on the information put forth in the RED HORSE 2010 Strategic Study. This strawman will be used as a basis to solicit the decision maker's value hierarchy. This will be accomplished at the same time, and in the same way, as the decision opportunity's objectives are obtained; through discussions and interviews with the decision maker's representative.

A value hierarchy for the decision of purchasing a car is shown in Fig 3.4. This hierarchy illustrates the three fundamental objectives of safety, performance, and price, as well as the means objectives that further classify each of the fundamental objectives. The gray boxes in Fig 3.4 denote evaluation measures.

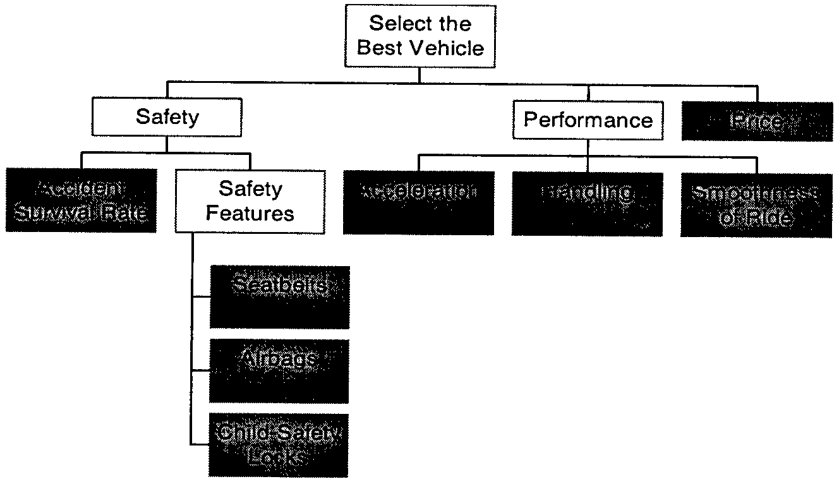


Fig 3.4 – Value Hierarchy for Car Example

Evaluation Measures

Evaluation measures are the methods and standards that assess the degree to which alternatives attain the decision maker's objectives [15:12]. They are the elements of the value hierarchy that transform the decision analysis process from a qualitative nature to a quantitative tool for measuring the degree to which each alternative meets the decision maker's preferences, according to the constructed value hierarchy [14:2-9]. In establishing these quantitative aspects of the hierarchy, the analyst must pay careful attention to the developing the type of scale used for each measure, ensuring each measure passes the clarity test, and maintaining neutrality in each measure.

Evaluation measures also answer the question of "What does that mean?," referring to the sub-criteria or objective directly above it in the value hierarchy. To accomplish this, evaluation measures provide scales of performance that are characterized as either natural or constructed, and either direct or proxy [15:24]. Kloeber defines each of these scales and gives particular examples, as follows [17]:

Natural – in general use and common interpretation by all (profit)

Constructed – developed for a particular objective (level of security classification)

Direct – focuses on the attainment of the objective (profit)

Proxy – focuses on the attainment of an associated objective (GNP for economic well being)

The type of scale used for evaluation measures depends on the preference of the decision makers and stakeholders of the decision opportunity. Referring back to the car example (Fig 3.4), the evaluation measures of "price" (measured in dollars), "acceleration" (time, in seconds, to go from 0 – 60 mph), and "number of seatbelts" in the vehicle would all be natural, direct scales. The scales of each of these measures (dollars, time, and number) are in common use, can be easily understood by all, and directly measure the attainment of objectives (price, acceleration, and seatbelts). Conversely, "handling" and "smoothness of ride" do not have obvious scales with which they can be measured. Perhaps "handling" could be as comfort of the driver, indicated by the presence of systems that enhance the vehicle's handling (i.e. power steering, power breaks, cruise control, etc.). This scale would be characterized as constructed (the presence of these systems comprise a scale specifically developed to measure "handling") and proxy (focuses on the driver's comfort as an indication of the vehicle's "handling"). "Smoothness of ride" may be measured by the number of times that the driver hits his/her head on the ceiling when driving. This scale would be characterized as constructed (a scale specifically developed to measure "smoothness of ride") and direct (numbers are in common use and easily understood by all).

Howard indicates that the critical factors in scale construction are that scales be precise, specific, and pass the "clarity test" [11:684]. The clarity test, also known as the clairvoyance test [17], asks whether a clairvoyant, capable of seeing into the future, would be able to determine what the score would be for each alternative, according to the scale developed for each evaluation measure. Clemen further notes that no interpretation or judgment should be required of the clairvoyant [3:75]. Kershchus points out the tradeoff that exists when constructing the scales for evaluation measures; namely, the effort spent in developing the scales, the ease of gauging each alternative against the scale, and the capability of communicating the results obtained from utilizing the scales of the evaluation measures [14:2-10].

Maintaining neutrality is one final consideration that must be addressed when constructing evaluation measures. When establishing the evaluation measures, maintaining neutrality is imperative to ensure an analysis that is not biased towards any potential alternative. To guarantee this, the evaluation measures must not indicate a direction (i.e. increase sales, decrease casualties, etc.) [17]. Rather, the evaluation measures merely signify one particular aspect of an objective; value functions (discussed in the "Multi-Attribute Preference Theory" section) will indicate direction.

The evaluation measures for this thesis effort will be developed at the same time, and in the same manner, as the value hierarchy and its objectives; through discussions and interviews with the decision maker's representative. The scales for the evaluation measures will be constructed by soliciting the inputs of a select group of experts from 823 RED HORSE, Hurlburt Field, Fl, as these personnel have the professional and technical expertise to accurately identify practical evaluation measures based on the decision maker's representative's objectives.

Multi-Attribute Preference Theory

Multi-attribute preference theory is the part of the decomposition and modeling step that allows an analyst to standardize the scores attained from the various evaluation measures throughout the value hierarchy. The difficulty here is in combining scores that relate to different units of measure, as each evaluation measure can be constructed with a different scale. For example, when purchasing a car, it is difficult to compare "price" (with units of dollars) with the "handling" of the car (with units of comfort). "Price" possesses a direct, natural scale while "handling" involves a constructed, proxy scale. This example illustrates the difficulty present when attempting to standardize various evaluation measure scores.

To alleviate this difficulty, a unitless, dimensionless value (or utility) function is assigned to each evaluation measure. Using these functions, the scores for each evaluation measure can be transformed into values (or utilities) and standardized throughout the entire VFT model. Converting the evaluation measure scores to standardized values (or utilities) allows the analyst to combine and compare them with one another, providing an established method of identifying the overall worth to the decision maker of that evaluation measure score. Herein lies the significance of multi-attribute preference theory [19].

Multi-attribute preference theory focuses on decision opportunities characterized by multiple, competing objectives. It provides the decision maker opportunities to examine and compare alternatives against competing objectives. Multi-attribute preference theory quantifies the objectives by constructing evaluation measures, develops and assigns weights (discussed in the "Assessing Weights" section) to each objective and evaluation measure, and translates the evaluation measure scores into standardized, dimensionless units of measure (value or utility). These values (or utilities) are then combined into an overarching value function, generating a single overall value (or utility) for each alternative and characterizing how well each alternative meets the decision maker's objectives [20]. This system of value (or utility) functions allows a decision maker to resolve his/her decision opportunity by trading off increased value on one objective for decreased value on another [3:534]. In an environment characterized by multiple competing objectives, multi-attribute preference theory suggests the most valuable alternative to a decision maker by specifically relating the alternatives to the decision maker's objectives.

Value and Utility Functions

As posited in the previous section, value (or utility) functions are required to transform evaluation measure scores into dimensionless units. This section discusses the difference between value and utility functions, and the independence considerations of these functions. It then addresses the different means of reflecting value functions for evaluation measures with continuous and discrete scales. Finally, it discusses the monotonicity requirement of all value functions.

The difference between value and utility functions lies in the conditions under which each is used; value functions are utilized under conditions of certainty, while utility functions are used when uncertainty (and accompanying risk) is involved [16]. As such, utility functions must incorporate uncertainty and probability, and are more difficult to assess. However, both types of functions are derived from the decision maker and must accurately reflect the decision maker's attitude. In addition, both functions must maintain the condition of independence. As such, value (and utility) functions must be single dimensional functions, reflecting the values (or utilities) associated with only one particular evaluation measure score.

Value functions for evaluation measures with continuous scales can be constructed by applying any of a vast array of general curves, each one indicating a different perspective of the decision maker. Kloeber defines the four most general curve possibilities as follows [21]:

Linear: Constant returns to scale. This value function shape demonstrates an equal preference for each increase in outcomes. The decision maker places the same value increment on equal increases in evaluation measure outcomes.

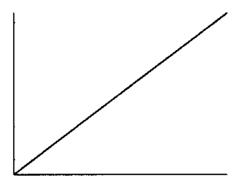


Fig 3.5 – Linear Value Function

Concave: Decreasing returns to scale. This value function shape demonstrates a preference for "lower" outcomes. Minimal additional value is gained with further improvements in possible outcomes beyond a particular outcome. This curve shape is indicative of a risk adverse decision maker.

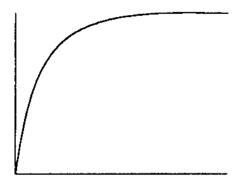


Fig 3.6 – Concave Value Function

Convex: Increasing returns to scale. This value function shape indicates a preference for higher outcomes. The decision maker places minimal value on outcomes realized before a specific "higher" outcome. This curve shape is indicative of a risk seeking decision maker.

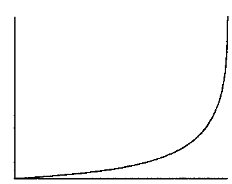


Fig 3.7 – Convex Value Function

S-curve: Combination of the above. This value function shape demonstrates an overwhelming preference for outcomes in a particular range. Once that range has been attained, there is little value to be gained for further outcomes, until the upper end of the range is realized.

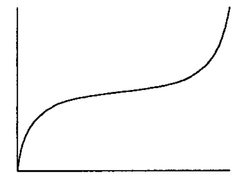


Fig 3.8 – S-curve Value Function

For example, when purchasing a car, a decision maker might consider each dollar worth the same. Most likely, he/she would prefer to pay as little as possible for a vehicle. As such, his/her value function (Fig. 3.9) would be reflected by a linear relationship, indicating that each dollar increment reflects the same value increment throughout the entire range of possibilities (in this case $10K - $30K).

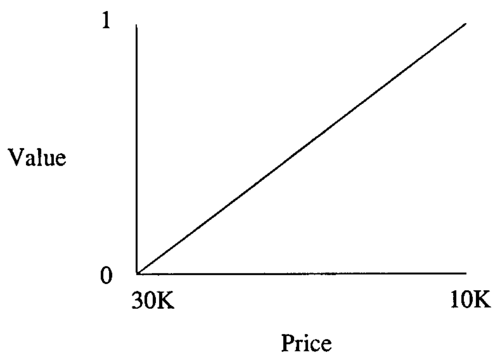


Fig 3.9 – Linear value function for car example

However, the decision maker may only have a preference for a particular range of prices. Perhaps, the decision maker is on a tight budget and values the lesser-priced cars much more than the more expensive ones. It could be that he/she doesn't have much use for cars above $17K. This type of preference would be characterized by a convex relationship, as shown in Fig 3.10 – indicating increasing returns to scale for vehicles priced below $17K.

In addition, there are two possible methods for approximating these curves:

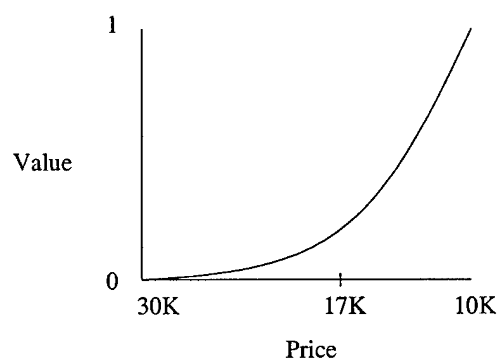


Fig 3.10 – Convex Value Function for Car Example

piecewise linear and exponential [15:61]. Piecewise linear is most practical to use when the evaluation measure being considered has a relatively small number of possible different scoring levels [15:61]. These functions identify specific values for the different scoring levels, and assigns value to the remaining scores by connecting these identified point in a linear fashion. In order to utilize these functions however, the relative value increments must be specified between possible evaluation measure scores [15:62]. One of the evaluation measures in the car example is acceleration; that is, the time, in seconds, required to increase the car's speed from 0 – 60 mph. Assuming that the realistic range of acceleration times varies from 12 (maximum) to 2 (minimum) seconds, the consumer's preferences along this range can be identified. Fig 3.11 illustrates a possible single dimension value function constructed in a piecewise linear manner. As can be seen, values are assigned to particular possible outcomes (in this case 12, 8, 4, and 2 seconds), and these identified points are connected in a linear fashion to complete the function.

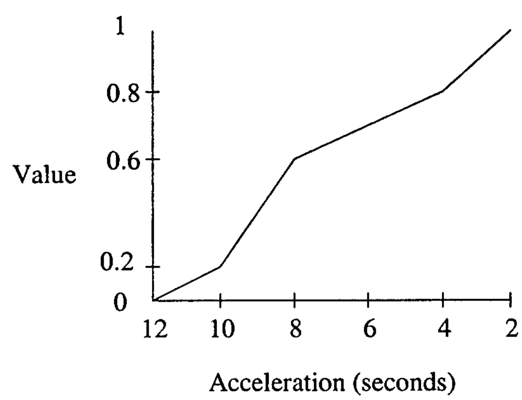


Fig 3.11 – Piecewise Linear Single Dimensional Value Function

Exponential value functions are preferred when there are many possible outcomes for evaluation measure scores, and utilizes an exponential constant (ρ) to reflect the decision maker's attitude. The exponential constant is used to determine the decision maker's value according to the following relationship:

$$v_i(x_i) = \begin{cases} \dfrac{\left[\dfrac{1 - e^{\left[-\left(x_i - x_i^L\right)\right]}}{\rho}\right]}{\left[\dfrac{1 - e^{\left[-\left(x_i^H - x_i^L\right)\right]}}{\rho}\right]}, \rho \neq \infty \\ \dfrac{x_i - x_i^L}{x_i^H - x_i^L}, \text{ otherwise} \end{cases} \qquad \textbf{(2.1)}$$

where:
$v_i(x_i)$ = the exponential single dimensional value function
x_i = the actual evaluation measure score
x_i^L = the lowest possible evaluation measure score
x_i^H = the highest possible evaluation measure score
ρ = the exponential constant

To identify ρ, the evaluation measure score corresponding to the decision maker's midvalue (v(x) = 0.5) is determined. This midvalue is then normalized with respect to the range of possible evaluation measure outcomes as follows:

$$z_{0.5} = \frac{x_i - x_i^L}{x_i^H - x_i^L} \qquad \textbf{(2.2)}$$

where:
$z_{0.5}$ = the decision maker's normalized midvalue
x_i = the actual evaluation measure score
x_i^L = the lowest possible evaluation measure score
x_i^H = the highest possible evaluation measure score

Tables are then employed, yielding specified values of ρ, dependent upon normalized midvalues. The result is a value function that takes on one of the curves illustrated in Fig 3.12. The shape of the curve is dependent upon the value of ρ. The exponential single-

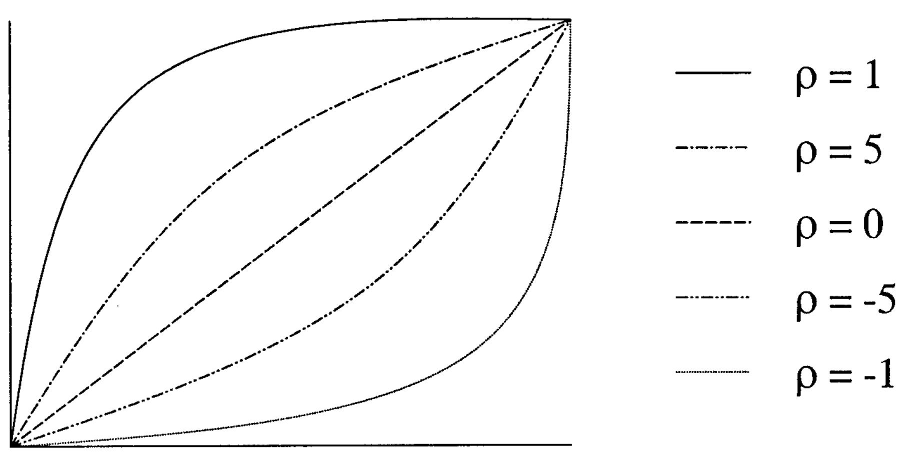


Fig 3.12 – Exponential Single Dimensional Value Function

dimension value function becomes increasingly linear as ρ approaches ∞ or $-\infty$. Conversely, the curves take on more of an exponential shape as ρ departs from ∞ or $-\infty$. The linear shape of the function indicates risk neutrality, indicated by $\rho = 0$.

Monotonicity is another requirement for value (or utility) functions [21]. This characteristic ensures that only one value is reflected for each evaluation measure scores. As such, a more preferred evaluation measure score always reflects a greater value, while a less desired evaluation measure score always reflects a lesser value. Value functions can be either monotonically increasing or monotonically decreasing. Each of these functions assigns a maximum value (1) to the best possible evaluation measure score and a minimum value (0) to the worst possible evaluation measure score. However, monotonically increasing functions reflect a "more is better attitude," indicating that the higher the evaluation measure score, the more value it is to the decision maker. Conversely, monotonically decreasing functions reflect a "less is more" attitude, indicating that the higher the evaluation measure score, the less value it is to the decision maker. Figs 3.5 – 3.12 all illustrated monotonically increasing functions; that is, the value apportioned by the decision maker increases along the entire range of outcomes as they go from worst to best.

For this research effort, value functions will be solicited from the decision maker's representative. These functions will reflect his attitude on the potential outcomes of each evaluation measure. These outcomes will be ascertained utilizing the expertise of qualified individuals from 823 RED HORSE, Hurlburt Field, Fl.

Assessing Weights

In an environment with multiple, competing objectives, decision makers will most oftentimes feel that one objective is more important than another. Assigning weights allows a decision maker to assign relative importance to each of the fundamental and means objectives and evaluation measures present in the value hierarchy. As all the weights on any particular level must sum to 1, the decision maker effectively partitions out the amount of weight he/she desires to place on any particular objective or evaluation measure. However, increasing the weight of any objective or evaluation measure can only be done at the expense of another objective or evaluation measure. This phenomenon is known as the corresponding tradeoffs condition [15:231].

For this thesis, weights will be generated using swing-weighting techniques. Swing weighting directly compares objectives by presenting the decision maker with hypothetical outcomes [3:547]. It directly compares two objectives by presenting the decision maker with two scenarios. The first scenario presents one objective at its best possible outcome (highest value) and the other objective at its worst possible outcome (lowest value); the second scenario provides the opposite outcomes for the two objectives being addressed. During both scenarios, all objectives not being addressed are held constant. The decision maker is then asked to identify which scenario he/she would prefer and by how much (i.e. 2 to 1, 3 to 1, 3 to 2, etc.). Whichever objective is indicated to be most important is then retained as the measuring stick (the control objective) to which all other objectives are compared. The remaining unanalyzed objectives in the hierarchy are then compared (one at a time) to this control objective. In this manner, each objective will be rated against the same control objective, providing standardized weightings for each objective. Since all the weights on a particular level must sum to one, all weights can be solved for by direct substitution, as shown in the following example accomplished for the three car objectives: safety (S) performance (P), and price (C):

The weight of safety (S) is worth twice a much as the weight of performance (P):

$$W_S = 2W_P$$

The weight of price (C) is worth twice as much as the weight of performance (P):

$$W_C = 2W_P$$

Recalling that all the weights must sum to 1:

$$W_S + W_P + W_C = 1$$

By direct substitution, the weight of performance (P) can be calculated:

$$2W_P + W_P + 2W_P = 1$$

$$W_P = 0.2$$

Therefore, the weights of safety (S) and price (C) can be calculated as well:

$$W_S = 0.4 \quad \text{and} \quad W_C = 0.4$$

An advantage of swing weights is their sensitivity to the range of values an evaluation measure score can undertake [3:549]. This provides an ability to compare evaluation measures that may have vastly different scales in terms of magnitude (i.e. cost of a house vs. cost of a piece of candy).

For this study, the weights will be solicited directly from the decision maker's representative. Since he is the one who identified the fundamental and means objectives present in the value hierarchy, he is also the one most qualified to assign the appropriate weights to each objective and evaluation measure.

Overarching Value Function

In value analyses characterized by multiple, competing objectives, it is necessary to develop an overarching value function. As Kirkwood states, this function "...combines the multiple evaluation measures into a single measure of the overall value of each evaluation alternative [15:53]." This overall value function must also be easily understood by and accurately reflect the attitudes of the decision maker. Although there are several forms of the value function in existence, the additive value function is the one most commonly used in cases that have multiple, competing objectives [15:230]. The additive value function presents a weighted average of the single dimensional value functions employed by each evaluation measure, utilizing the following relationship [19]:

$$V(x) = \sum_{i=1}^{n} w_i \cdot v_i(x_i) \qquad \textbf{(2.3)}$$

where:
- $V(x)$ = the total value
- n = the total number of single dimensional value functions
- w_i = the weight assigned to the corresponding single dimensional value function
- $v_i(x_i)$ = the single dimensional value function

This function relies upon the critical assumption that the objectives to which it is being applied possess mutual preferential independence; more specifically, the decision maker's attitudes towards one objective are independent of his/her attitudes towards the other objectives [15:238]. This function also denotes that the corresponding tradeoffs condition holds between any two objectives [20]. Utilizing the additive value function produces one overarching value for each alternative by combining the values obtained from the evaluation measures' single dimensional value functions. Obtaining one overarching value for each alternative then permits comparison between alternatives with respect to how well they achieve the decision maker's objectives. This comparison allows for the ranking of alternatives so often desired by decision makers.

The Remainder of the DA Process

The entire DA process is illustrated in Fig 3.13. Once the first three steps have been accomplished, the next step is to choose the best alternative. This step selects the alternative with the greatest utility or expected value after developing the single dimensional value (or utility) functions, constructing the overarching value function, and applying the power additive value function. This alternative will be the one that ranks the highest in the deterministic rankings produced after applying these analysis tools.

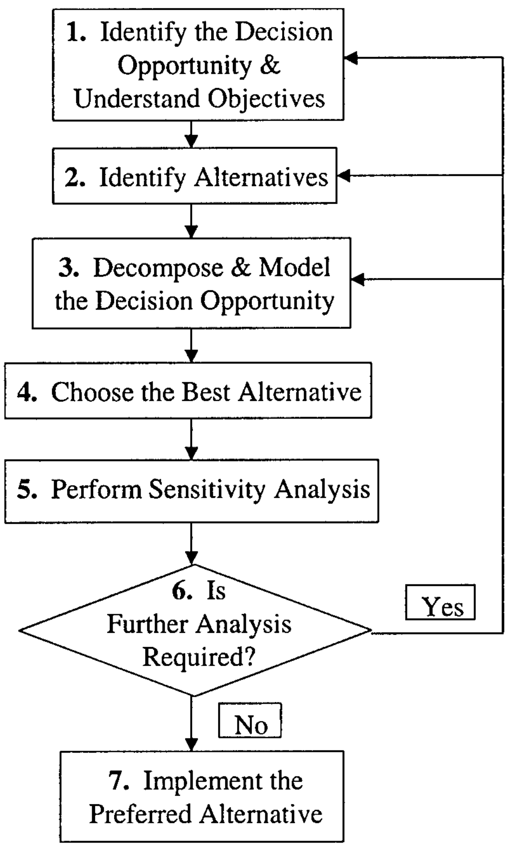


Fig 3.13 – The Remainder of the DA Process

The fifth step in the process involves performing sensitivity analysis on the objectives and evaluation measures weights. Sensitivity analysis indicates how the model reacts to slight changes in one or more of its various aspects. If the results of the analysis alter due to these slight changes, the model is said to be sensitive to these changes, and further analysis may be required to investigate more carefully these sensitive aspects [3:7].

The sixth step in the process is a determination of the sufficiency of the analysis. Based upon the previous steps in the DA process, further analysis may be required, characteristic of the iterative nature of the DA process. Clemen offers several potential reasons for required further analysis,

> the decision maker's perception of the problem changes, beliefs about the likelihood of various uncertain eventualities may develop and change, and preferences for outcomes not previously considered may mature as more time is spent in reflection [3:7].

Results obtained through sensitivity analysis could also provide a requirement for further analysis. Further analysis could include refining the definition of the objectives present in the model, or changing some of the objectives in the model (include new or remove existing objectives) [3:7]. However, this step may be outside the scope of this research, and it oftentimes spawns related studies. Resolution sometimes occurs without this step, but can only be reached if the decision maker is comfortable with the final model and its results, lending validity to the analysis effort.

Once resolution is achieved, the only remaining step is to implement the preferred alternative, as identified by the model. This final step is outside the scope of research; it is entirely up to the decision maker and may or may not happen. Some of the factors possibly influencing an alternative's implementation include the practicality of the alternative, political factors influencing the decision maker that were not accounted for in the model, a change in the decision maker's priorities during or after the analysis, or a change in the decision maker during or after the analysis.

As this chapter discusses, one of the goals of the DA process is to put forth an alternative based on the decision maker's objectives and attitudes. Clemen points out that the DA process has other goals as well:

> Decision analysis not only provides a structured way to think about decisions, but also more fundamentally provides a structure within which a decision maker can develop beliefs and feelings, those subjective judgements that are critical for a good solution [3: 7-8].

This chapter described the DA and VFT processes, applying them directly to the decision opportunity for this thesis effort; suggesting the best macroscopic organizational structure for RED HORSE. It outlined these processes using a modified DA process flowchart, and used the decision process example of purchasing a car to illustrate each step of the DA and VFT processes. The next chapter will discuss the accomplishment of these steps in undertaking this thesis effort, and provide the results obtained through employing these processes.

IV. Results and Analysis

This chapter presents the model developed according to the methodology outlined in the previous chapter. It also provides the deterministic results from analysis conducted according to the VFT model.

Identify the Decision Opportunity and Understand Objectives

The first step of the DA process consisted of two separate parts: identifying the decision opportunity and understanding the objectives that contribute to that decision opportunity.

Identifying the Decision Opportunity

The three-part process of identifying the decision opportunity entailed isolating and describing the specific decision that needed to be made, distinguishing a qualified decision maker, and defining a value proposition to guide the research effort. The first of these parts, isolating and defining the specific decision that needs to be made, was accomplished via the RED HORSE 2010 Strategic Study. The results of the study posited several hybrid proposals, strategic improvements, and areas of improvement designed to improve the capabilities, effectiveness, and overall efficiency of RED HORSE [1:Sections 7, 9-10]. A number of these findings addressed issues of organizational structure from a macroscopic perspective – i.e. RED HORSE as a whole instead of internal squadron adaptations (such as varying the UTC mix of a squadron). The large number of propositions relating to this matter pointed to a requirement for further investigation; hence this research effort aimed at addressing those queries.

The second part of identifying the decision opportunity is to distinguish a decision maker capable of providing qualified input to the decision making process. The USAF/CE is the decision maker for all policy issues affecting any aspect of USAF CE. It was not practical to utilize the USAF/CE personally for this research effort. As such, the ACC/CEX was identified as a qualified decision maker's representative (see Chapter 3). During the course of this research effort however, the identified decision maker's representative changed due to a Permanent Change of Assignment (PCA), characteristic of the military environment. Col James T. Ryburn replaced LTC Brent Chubb as ACC/CEX in late August 2000 as the ACC/CEX. Since the ACC/CEX is charged with setting policy for, and possesses OPCON of, RED HORSE active duty units, Col Ryburn possessed the same qualifications as his predecessor with regards to the office he holds, and his participation was solicited for this research effort. Although Col Ryburn did not have the familiarity with the RED HORSE 2010 Strategic Study as LTC Chubb, he did possess extensive experience in the RED HORSE community, serving in RED HORSE units twice [2:1-2], and accomplishing an investigative report addressing the missions and mobility configurations for RED HORSE [29]. His qualifications are highlighted in his biography, provided in Appendix F. Col Ryburn's overwhelming experience, combined with his position as ACC/CEX, made him highly qualified to serve as the decision maker's representative.

Preliminary discussions with the decision maker's representative were dedicated to updating him on the proposed emphasis of this research effort, ensuring it was commensurate with his desires. Based upon the findings posited in the RED HORSE

2010 Strategic Study and the decision maker's representatives' desires, these discussions resulted in the following value proposition that served as a guideline for this study:

> *To provide an objective, traceable, and robust analysis to identify the most effective macroscopic organizational structure that will allow RED HORSE to meet its strategic objectives in the future.*

The decision maker's representative supported this statement as an accurate reflection of RED HORSE priorities, stating that it answers one of the central questions posed by the HQ AF/CE in initiating the RED HORSE 2010 Strategic Study [26]. The decision maker's representative's concurrence with the value proposition validated the emphasis of this research effort, and fulfilled the third requirement of identifying the decision opportunity.

Fundamental and Means Objectives

Once the decision opportunity was adequately identified, the fundamental and means objectives were solicited from the decision maker's representative. Prior to this solicitation however, several assumptions first had to be made to limit the scope of this thesis. In addition, strawmen hierarchies were constructed to help guide the solicitation process. These strawmen provided additional insight into the decision opportunity, based upon the RED HORSE 2010 Strategic Study, and the experiences of active duty CE officers familiar with RED HORSE operations.

Assumptions

Prior to any model development, the scope of the research effort had to be refined. This was done by declaring several initial assumptions, aimed at concentrating this analysis solely on the issues affecting the macroscopic organizational structure of RED HORSE. These initial assumptions were:

- RED HORSE is capable of accomplishing all of its current missions provided it has the required resources (personnel, equipment, funds) in place
    - Specifically, it can fully accomplish its OOTW and AEF missions, and can fulfill its MTW mission as well as it can now
- RED HORSE will have sufficient funds to accomplish any mission required
- RED HORSE can accomplish its missions in any theater, and in any environment
- RED HORSE and Prime BEEF ConOps will remain as they currently exist
    - Roles and responsibilities of these two CE functions remain the same
- Only existing Active Duty and ARC RED HORSE units are considered
    - No existing units will be disbanded; no new units will be formed
- Units will remain manned and equipped at current levels
    - Equipment and personnel will not be added or removed on a unit basis
- OOTW project distribution will continue along current trends
    - Theater and project type broken out as shown on p.2-12

These initial assumptions focused this study, and guided the strawman construction and objective solicitation processes.

Strawman Construction

To provide a guide to objective solicitation, two value hierarchy strawmen were constructed. The first of these strawmen (Fig 4.1) was based on the priorities and findings posited in the RED HORSE 2010 Strategic Study, emphasizing the "Ready, Relevant, and Right-Sized" approach requested by the ACC/CE who commissioned the study. Along with these objectives, this strawman also indicated potential evaluation measures, shown by the gray boxes in Fig 4.1. In addition, an alternate value hierarchy was explored, utilizing RED HORSE's three missions (MTW, OOTW, and AEF) as objectives. However, this hierarchy was abandoned as it did not capture the preferences of the decision maker's representative across the entire spectrum of the decision opportunity.

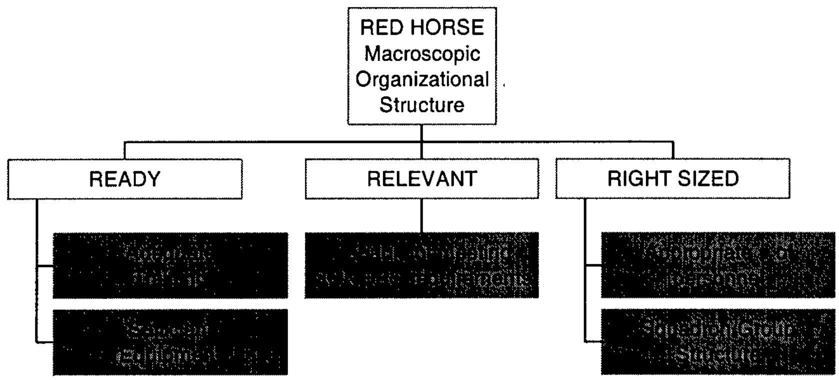


Fig 4.1 – First Value Hierarchy Strawman

To provide additional guidance, a second value hierarchy strawman was constructed, shown in Fig 4.2. This strawman was based on the inputs of a panel of experienced CE

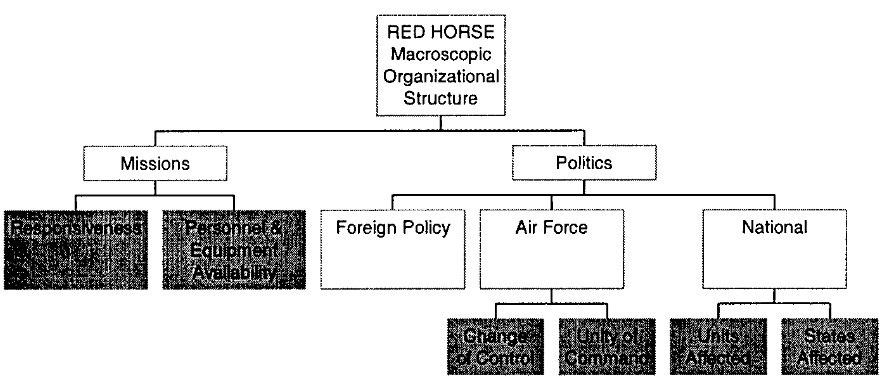


Fig 4.2 – Second Value Hierarchy Strawman

personnel, familiar with RED HORSE and USAF CE contingency operations. This strawman characterizes the decision opportunity via missions-oriented and political fundamental objectives. The political objective possessed second-tier objectives in the foreign policy, Air Force, and national arenas as well. The gray boxes in this strawman again indicate proposed evaluation measures. As a note, the panel felt that foreign policy considerations would be a factor in the decision opportunity, but wasn't sure how to quantify such an influence (hence no gray boxes relating to the "Foreign Policy" objective).

Both of these strawmen were developed in advance of the first meeting with the decision maker's representative. Based upon his inputs, the amended value hierarchy strawman was eventually used as a baseline upon which the objective solicitation process with the decision maker's representative was founded.

Identify Alternatives (Part I)

Prior to soliciting objectives from the decision maker's representative, a set of initial alternatives had to be developed. These initial alternatives were derived from the findings of the RED HORSE 2010 Strategic Study. The initial list of alternatives were:

- Status Quo
    - RED HORSE force remains as is, with differing chains of command (ADCON and OPCON), and multiple locations
- As-is with unified command
    - RED HORSE force possesses a unified command (possibly headquartered at ACC, AMC, or PACAF), while maintaining multiple locations

- CONUS Super-Unit
    - o RED HORSE force possesses a unified command (possibly headquartered at ACC, AMC, or PACAF), and is stationed at one location within the CONUS
- Global Force
    - o Units stationed in and assigned to each theater (CONUS, SOUTHCOM, CENTCOM, EUCOM, PACOM).

Although this list of alternatives was not all-inclusive, it provided an adequate amount of choices to differentiate between potential options. This differentiation helped identify key areas of interest in the study, and assisted in the model generation effort.

Decompose and Model the Decision Opportunity

Once the value proposition was validated, assumptions outlined, and an initial list of alternatives developed, model generation commenced. As this study reflects the preferences of the decision maker's representative, the model was founded almost exclusively on input from the decision maker's representative.

Objectives Solicitation and Decision Maker's Value Hierarchy

The solicitation of objectives was conducted through interviews with the decision maker's representative, and was based upon the agreed upon value proposition. To provide clarity to the process, an experienced DA recorder annotated the dialogue that occurred during the interviews. During the initial interview (October), the decision maker's representative indicated that his primary two objectives were the responsiveness of RED HORSE, and the political considerations surrounding a decision concerning the macroscopic organizational structure of RED HORSE. He further specified that responsiveness meant "getting people and equipment to the war (contingency, deployment location, etc.)," and entailed being responsive to doctrine, troop training, and war plans. In addition, the decision maker's representative stated that political considerations posed substantial ramifications on the global stage and in the Air Force [26]. During the second interview, the decision maker's representative indicated an additional primary objective of "Readiness." According to the decision maker's representative, this objective entailed ensuring that RED HORSE personnel were adequately trained on and familiar with the equipment sets they would be using in a contingency situation [27].

Once the decision maker's representative identified these objectives, he was shown the amended value hierarchy strawman (Fig 4.2). He agreed that the strawman reflected his basic objectives, but wanted to amend the second and third tier objectives and include different evaluation measures. Fig 4.3 shows the value hierarchy developed

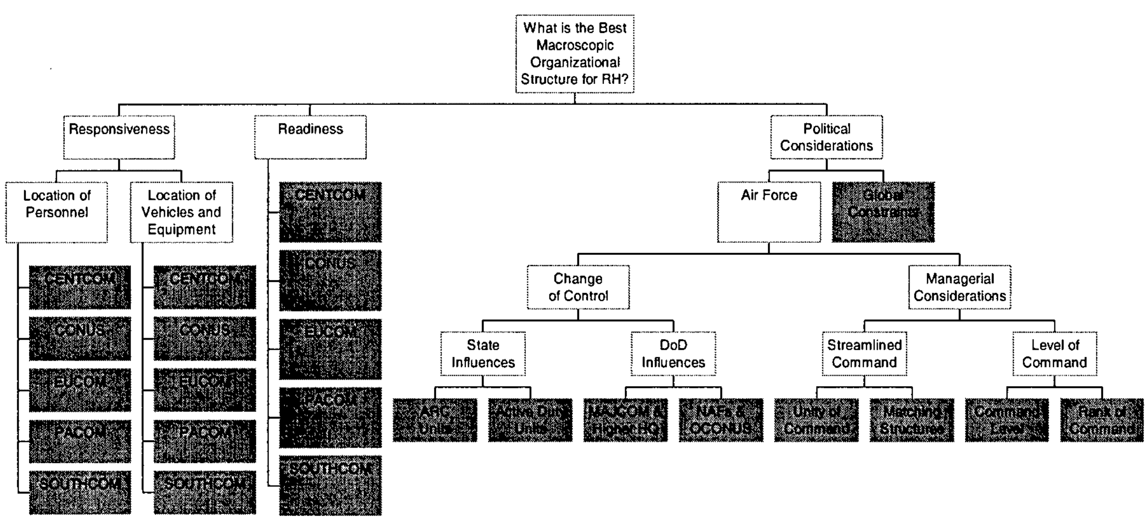


Fig 4.3 – Decision Maker's Representative's Value Hierarchy

and used as the structure underlying this research effort. This value hierarchy was based entirely on the decision maker's representative's inputs. Again, the portions shown in gray are the evaluation measures for this hierarchy, and are discussed in the "Evaluation Measures" section, presented later in this chapter.

Primary Objectives

As shown in Fig 4.4, the primary (or first-tier) objectives are "Responsiveness," "Readiness," and "Political Considerations." The remaining objectives and evaluation measures present in the value hierarchy served to further define and evaluate these three primary objectives.

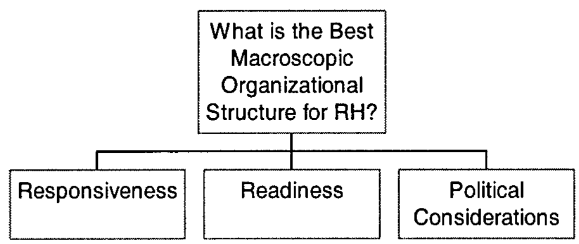


Fig 4.4 – Decision Maker's Representative's Primary Objectives

"Responsiveness" addressed the ability of RED HORSE to quickly arrive at a contingency location with resources (personnel and equipment). The decision maker's representative stated that it was imperative to meet the delivery requirements of the customers, and that this ability was directly dependent on time and money. Because sufficient funds were provided by one of the initial assumptions, the decision maker's representative indicated that time was the primary contributor to the responsiveness criteria. More specifically, time referred to how long it took to transport equipment and personnel to the contingency [26]. This concern is highlighted in its two second-tier objectives, described later in this chapter.

"Readiness" was defined as the ability of RED HORSE units to adequately train and familiarize themselves with their vehicles and equipment. The decision maker's representative highlighted the importance of having personnel trained and familiar with the actual pieces of equipment with which they would be required to perform their given contingency tasks. This familiarity directly affects a RED HORSE unit's ability to accomplish its taskings, and would contribute significantly to any decision involving the macroscopic organizational structure of RED HORSE [27].

"Political Considerations" referred to the organizational and governmental influences that affect the decision making process of a macroscopic organizational structure for RED HORSE. These influences included both domestic and foreign attitudes and regulations that govern the manner in which RED HORSE is organized and employed. The decision maker's representative indicated that the political effects of a reorganized structure would be felt throughout the Air Force – from the guard and reserves, to existing active duty commands, to CE personnel themselves. He stressed the importance of accounting for these effects in the model [26].

The remaining discussion in this section further describes these three primary objectives through the means objectives identified by the decision maker's representative.

Responsiveness

Fig 4.5 reflects the means objectives and evaluation measures that further define the primary objective of "Responsiveness." The two means objectives relating to "Responsiveness" are "Location of Personnel" and "Location of Vehicles and Equipment." Both of these means objectives address the dispersion of RED HORSE resources throughout the globe. The more dispersed the resources, the closer they will be to contingency locations, and the less time it will take for them to arrive at the

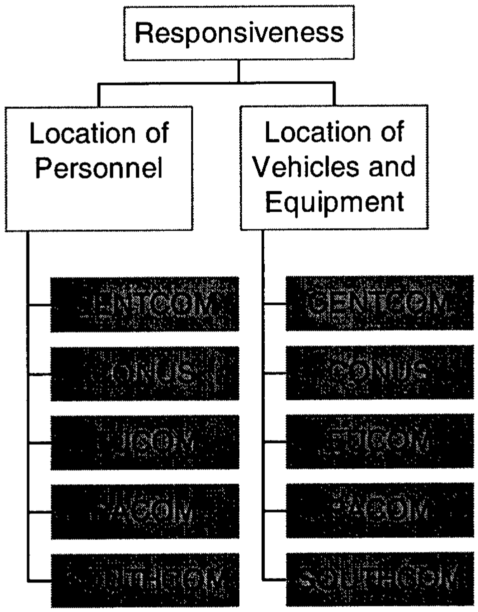


Fig 4.5 – Primary Objective of Responsiveness

contingency site. In addition, the decision maker's representative indicated that the weight of each unit is one of RED HORSE's major drawbacks. Weight is critically important to theater planners when scheduling airlift, as each available airframe has weight and size limitations. Theater planners prioritize incoming units based on the unit's capabilities vs. its size and weight. Currently, RED HORSE requires multiple aircraft and airframes in order to arrive in theater with its associated assets, making it "hard to sell to theater planners [26]". In contingency planning, airlift is a precious resource, and theater planners are extremely hesitant to commit multiple airframes for RED HORSE deployment. If RED HORSE was lighter (i.e. not as much equipment required to be transported) it would be seen as much more of a bargain to theater planners, and receive a higher prioritization for receiving airlift. Forward locating assets would potentially minimize the amount of airlift required to deploy RED HORSE units [26].

As stated in the initial assumptions, the two required resources of RED HORSE considered in this study are personnel, and vehicles and equipment. "Location of Personnel" in this model referred to the theaters in which personnel were located. The decision maker's representative noted that transporting personnel isn't as time consuming as transporting vehicles and equipment, but the transporting process still requires time (the basis of responsiveness for this study). In addition, the decision maker's representative indicated that his preference for personnel location varied with respect to each of the five theaters (CENTCOM, CONUS, EUCOM, PACOM, and SOUTHCOM) [26]. Therefore, these five theaters were reflected as evaluation measures, and are discussed later in this chapter.

RED HORSE's other required resource is vehicles and equipment. Therefore, "Location of Vehicles and Equipment" referred to the theaters in which these resources are located. For this study, "Responsiveness" was essentially a time consideration; the closer equipment is to a potential contingency location, the less time it will take to arrive at that location. However, the decision maker's representative also indicated that the increase in responsiveness realized by forward locating vehicles and equipment varies, depending upon the theater (CENTCOM, CONUS, EUCOM, PACOM, and SOUTHCOM) in which they are pre-positioned [26]. Therefore, these five theaters were again reflected as evaluation measures, and are discussed later in this chapter.

Readiness

Fig 4.6 reflects the evaluation measures that further define the primary objective of "Readiness." This primary objective indicated the ability of RED HORSE units to adequately train and familiarize themselves with their designated equipment sets. The decision maker's representative stressed the importance of this familiarity when it comes to task proficiency. As with the means objectives for "Responsiveness," the importance of this

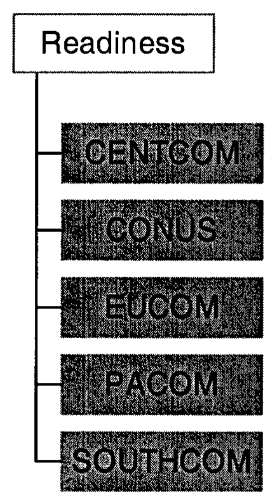


Fig 4.6 – Primary Objective of "Readiness"

familiarity was dependent upon the theater in which the personnel were located (CENTCOM, CONUS, EUCOM, PACOM, and SOUTHCOM) [27]. As such, each of these theaters served as evaluation measures to quantify "Readiness," and is discussed later in this chapter.

Political Considerations

Fig 4.7 reflects the means objectives and evaluation measures that further define the primary objective of "Political Considerations." This primary objective is further described by the means objective "Air Force" and the evaluation measure "Global Constraints." Both of these address the different types of political influences that would effect the decision maker's consideration of a macroscopic organizational structure for RED HORSE. "Air Force" pertains to the organizational influences internal to the USAF that affect the utilization and organization of RED HORSE. These were the Air Force specific factors contributing to a decision of RED HORSE's macroscopic organizational

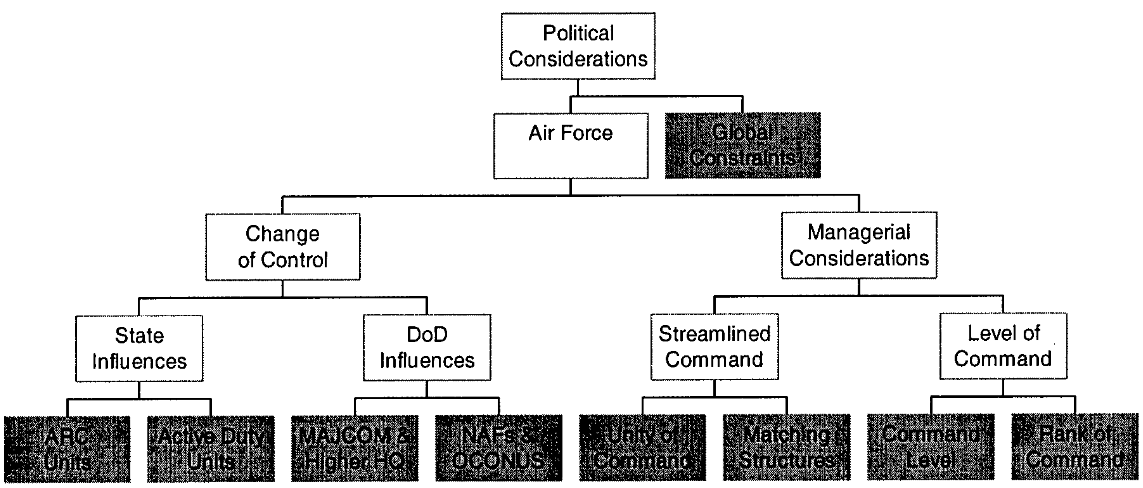


Fig 4.7 – Primary Objective of Political Considerations

structure [26]. As "Global Constraints" was deemed to be an evaluation measure, it will be discussed in the "Evaluation Measures" section of this chapter.

"Air Force" was further quantified by two third-tier means objectives: "Change of Control" and "Managerial Considerations." "Change of Control" represented the discord created by removing an organization's currently existing control over RED HORSE. Altering RED HORSE's macroscopic organizational structure would inevitably entail shifting the lines of authority from their current positions. The decision maker's representative indicated that there would be a tremendous "emotional cost of pulling a RED HORSE from a NAF," or any other unit currently possessing control [26]. This move would inevitably result in adverse political ramifications among organizations internal to the USAF. The third-tier means objective of "Managerial Considerations" referred to the ability of a commander to maintain the integrity of his/her command at an appropriate level. Changes in the macroscopic organizational structure of RED HORSE would likely involve altering the level at which command is placed, as well as the responsibility given to each level of command. Changes in either of these managerial facets could impair RED HORSE's ability to accomplish its mission. According to the decision maker's representative, it is imperative that RED HORSE control be held at a level and rank commensurate with its mission [26]. Both third-tier objectives were additionally characterized by fourth-tier means objectives.

"State Influences" and "DoD Influences" further defined the third-tier means objective "Change of Control". Each of these fourth-tier means objectives addressed existing controls that could potentially be altered due to a change in RED HORSE's macroscopic organizational structure. "State Influences" represented the affects of altering state influences over RED HORSE. These altered influences could include changes in active duty unit locations, altered ARC missions and/or locations, and the political repercussions that may arise due to these altered influences. The decision maker's representative indicated that members of Congress (each keeping the interests of his/her own state in mind) had the final say in military posture, including the locations of RED HORSE units nationwide [26]. As such, state influences would be a significant player in the macroscopic organizational structure of RED HORSE, and was further quantified by the evaluation measures "ARC Units" and "Active Duty Units," both of which are discussed in the "Evaluation Measures" section of this chapter. Similarly, "DoD Influences" addressed the political ramifications of altering existing federal influences on RED HORSE. The decision maker's representative indicated that RED HORSE currently receives input from a number of federal organizations, among them NAFs; MAJCOMs; Air Force Civil Engineering Support Agency (AFCESA); the Installation and Logistics, Engineers (ILE) department of Air Staff; and the executive branch. A change in the influence of any of these players could create discord within the Air Force and the federal branch, making it a consideration in determining the macroscopic organizational structure of RED HORSE [26]. To account for this federal discord, the evaluation measures of "MAJCOMs and Higher HQs" and "NAF and OCONUS bases" were developed, and are discussed in the "Evaluation Measures" section of this chapter.

"Streamlined Command" and "Level of Command" further characterized the third-tier means objective "Managerial Considerations." Each of these fourth-tier means objectives addressed the managerial aspects that could potentially be affected due to a change in RED HORSE's macroscopic organizational structure. "Streamlined Command" denoted the efficiency of RED HORSE's command and control. This means objective accounted for how unified RED HORSE's command would be, and how well its ADCON and OPCON command structures matched, denoted by its evaluation measures "Unity of Command" and "Matching Structures," both of which are discussed in the "Evaluation Measures" section of this chapter. "Level of Command" indicated the level at which overarching authority is maintained in an organizational structure. This means objective accounted for both the organizational level of command (MAJCOM, NAF, Theater Command, or wing levels) as well as the rank associated with that command level [26]. The evaluation measures "Command Level" and "Rank of Command" further quantified this fourth-tier means objective, and are discussed in the next section.

Evaluation Measures and Value Functions

In the decision maker's representative's value hierarchy (Fig 4.3), there were a total of twenty-four evaluation measures developed for this research effort. Each of these evaluation measures were developed in the same manner as the fundamental and means objectives identified in the previous section; they were solicited from the decision maker's representative during interviews in October and November, and various discussions that followed. This section defines these evaluation measures as they relate to their primary objectives ("Responsiveness," "Readiness," and "Political Considerations"). In addition, the scales and the value functions developed for each evaluation measure are presented. Each of these evaluation measures were constructed in a piecewise linear fashion; none of them utilized the exponential method discussed in Chapter 3.

Responsiveness

As shown in Fig 4.5, there were ten evaluation measures developed for the primary objective of "Responsiveness," five for each of its two means objectives. Each of these evaluation measures indicated the decision maker's representative's preference for having RED HORSE resources located in various theaters around the globe. As this research effort assumes that no RED HORSE units will be added or removed from those currently existing, the existing number of squadron equivalents (7) and equipment sets (9) served as constraints as to the maximum number that could be forward located in a theater. The scales for each of the "Responsiveness" evaluation measures were natural, direct scales. The "Location of Personnel" evaluation measures assessed the number of squadron equivalents (in units of 0.5 squadron equivalents) located in a particular theater; this is a natural scale (number of squadron equivalents) that focuses on the attainment of the specific objective (location of personnel). Similarly, the "Location of Vehicles and Equipment" evaluation measures assessed the number of equipment sets located in a particular theater; this too is a natural scale (number of equipment sets) that focuses on the attainment of the specific objective (location of equipment sets).

The first evaluation measure of "CENTCOM" indicated the decision maker's representative's preference of locating personnel in SWA. As shown in Fig 4.8, the decision maker's representative's preferences in regards to personnel in the CENTCOM theater of operations were linear in nature. This indicated that the decision maker's

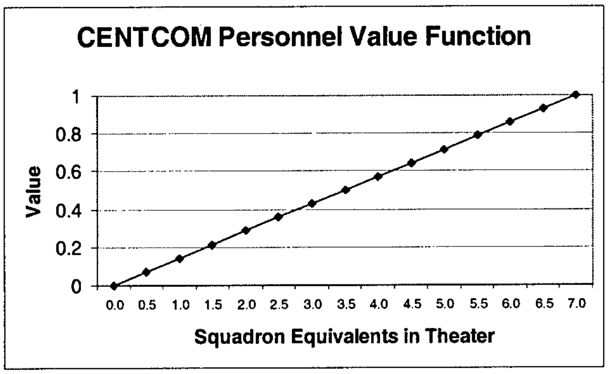


Fig 4.8 – Value Function for CENTCOM Personnel

representative placed the same value increment on each additional increase in personnel located in theater – i.e. each additional squadron equivalent increased the value of the decision maker's representative the same amount.

The evaluation measure of "CONUS" indicated the decision maker's representative's preference of locating personnel in CONUS. As shown in Fig 4.9, the decision maker's representative's preferences in regards to personnel in CONUS were slightly concave in nature. This concavity was comprised of two separate linear regions – between 0 and 6 squadron equivalents, and between 6 and 7 squadron equivalents. The decision maker's representative's preferences indicated that every time

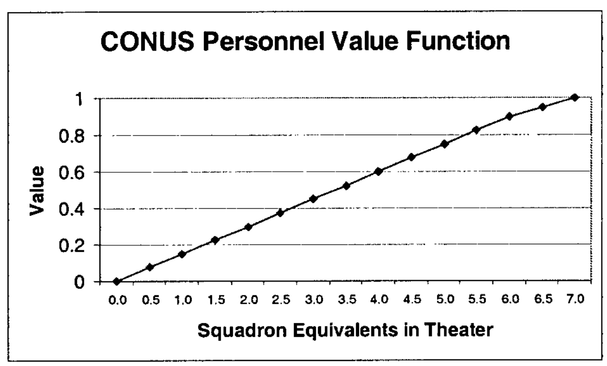


Fig 4.9 – Value Function for CONUS Personnel

an additional squadron equivalent was located in CONUS, the decision maker's representative placed the same amount of value increase on that increase of personnel (within each region of linearity). Fig 4.9 also shows that the majority of the decision maker's representative's value (90%) had been realized once 6 squadron equivalents were located in CONUS; minimal additional value could be gained from locating further squadron equivalents in theater. The decision maker's representative indicated 6 squadron equivalents as the 90% mark as that was the number of squadron equivalents currently located in CONUS. He cited recent operations in Kosovo and Bosnia as proving the benefits of maintaining this number of squadron equivalents in CONUS from a responsiveness standpoint [28].

The evaluation measure of "EUCOM" indicated the decision maker's representative's preference of locating personnel in the European theater of operations. As shown in Fig 4.10, the decision maker's representative's preferences in regards to personnel in EUCOM were concave in nature. This indicated decreasing returns for placing additional squadron equivalents in theater, according to the decision maker's representative's preferences. Specifically, the majority of the decision maker's representative's value (90%) could be realized after locating 0.5 squadron equivalents in the European theater; very little additional value could be obtained by placing more squadron equivalents in this theater. The decision maker's representative indicated that 0.5 squadron equivalents in the European theater would be sufficient to respond to any unforeseen contingencies, as very few unanticipated contingencies have historically arisen in that theater [27].

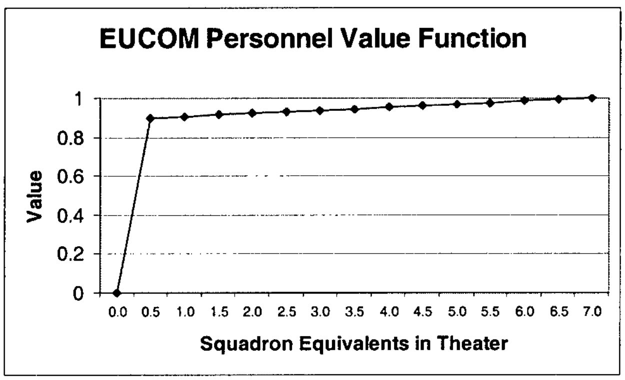


Fig 4.10 – Value Function for EUCOM Personnel

The evaluation measure of "PACOM" indicated the decision maker's representative's preference of locating personnel in the Pacific theater of operations. The decision maker's representative's preferences in regards to personnel in PACOM are shown in Fig 4.11. Similar to the decision maker's representative's preferences in regards to personnel in CENTCOM, his preferences in regards to personnel in PACOM were linear in nature; the decision maker's representative placed the same value increment on each additional increase in personnel located in theater.

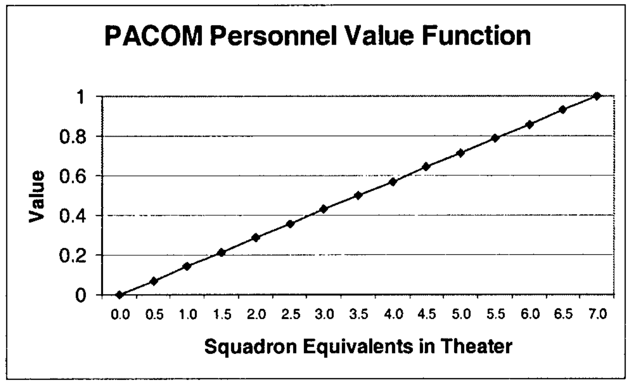


Fig. 4.11 – Value Function for PACOM Personnel

The evaluation measure of "SOUTHCOM" indicated the decision maker's representative's preference of locating personnel in the Southern theater of operations; these preferences are shown in Fig 4.12. Similar to the decision maker's representative's preferences in regards to personnel in EUCOM, his preferences in regards to personnel in SOUTHCOM were concave in nature. The decision maker's representative again indicated that 0.5 squadron equivalents in the Southern theater would be sufficient to respond to any unforeseen contingencies, as very few unanticipated contingencies have historically arisen in that theater [27].

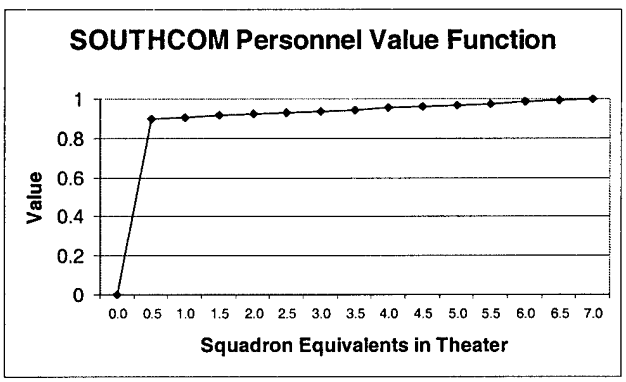


Fig 4.12 – Value Function for SOUTHCOM Personnel

The second evaluation measure of "CENTCOM" indicated the decision maker's representative's preference of locating vehicles and equipment in SWA. Fig 4.13 shows that the decision maker's representative's preferences in regards to vehicles and equipment in the CENTCOM theater of operations as linear.

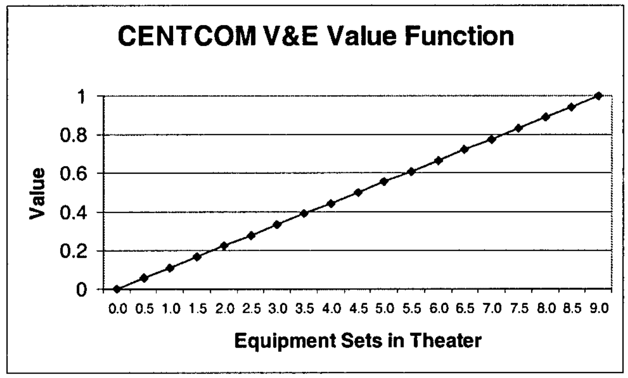


Fig 4.13 – Value Function for CENTCOM Vehicles and Equipment

The evaluation measure of "CONUS" indicated the decision maker's representative's preference of locating vehicles and equipment in CONUS. As shown in Fig 4.14, the decision maker's representative's preferences in regards to vehicles and equipment in CONUS were concave in nature. Similar to the value function for CONUS Personnel, this concavity was comprised of two separate regions of linearity – between 0 and 6 equipment sets, and between 6 and 9 equipment sets. The decision maker's representative indicated 6 equipment sets as the 90% mark as that was the number of equipment sets currently located in CONUS. He cited recent operations in Kosovo and Bosnia as proving the benefits of maintaining this number of equipment sets in CONUS from a responsiveness standpoint [28].

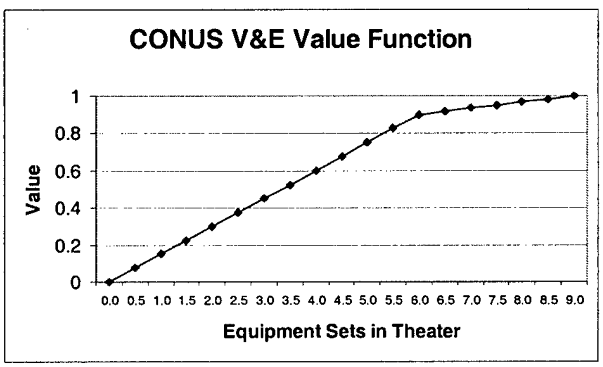


Fig 4.14 – Value Function for CONUS Vehicles and Equipment

The evaluation measure of "EUCOM" indicated the decision maker's representative's preference of locating vehicles and equipment in the European theater of operations. As shown in Fig 4.15, the decision maker's representative's preferences in regards to vehicles and equipment in EUCOM were concave in nature. This indicated decreasing returns for placing additional equipment sets in theater, according to the decision maker's representative's preferences. Half of the decision maker's representative's value could be realized after placing a single equipment set in theater, as there have been very few unforeseen contingencies in that theater historically. The large majority of the decision maker's representative's value (90%) could be realized after locating 3 equipment sets in the European theater, as the decision maker's representative was confident that 3 equipment sets could adequately support any unforeseen contingencies in that theater [27].

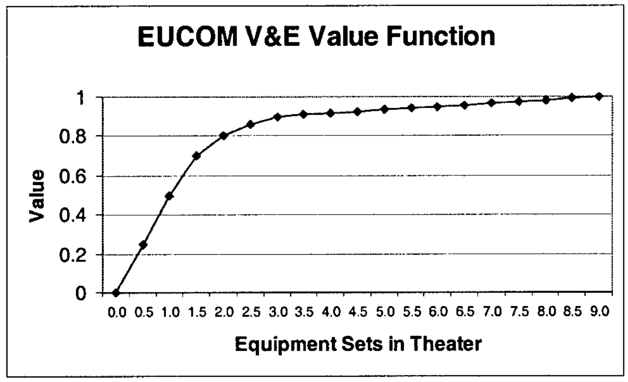


Fig 4.15 – Value Function for EUCOM Vehicles and Equipment

The evaluation measure of "PACOM" indicated the decision maker's representative's preference of locating vehicles and equipment in the Pacific theater of operations; these preferences were linear, as shown in Fig 4.16

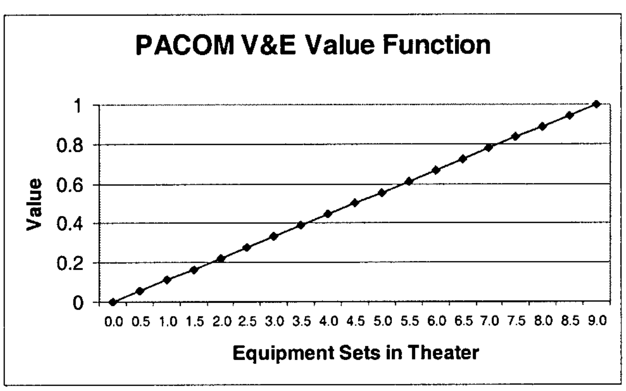


Fig 4.16 – Value Function for PACOM Vehicles and Equipment

The evaluation measure of "SOUTHCOM" indicated the decision maker's representative's preference of locating vehicles and equipment in the Southern theater of operations. As shown in Fig 4.17, these preferences were also linear.

This contrasted with the decision maker's representative's preferences for locating personnel in the SOUTHCOM theater. This contrast was explained due to the significant amount of increased effort it takes to transport vehicles and equipment than personnel [27].

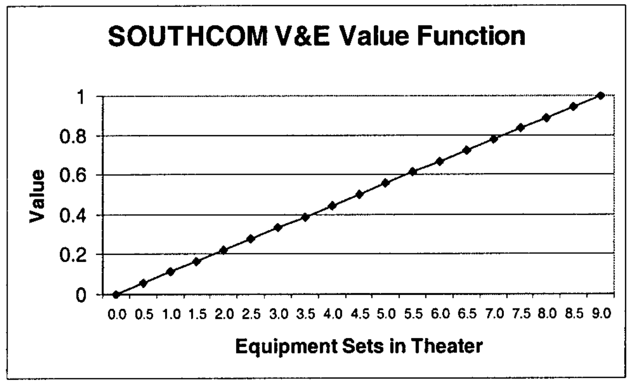


Fig 4.17 – Value Function for SOUTHCOM Vehicles and Equipment

Readiness

As shown in Fig 4.6, there were five evaluation measures developed that pertained to the primary objective of "Readiness." Each of these evaluation measures indicated the decision maker's representative's preference for having RED HORSE resources co-located in various theaters around the globe. To train and become familiar with equipment, personnel must have the opportunity to gain access to the equipment. The decision maker's representative indicated that this requirement would be satisfied as long as the personnel and equipment were located in the same theater [27]. A maximum number of 7 squadron equivalents could be located in a theater without equipment, since this study only utilized those units currently in existence. The scales for each of the "Readiness" evaluation measures were natural, direct scales. They each assessed the number of squadron equivalents (in units of 0.5 squadron equivalents) located in a particular theater without equipment; a natural scale (number of squadron equivalents) that focused on the attainment of the specific objective (equipped personnel).

The evaluation measure of "CENTCOM" indicated the decision maker's representative's preference of co- locating personnel and equipment in SWA. As shown in Fig 4.18, the decision maker's representative's preferences in regards to unequipped personnel in the CENTCOM theater of operations were linear in nature.

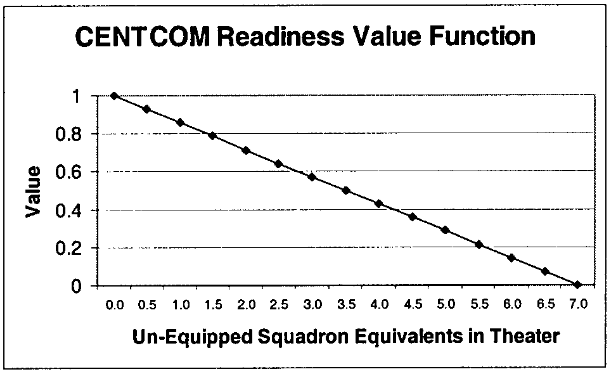


Fig 4.18 – Value Function for CENTCOM Readiness

The evaluation measure of "CONUS" indicated the decision maker's representative's preference of co- locating personnel and equipment in the U.S. As shown in Fig 4.19, the decision maker's representative's preferences in regards to equipped personnel in CONUS were concave in nature. Similar to the previous CONUS evaluation measures, this concavity was comprised of two separate regions of linearity – between 0 and 6 squadron equivalents, and between 6 and 7 squadron equivalents. The decision maker's representative again indicated that recent contingencies in Kosovo and Bosnia proved the benefits of having all 6 CONUS squadron equivalents co-located with their equipment sets.

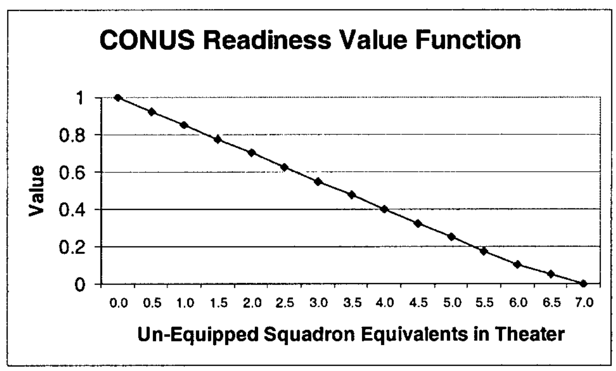


Fig 4.19 – Value Function for CONUS Readiness

The evaluation measure of "EUCOM" indicated the decision maker's representative's preference of co- locating personnel and equipment in the European theater of operations. Fig 4.20 illustrates that these preferences were linear.

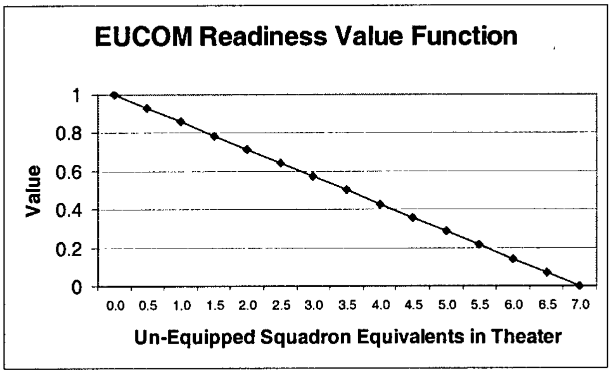


Fig 4.20 – Value Function for EUCOM Readiness

The evaluation measure of "PACOM" indicated the decision maker's representative's preference of co- locating personnel and equipment in the Pacific theater of operations. These preferences are shown in Fig 4.21. As with the previous value functions for the PACOM theater (those addressing the "Location of Personnel" and the "Location of Vehicles and Equipment"), the decision maker's representative's preferences in regards to unequipped personnel in the Pacific theater of operations were linear in nature.

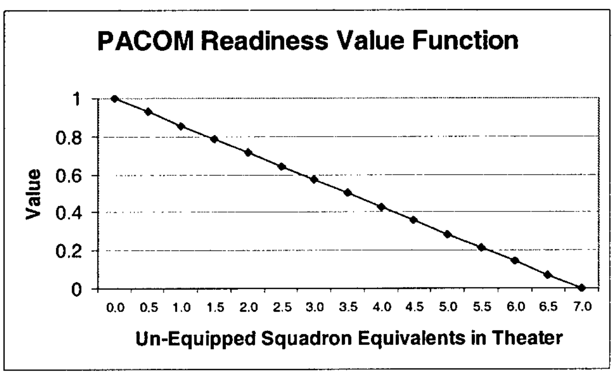


Fig 4.21 – Value Function for PACOM Readiness

The evaluation measure of "SOUTHCOM" indicated the decision maker's representative's preference of co- locating personnel and equipment in the Southern Theater. These preferences are reflected in Fig 4.22. As shown, the decision maker's representative's preferences in regards to unequipped personnel in the SOUTHCOM theater of operations were also linear in nature.

Political Considerations

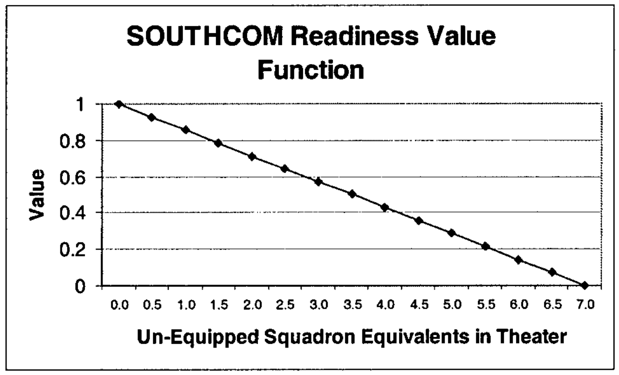


Fig 4.22 – Value Function for SOUTCOM Readiness

As shown in Fig 4.7, there were nine evaluation measures developed for the primary objective of "Political Considerations." One of these evaluation measures, "Global Constraints," directly related to "Political Considerations," while the remaining eight pertained to the means objective of "Air Force."

"Global Constraints" addressed the governmental influences affecting the utilization and organization of RED HORSE around the globe. The decision maker's representative remarked "Getting the resources to a contingency location is one thing, but being able to use them once they are there is another [26]." Governmental influences include legislation and foreign policy philosophy adopted by the U.S. government, as well as those influences imparted by the local, foreign governments. Because of these influences, US forces often encounter difficulties concerning the utilization of in-theater assets. The decision maker's representative indicated that various theaters had additional regulations concerning the use of American resources. Some of these regulations include limiting the types of operations in-theater resources can support, restricting the movement of resources within a theater, and the removal of resources from a theater once they have fulfilled their intended purpose. As an example, the decision maker's representative pointed out the complications that Americans have experienced in Saudi Arabia, stating how the Saudis want an American presence, but don't want to project the image of being used as a staging base against its Arab brethren [26]. These regulations could significantly reduce the effectiveness of these resources in various contingency locations around the world. The decision maker's representative indicated a desire to locate RED HORSE resources in those theaters with the least amount of constraints. Accordingly, this evaluation measure possessed a constructed, proxy scale; it was comprised of the different theaters in which resources could be located (CENTCOM, CONUS, EUCOM, PACOM, SOUTHCOM), and assumed that the theater in which resources were located was indicative of the governmental constraints that would be encountered by RED HORSE resources located in that theater. Fig. 4.23 illustrates that the decision maker's representative indicated that the greatest difficulty was encountered when locating resources in CENTCOM (corresponding value of 0); while the least amount of difficulty was encountered when resources were located in CONUS (corresponding value of 1). The degree of difficulty decreased (and the value of the decision maker's representative increased) as resources progressed from CENTCOM, to SOUTHCOM, to PACOM, to EUCOM, to CONUS.

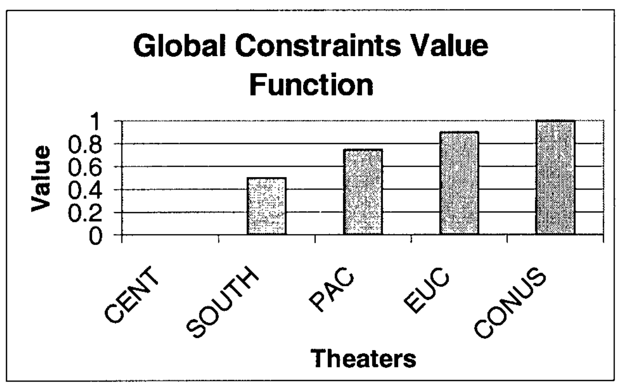


Fig 4.23 – Value Function for Global Constraints

The remaining eight evaluation measures address the "Air Force," each relating directly to its four fourth-tier means objectives. These eight evaluation measures were "ARC Units," "Active Duty Units," MAJCOM & Higher HQs," "NAFs & OCONUS Bases," "Unity of Command," "Matching Structures," "Command Level," and "Rank of

Command." Almost all of these evaluation measures possessed natural, direct scales, each scale measuring the number of units or the number of colonels; natural scales (number of units or colonels) that focused on the attainment of the specific objective (units affected, units in a command, rank of a command, etc.). The only exception was the "Command Level" evaluation measure. This measure had a constructed, direct scale; a scale comprised of three command level possibilities (base, NAF, and MAJCOM) that focused on the attainment of the specific objective (level at which command was held).

"ARC Units" was the first evaluation measure that accounted for the different state influences existing in the current command structure of RED HORSE. These influences were comprised of the nine existing ARC units listed in Tbl 2.1. This evaluation measure accounted for geographically relocating and/or changing the command structure of an ARC unit. Either of these scenarios resulted in an altered state influence, and its impact was assessed by the "ARC Units" evaluation measure. As shown in Fig 4.24, the decision maker's representative's preferences were reflected by an S-curve shape. This implies that the decision maker's representative's preferences remained relatively unchanged along a smaller range of outcomes. In this case, the decision maker's representative did not perceive much of a value difference in changing the influences of 6 units from changing the influences of 2 units. The decision maker's representative indicated a minimal value loss

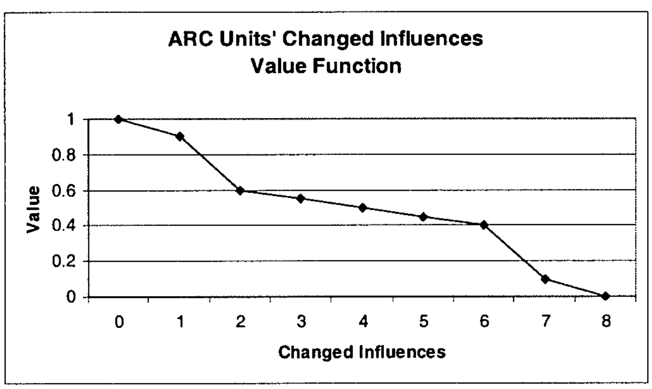


Fig 4.24 – Value Function for ARC Units

as a result of changing the influence of just one ARC unit (only a 10% reduction in value); whereas there was a significant loss of value as a result of changing the influences of greater than one ARC unit (a loss of at least 30%).

"Active Duty Units" was the second evaluation measure that accounted for the different state influences existing in the current command structure of RED HORSE. These influences were comprised of the three existing CONUS AD Units listed in Tbl 2.1. According to this evaluation measure, a state's influence was impacted as a result of geographically relocating a CONUS AD. As can be seen from Fig 4.25, the decision maker's representative's preferences in regards to affecting CONUS AD units were linear; each additional CONUS AD units affected decreased the value of the decision maker's representative the same amount.

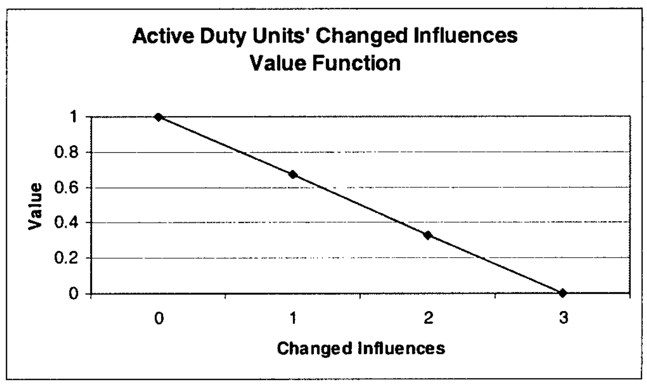


Fig 4.25 – Value Function for AD CONUS Units

"MAJCOMs & Higher HQs" was the first of two evaluation measure that accounted for the different DoD influences existing in the current command structure of RED HORSE. These influences were comprised of the four existing MAJCOMs (ACC, AFRC, PACAF, and USAFE) and two higher headquarters organizations (ILE and the Air Force Civil Engineering and Services Agency (AFCESA)) currently affecting RED HORSE employment and utilization. This evaluation measure assessed the potential impact on the influence of these federal organizations due to a change in the command structure of AD or ARC RED HORSE units. For example, if the command structure or geographic location of any of the active duty RED HORSE units were changed, these DoD organizations may not have the same influence as they currently enjoy – perhaps ACC would no longer possess OPCON for AD units, PACAF no longer possessed an in-theater RED HORSE unit, or ILE no longer had the same degree of input because each unit reported to a different chain of command. As can be seen from Fig 4.26, the

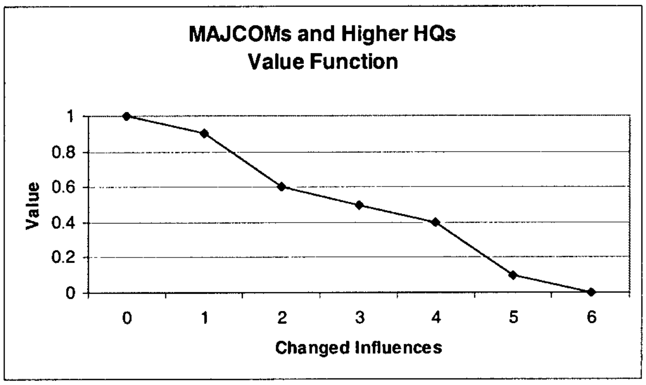


Fig 4.26 - Value Function for MAJCOMs & Higher HQs

decision maker's representative's preferences were indicated by an S-curve shape. For this evaluation measure, the decision maker's representative did not perceive much of a value difference in changing the influences of 4 organizations from changing the influences of 2 organizations. Also, the decision maker's representative was not opposed to changing the influence of only one organization (only a 10% reduction in value), but he indicated a significant loss of value in changing the influences of more than one organization (a loss of at least 30%).

"NAFs & OCONUS Bases" was the second evaluation measure that accounted for the different federal influences existing in the current command structure of RED HORSE. These influences were comprised of the four existing NAFs (7 AF, 9 AF, 10 AF, and 12 AF) and two OCONUS bases (Camp Darby, Italy and Osan, Korea) currently affecting RED HORSE employment and utilization. This evaluation measure assessed the potential impact on the influence of these federal organizations due to a change in the command structure of AD or ARC RED HORSE units. A shift in the existing command structure of RED HORSE units could result in one or more of these NAFs or OCONUS bases losing their RED HORSE contingent – i.e. relocating 554 RHS from the Pacific Theater (affects 7AF and Osan AB, ROK), placing all RED HORSE units under the unified command (OPCON and ADCON) of a MAJCOM (affects all of the NAFs), or relocating the 2 equipment sets currently maintained by 31 RHF (affects Camp Darby, Italy). Fig 4.27 shows that the decision maker's representative's preferences were indicated by an S-curve shape, identical to those preferences obtained for "MAJCOMs & Higher HQs." The decision maker's representative's preferences were relatively unchanged along a smaller range of outcomes (between 2 and 4 changed influences), while drastically affected before and after this range.

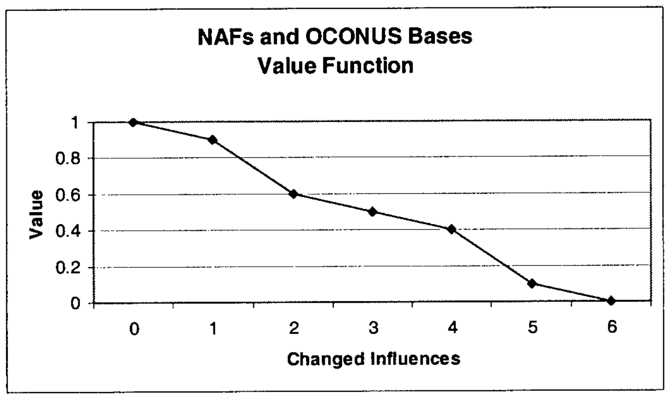


Fig 4.27 – Value Function for NAFs and OCONUS bases

"Unity of Command" was the first of two evaluation measures to address the degree to which RED HORSE's command was streamlined. It measured the degree to which all RED HORSE units fell under the command of a single organization. The decision maker's representative indicated, and Air Force doctrine dictates, that a unified command provides maximum flexibility and a clear chain of command for a unit. These aspects significantly increase the effectiveness of a unit and are sought after when designing unit structure [26]. RED HORSE units have the potential to fall under nine different commands for ADCON and/or OPCON – four Theater Commands

(CENTCOM, EUCOM, PACOM, and SOUTHCOM) and five MAJCOMs (ACC, AFRC, AMC, PACAF, and USAFE). Fig 4.28 reflects the concavity of the decision maker's representative's preferences in regards to the number of units falling under a single command. This indicated decreasing returns for a greater number of commands to which RED HORSE units report. Specifically, the majority of the decision maker's representative's value (60%) had eroded after 3 different commands were utilized to organize RED HORSE on a macroscopic scale; utilizing additional commands would result in the loss of relatively little additional value.

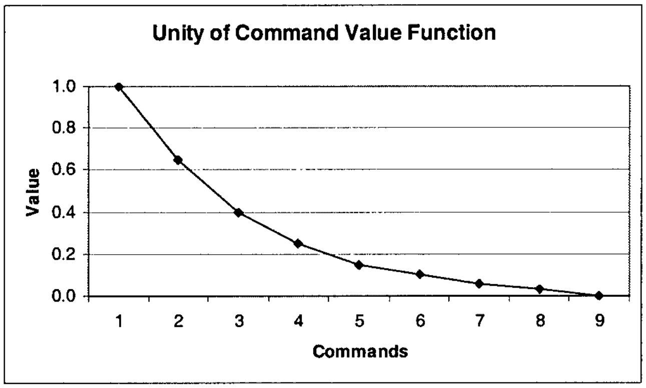


Fig 4.28 – Value Function for Unity of Command

"Matching Structures" was the second evaluation measure addressing the "Streamlined Command" objective. It specifically measured the degree to which the peacetime (ADCON) and wartime (OPCON) command structures matched for each AD RED HORSE unit (554 RHS, 819 RHS, 820 RHS, and 823 RHS). ARC units were not included in this evaluation measure, as these units possess the same chain of command in peacetime and wartime [26]. As shown in Fig 4.29, the decision maker's representative's preferences in regards to matching peacetime and wartime command structures were linear. This

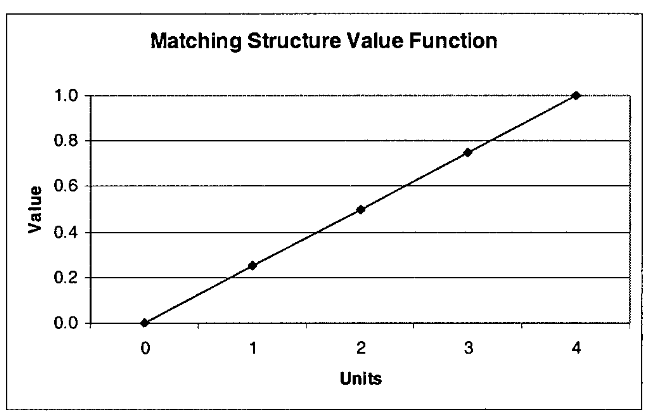


Fig 4.29 – Value Function for Matching Structures

indicated the same value increment placed on each additional AD RED HORSE unit that possessed the same command structure in peacetime as in wartime.

"Command Level" was the first of two evaluation measures that addressed the level of command present in RED HORSE's macroscopic organizational structure. This measure assessed the actual level at which RED HORSE command was maintained, and the decision maker's preferences are reflected in Fig 4.30. The decision maker's representative pointed out that failing to maintain RED HORSE command at the appropriate level would reduce its ability to function as intended, significantly impairing its ability to accomplish its mission. For example, if a RED HORSE unit was assigned to a wing commander, the "...temptation would be far too great for a commander..." to use RED HORSE to accomplish base maintenance or construction requirements, rather than reserving it for its MTW, OOTW, and AEF missions [26]. This evaluation measure assessed each alternative at the lowest level at which command was held. The decision maker's representative indicated that he had just as little use for one unit assigned to the base level as to having all units assigned to the base level [28]. As discussed previously, this evaluation measure possessed a constructed, direct scale, consisting of three potential outcomes: base, NAF, and MAJCOM. The only other possible outcome would be HQ AF, but that was deemed impractical due to the nature of RED HORSE [27]. As Fig.

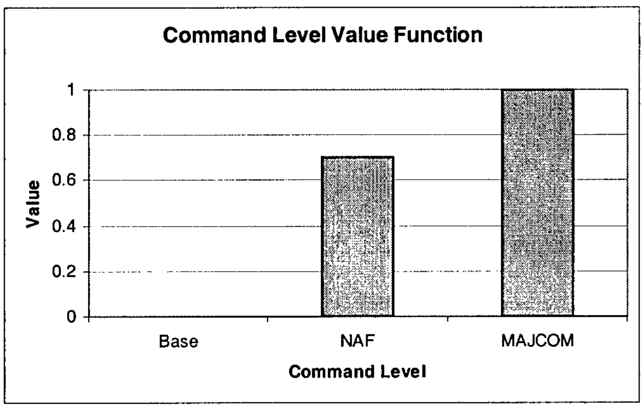


Fig 4.30 – Value Function for Command Level

4.30 shows, the decision maker's representative indicated that the worst level for command of a RED HORSE unit was at the base (corresponding value of 0); while the best level for command of RED HORSE was at the MAJCOM (corresponding value of 1).

"Rank of Command" was the second evaluation measure that addressed the level of command present in a macroscopic organizational structure. This measure addressed the number of Colonels present within the RED HORSE community. The decision maker's representative stated that a commander's rank affects his/her ability to obtain the resources required for his/her unit, as well as his/her ability to negotiate among other organizations (Air Force or otherwise) for his/her unit's best interests. As such, the decision maker's representative indicated a desire to keep the greatest number of Colonels within RED HORSE as possible [26]. Currently, there is a Colonel assigned to each of the three AD CONUS RED HORSE units. As this research effort assumed that no units would be added, three Colonels were deemed the maximum number possible for this study. As shown in Fig 4.31, the decision maker's representative's preferences in regards to the number of Colonels existing in RED HORSE were linear; each additional Colonel within the RED HORSE organization increased the value of the decision maker's representative the same amount.

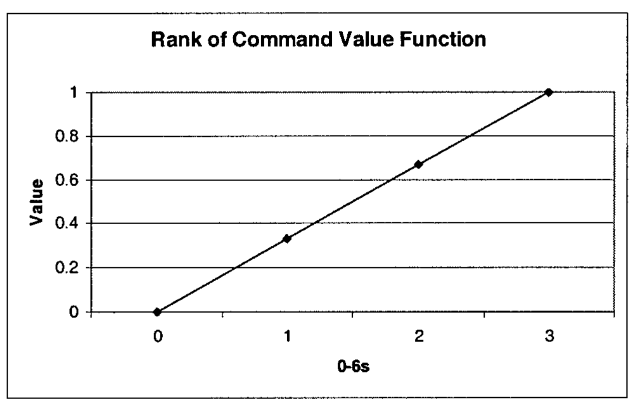


Fig 4.31 – Value Function for Rank of Command

Objective and Evaluation Measure Weights

Once the decision maker's representative validated the value hierarchy, weights were assigned to the objectives and evaluation measures represented in the hierarchy. These weights were assigned during the second interview (November), utilizing the swing weighting technique. As with the other solicitation processes, an experienced DA recorder annotated the dialogue that occurred during the interview to provide clarity to the process.

Swing weighting techniques rely on the tradeoffs prevalent in a decision situation involving multiple, competing objectives. Recalling the decision maker's representative's value hierarchy (Fig 4.3), these competing objectives are apparent. For example, "Responsiveness," "Readiness," and "Political Considerations" all compete with one another to determine the best macroscopic organizational structure for RED HORSE. Similarly, "Command Level" and "Rank of Command" compete with one another to determine the best "Level of Command." Quantifying the tradeoffs that existed in the value hierarchy was first accomplished on the lowest level, and then advanced up the hierarchy. In this manner, local and global weights were developed for all of the objectives and evaluation measures existing in the hierarchy. Local weights are ones relevant between evaluation measures and/or objectives existing on the same level; whereas global weights are the normalized weights of each evaluation measure or objective over the entire value hierarchy. These weights are illustrated in Fig 4.32 (global weights in parenthesis), and the calculations supporting these weights are provided in Appendix A. The remainder of this section describes how the decision maker's representative quantified the tradeoffs existing in the value hierarchy.

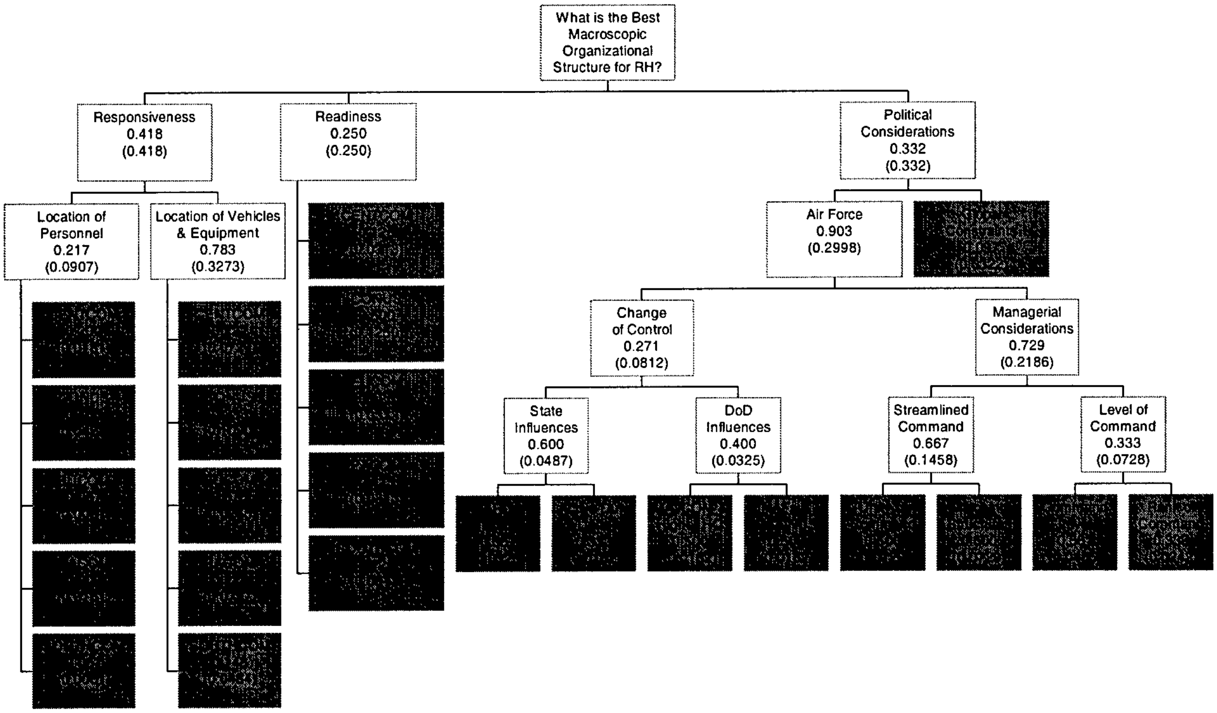


Fig 4.32 – Objective's and Evaluation Measure's Weights

Political Considerations

As shown in Fig 4.3, the greatest number of evaluation measures and objectives existed in the "Political Considerations" branch of the decision maker's representative's value hierarchy. As such, this is where the weight assessment process began, beginning at the lowest level and working through the hierarchy from right to left.

The first tradeoff discussed was the one existing between "Command Level" and "Rank of Command." The decision maker's representative indicated "Command Level" was twice as important as "Rank of Command." He felt that if command were placed at the appropriate level then the commander would be able to obtain the support he/she required, regardless of his/her rank [27].

The next tradeoff analyzed was the one existing between "Unity of Command" and "Matching Structures." The decision maker's representative indicated that these evaluation measures were equal in importance, stating that it was equally valuable to him to have all RED HORSE units under one command as it was to have matching command structures in AD RED HORSE units.

Next, the tradeoffs existing between "Streamlined Command" and "Level of Command" were identified. This was accomplished by quantifying the decision maker's representative's preference between "Matching Structures" and "Command Level." The decision maker's representative felt that "Matching Structures" would contribute more to the political considerations surrounding a macroscopic organizational decision, and as such, was slightly more important. He indicated that the ratio of these two evaluation measures was 60/40, resulting in a ratio of 2 – 1 between "Streamlined Command" and "Level of Command," indicated by the local weights shown in Fig 4.32.

The tradeoff between "MAJCOMs & Higher HQs" and "NAFs & OCONUS Bases" was quantified next. The decision maker's representative indicated that each of these evaluation measures were of equal importance as well. He stated that affecting the influence of either one would have significant implications in the political context of any macroscopic organizational decision made concerning RED HORSE structure.

The decision maker's representative next quantified the tradeoff between "ARC Units" and "AD Units," indicating that affecting "ARC Units" was twice as significant as affecting "AD Units." He stated that AD units are affected all of the time – they are organized in a manner to deal with change. Conversely, affecting the command structure or location of an ARC unit would cause significant repercussions, as these units are comprised of local civilians, unable to rapidly change locations.

The tradeoff between "State Influences" and "DoD Influences" was quantified by analyzing the evaluation measures "ARC Units" and "MAJCOMs & Higher HQs." The decision maker's representative indicated that "ARC Units" was twice as significant as "MAJCOMs & Higher HQs." As before, he stated that the impact of affecting ARC personnel and organizations was more significant than the impact of affecting AD personnel and organizations (such as those comprising "MAJCOMs and Higher HQs").

"ARC Units" and "Command Level" were used to quantify the tradeoff that existed between "Management Considerations" and "Change of Control." According to the decision maker's representative, the relationship between these two evaluation measures was 60/40, in the favor of "Command Level." He stated that assigning command at an appropriate level was more important than the units that might be affected because of such a responsibility shift. These preferences resulted in the weights reflected for "Management Considerations" and "Change of Control" shown in Fig 4.32.

The final tradeoff existing in the "Political Considerations" branch was between "Air Force" and "Global Constraints." To quantify this relationship, the ratio between "Command Level" and "Global Constraints" was established as 60/40. The decision maker's representative stated that internal organizational dynamics were more significant to macroscopic organizational structure than regional constraints due to terrain or government influences. This resulted in the overwhelming local weight of "Air Force" compared to "Global Constraints," as shown in Fig 4.32.

Responsiveness

The evaluation measures and objectives in the "Responsiveness" branch of the value hierarchy were quantified next, as this branch had the second most number of objectives and evaluation measures. Again, the weight assessment process began at the lowest level in this portion of the hierarchy, and worked up through the hierarchy.

The tradeoffs existing between the five "Location of Personnel" evaluation measures were identified first. The relationship between "CENTCOM" and each of the other four theaters was quantified. The decision maker's representative stated that RED HORSE personnel could be most responsive by being located in the CONUS. He expanded his opinion to say that transporting personnel is not that time consuming, and by having them in CONUS they could be deployed to any contingency theater. Accordingly, the decision maker's representative indicated that the ratio of importance between "CONUS" and "CENTCOM" was 70/30. In addition, he indicated that if personnel were to be located outside of the CONUS, the most benefit (in terms of responsiveness) could be gained by locating those personnel in the theaters with the highest MTW potential (PACOM and CENTCOM). As such, he indicated that the importance of "CENTCOM" and "PACOM" was equal. He also denoted "CENTCOM" to be three times as important as "EUCOM" and "SOUTHCOM" [27].

The tradeoffs existing between the five "Location of Vehicles and Equipment" evaluation measures were identified next. These tradeoffs were addressed by quantifying the relationship between "CENTCOM" and each of the other four theaters, and were very similar to the tradeoffs identified for the "Location of Personnel" evaluation measures. The primary difference between these sets of tradeoffs was in the weight ratios between the evaluation measures relating to different resources (personnel or vehicles and equipment). Similar to RED HORSE personnel, the decision maker's representative stated that RED HORSE vehicles and equipment could be most responsive by being located in the CONUS. He expanded his opinion to say that although transporting vehicles and equipment is time-consuming, having them in CONUS would provide RED HORSE the flexibility to deploy to any contingency theater. As such, the decision maker's representative indicated that the ratio of importance between "CONUS" and "CENTCOM" was 60/40. As with the "Location of Personnel" evaluation measures, he indicated that if resources were to be located outside of the CONUS, the most benefit (in terms of responsiveness) could be gained by locating them in the theaters with the highest MTW potential (PACOM and CENTCOM). Accordingly, he indicated that the importance of "CENTCOM" and "PACOM" was equal. Further, he characterized the ratio of "CENTCOM" to "SOUTHCOM" as 60/40, and denoted "CENTCOM" to be three times as important as "EUCOM" [27].

Finally, the relative importance of "Location of Personnel" and "Location of Vehicles and Equipment" was established. This was done by quantifying the relationship between "CENTCOM [personnel]" and "CENTCOM [V&E]." The decision maker's representative again emphasized that the location of vehicles and equipment had a much greater impact on "Responsiveness" than the location of personnel. As such, he characterized the ratio between these two as 80/20, in favor of "CENTCOM [V&E]" [27]. This resulted in the overall weights of these two objectives being overwhelmingly skewed towards "Location of Vehicles and Equipment," as shown in Fig 4.32.

Readiness

The last evaluation measures and objectives to be quantified were those in the "Readiness" branch of the value hierarchy. Similar to the "Responsiveness" evaluation measures, the tradeoffs existing in the "Readiness" branch were quantified by defining the relationship between "CONUS" and each of the other four theaters. The decision maker's representative indicated that it was most important to have personnel and equipment co-located in the CONUS, as this was the theater in which ARC personnel were located. These personnel did not have the same exposure to vehicles and equipment as AD personnel, and required more opportunity to gain familiarity. The decision maker's representative also stated that the importance of co-locating equipment and personnel in each of the other four theaters were equal. Consequently, he defined "CONUS" to be four times as important as each of the other theaters (all of them being equal) [27].

Primary Objectives

After the weights for all the means objectives and evaluation measures were identified, the weights for each of the three primary objectives were solicited. To accomplish this, the relationships between "CENTCOM [V&E]," "CONUS [Readiness]," and "Command Level" were quantified. These three evaluation measures were selected for comparison because the decision maker's representative felt that he had the most accurate grasp on them (as compared to the remaining evaluation measures within the realm of each of the three primary objectives), as indicated by their larger local weights. The decision maker's representative characterized the ratio between "CENTCOM

[V&E]" and "Command Level" as 60/40. In addition, he identified the ratio between "CONUS [Readiness]" and "CENTCOM [V&E]" as 70/30. These relationships resulted in the overall primary objective weights shown in Fig. 4.32. As illustrated, "Responsiveness" was identified as the most important consideration to the decision maker's representative, while "Readiness" was found to be the least important.

Identify Alternatives (Part II)

Once the model was completely constructed, alternative generation was revisited. This included expanding the five original alternatives used to guide the model construction, as well as developing new alternatives that addressed the different objectives put forth in the model. As with all DA processes, the Status Quo (things remain as they currently exist) and null alternatives (eliminate RED HORSE) were automatically included as alternatives. These are represented as Alternatives A and T, respectively. There were also five alternatives put forth by the RED HORSE 2010 Strategic Study that were included for analysis; these are shown as alternatives K, L, M, P, and R. In addition, Alternative C was based upon a question posed by the ACC/CE when commissioning the RED HORSE 2010 Strategic Study [25:5]. Additional alternatives were developed using the strategy generation table located in Appendix B. Although this technique had the potential to produce a plethora of alternatives, only those that were deemed feasible (regardless of the difficulty to implement) were generated. The strategy generation table lists all twenty-four evaluation measures as column headings, listing all the possible outcomes for each evaluation measure beneath the appropriate column heading. Alternatives were generated by tracing a path through the table, using the outcomes highlighted in that path to define the proposed alternative. In this manner, thirteen additional alternatives were developed. The twenty alternatives explored for this research effort are listed on the next four pages.

A) Status-quo

All units remain located where they currently are, and maintain their existing chains of command.

B) As-is Semi-Unified

All units remain located where they currently are, but each of the AD units falls under the same NAF for ADCON. AD units still report to ACC for OPCON. ARC units remain as-is.

C) As-is Unified

All units remain located where they currently are, but all CONUS AD units are organized in a group, reporting to one MAJCOM for ADCON and OPCON.

D) Super Unit

All personnel and equipment (AD and ARC) belong to a single RED HORSE organization (probably a wing structure, composed of ARC and AD groups), and are co-located in CONUS at an existing AD location. This organization reports to a single MAJCOM for ADCON and OPCON.

E) Semi-Super Unit

All AD and ARC units are co-located in CONUS as an existing AD location. All AD units are organized in a group, reporting to a single MAJCOM for both ADCON and OPCON. ARC units continue to report to AFRC.

F) As-Is Diversified

All units remain located as-is. Each AD unit reports to a different NAF/theater command for both ADCON and OPCON. ARC command structure remains as-is.

G) Diversified

All AD personnel and equipment are forward located in each theater, reporting to that NAF/theater command for OPCON and ADCON. ARC command structure and location remain as-is.

H) Dispersed Equipment

All personnel located as-is. All equipment is forward located in overseas theaters (1 equipment set located in SOUTHCOM, 2 sets located in all other theaters). All AD units are organized in a group, reporting to a single MAJCOM for both ADCON and OPCON. ARC command structure and location remain as-is.

I) MTW Diversified

CONUS AD units (personnel and vehicles) relocated in each theater, with extra vehicle sets located in each projected MTW theater (CENTCOM and PACOM). Relocated units report to theater commands for ADCON and OPCON. ARC units remain as-is.

J) Semi-MTW

One AD unit (personnel and V&E) assigned to each projected MTW theater (CENTCOM and PACOM) for ADCON and OPCON. Most likely, the unit relocating to CENTCOM theater would be 823 RHS as they are the only full squadron contingent already reporting to 9AF (CENTAF) for ADCON. Darby sets relocated in each projected MTW theater as well. Remaining AD and ARC units remain as-is (location and command).

K) Study MTW Relocation I

Relocate according to RED HORSE 2010 Strategic Study's suggestions shown in Tbl 4.1 [1:Section 6.2.3.2.1] below:

Tbl 4.1 – RED HORSE 2010 Strategic Study's Proposed Unit Relocations

Unit	Current Location	Proposed Location	Remarks
819 RHS	Malmstrom AFB *(Great Falls, MT)*	Camp Pendleton *(Virginia Beach, VA)*	Co-locate with 219 RHF
219 RHF	Malmstrom AFB *(Great Falls, MT)*	Camp Pendleton *(Virginia Beach, VA)*	Co-locate with 819 RHS
202 RHS	Camp Pendleton *(Virginia Beach, VA)*	Hurlburt Field *(Ft Walton Beach, FL)*	Move into 823 RHS compound
823 RHS	Hurlburt Field *(Ft Walton Beach, FL)*	Camp Blanding *(Jacksonville, FL)*	Co-locate with 202 RHS
307 RHS	Kelly AFB *(San Antonio, TX)*	Nellis AFB *(Las Vegas, NV)*	Co-locate with 820 RHS & Det 1, 307 RHS
Det 1, 307 RHS	Barksdale AFB *(Bossier City, LA)*	Nellis AFB *(Las Vegas, NV)*	Co-locate with 820 RHS & 307 RHS

These co-located units would form RED HORSE groups (comprised of AD and ARC squadrons) commanded by an AD Col. All AD units report to a single MAJCOM for ADCON and OPCON; ARC units remain as-is.

L) Study MTW Relocation II

Relocate according to Tbl 4.1. These co-located units would form RED HORSE groups (comprised of AD and ARC squadrons) commanded by an AD Col. All groups report to a different theater command (except for EUCOM) for ADCON and OPCON. Remaining ARC units and 31 RHF remain as-is, but are responsible for EUCOM operations.

M) Study MTW Relocation III

Relocate according to Tbl 4.1. These co-located units would form RED HORSE groups (comprised of AD and ARC squadrons) commanded by an AD Col. All groups report to a different theater command (except for EUCOM) for ADCON and OPCON, with equipment sets forward located in each theater. Remaining ARC units and 31 RHF remain as-is, but responsible for EUCOM ops.

N) MTW Geared

2 AD units (personnel and equipment) assigned to groups and located in MTW theaters (CENTCOM and Korean peninsula). These groups report to the respective NAF/theater command for both ADCON and OPCON. 31 RHF (personnel and equipment) remains located at Camp Darby, but report directly to USAFE. ARC command structure and location remain as-is.

O) OOTW Geared

All personnel belong to a single RED HORSE organization (probably a wing structure, composed of ARC and AD groups), and are co-located in CONUS at an existing AD location. This organization reports to a single MAJCOM for both ADCON and OPCON. 2 equipment sets are pre-positioned in each theater, under control of the NAF/theater command.

P) Study Co-location

Command structure for all RED HORSE units (AD and ARC) remains as-is. One AD and one ARC unit are relocated to provide co-located AD and ARC units at every CONUS, AD RED HORSE location.

Q) Co-located Diversified

All ARC units co-locate with existing CONUS AD units, forming RED HORSE Groups (comprised of ARC and AD squadrons) commanded by an AD Col. These groups are assigned to theater commands (none assigned to EUCOM) for both ADCON and OPCON (command structure of ARC portions would remain as-is). 31 RHF remains as-is, but is assigned to EUCOM theater command. 554 RHS remains as-is, but reports to theater command for both ADCON and OPCON.

R) Study Heavy OOTW Hybrid

Vehicle sets and personnel are located in every theater according to projected OOTW demands. 31 RHF merges with projected forward located RED HORSE personnel, and reports to EUCOM for ADCON and USAFE for OPCON. Command structure does not change for remaining units. MAJCOM influences do not change as all CONUS AD units will continue to report to ACC for OPCON. Most likely, 820 RED HORSE (currently reporting to 12 AF for ADCON) would permanently locate one-half of its unit in the SOUTHCOM theater; similarly, 823 RHS (currently reporting to 9AF for ADCON) would permanently locate one-half of its unit in the CENTCOM theater.

S) Super Personnel

All personnel belong to a single RED HORSE organization (probably a wing structure, composed of ARC and AD groups), and are co-located in CONUS at an existing AD location. This organization reports to a single MAJCOM for both ADCON and OPCON. Vehicle and equipment sets are forward located (falling under the control of RED HORSE) in each theater, with an additional set located in each projected MTW theater (CENTCOM and PACOM).

T) No RED HORSE

Eliminate all existing RED HORSE units, farming out its capability to Prime BEEF, contractors, or other military organizations (SEABEES, Army ESBs, Marine EBs).

The decision maker's representative expressed a desire to refine the list of generated alternatives, to ensure that this study analyzed the alternatives he thought most feasible. As such, the list of twenty alternatives was provided to him for approval. To add more validity to the study, the decision maker's representative forwarded the list to AF/ILE, the position charged with setting policy for all AF CE units. Once there, this list was also submitted to the AF/CE, the actual decision maker for all matters of USAF CE (including RED HORSE). These personnel agreed that the list of alternatives covered the spectrum of possibilities for this research effort, and endorsed their inclusion in this study [28].

Model Analysis

Once the model was constructed and the alternatives were identified, the remainder of the DA process was accomplished. This remainder consisted of three parts: alternative scoring and ranking, sensitivity analysis, and "what-if" analysis. This section presents these three remaining aspects of the DA process.

Alternative Scoring and Ranking

The evaluation measures' value functions were used to score all twenty of the generated alternatives. Each alternative had a distinct outcome for each evaluation measure, and was assigned the score (value) commensurate with that outcome for each evaluation measure, as indicated by the evaluation measures' value functions. The evaluation measure outcomes for each alternative are shown in Appendix C.

Next, the overall alternative scores were calculated. Applying the additive value function, the global weight of each evaluation measure was multiplied by the score of that evaluation measure for each alternative to yield the overall score for that alternative. The overall results from these calculations are reflected in the results table located in Appendix D. Also included in Appendix D are four charts, illustrating the score each alternative received for each evaluation measures, as well as the maximum score possible for each evaluation measure. Each of these four charts illustrate different evaluation measures as follows:

Fig D.1 – Scores for "Location of Personnel" Evaluation Measures
Fig D.2 – Scores for "Location of Vehicles and Equipment" Evaluation Measures
Fig D.3 – Scores for "Readiness" Evaluation Measures
Fig D.4– Scores for "Political Considerations" Evaluation Measures

Once the overall scores for each alternative were calculated, the alternatives were ranked in descending order by score (i.e. the higher the score, the better the alternative). The alternatives and their overall scores are reflected in Table 4.2. The model yielded Alternative F (As-is Diversified) as the highest ranked alternative. This was to be

Tbl 4.2 – Alternative Rankings

Rank	Alternative	Description	Score
1	F	As-is Diversified	**0.65400**
2	D	Super Unit	**0.64938**
3	L	Study MTW Relocation II	**0.63055**
4	E	Semi-Super Unit	**0.62712**
5	Q	Co-located Diversified	**0.62109**
6	M	Study MTW Relocation III	**0.62036**
7	G	Diversified	**0.61233**
8	C	As-is Unified	**0.58726**
9	I	MTW Diversified	**0.58268**
10	J	Semi-MTW	**0.56853**
11	K	Study MTW Relocation I	**0.56740**
12	N	MTW Geared	**0.56348**
13	B	As-is Semi-Unified	**0.56092**
14	A	Status Quo	**0.54870**
15	P	Study Co-location	**0.54004**
16	S	Super Personnel	**0.53343**
17	H	Dispersed Equipment	**0.53274**
18	R	Study Heavy OOTW Hybrid	**0.52789**
19	O	OOTW Geared	**0.40428**
20	T	No RED HORSE	**0.32188**

expected, as this alternative recommended locating the majority of personnel (6 squadron equivalents) and vehicles and equipment (6 equipment sets) within the CONUS, achieving 90% of the maximum possible value for each of these evaluation measures. Since the decision maker's representative indicated these two evaluation measures to be the most important of their respective local evaluation measures, they were also weighted the most – awarding this alternative one of the highest scores for "Responsiveness." In addition, Alternative F did not recommend locating any unequipped squadron equivalents in any theater, achieving the maximum value outcomes for each of the "Readiness" evaluation measures, and attaining the maximum possible score for "Readiness." Alternative F also recommended the maximum value outcomes for five ("ARC Units," "Active Duty Units," "NAFs & OCONUS Bases," "Matching Structures," and "Rank of Command") of the nine "Political Considerations" evaluation measures. "Unity of Command" was the only "Political Consideration" in which Alternative F failed to attain at least half of the decision maker's representative's assigned value.

The second and third highest-ranking alternatives were alternatives D (Super Unit) and L (Study MTW Relocation II), respectively. As was expected, alternative T (eliminate RED HORSE) ranked the lowest. It received no points for any of the "Responsiveness" evaluation measures, as it did not recommend having any squadron equivalents or equipment sets in any theater.

Of interest, Alternative A (Status Quo) ranked 14th out of the twenty alternatives. This indicates that the current structure of RED HORSE is not commensurate with the values of the decision maker's representative. Specifically, this alternative suffered in several areas. The two most detrimental evaluation measures for this alternative were "Matching Structures" and "Command Level," as it failed to achieve any points for either of these evaluation measures. Alternative A did not recommend matching peacetime and wartime command structures for any of the four active duty RED HORSE units, and maintained control a RED HORSE unit at the base. In addition, it only placed six of seven squadron equivalents and six of seven equipment sets in CONUS – the theater identified as most important by the decision maker's representative for each "Responsiveness" means objective.

Sensitivity Analysis

Sensitivity analysis was performed on each of the twenty-four evaluation measures in the decision maker's representative's value hierarchy. This process explored the effect on alternative ranking as the global weight of a particular evaluation measure changed. However, in accordance with the rules of swing weighting, all local weights still had to sum to one throughout the sensitivity analysis. As such, changing the weight of one evaluation measure impacted the weight of other evaluation measures. The extent of this impact was dependent upon the particular evaluation measure being analyzed (it could impact the weight of as many as four other evaluation measures, or as few as one other evaluation measure). In instances where only one other evaluation measures was affected, a linear relationship existed; more specifically, the increase in the weight of the evaluation measure being analyzed was offset by a decrease in the weight of the affected evaluation measure. Where multiple evaluation measures were affected, the weight ratios between the affected evaluation measures were held constant; more specifically, the increase in the weight of the evaluation measure being analyzed was offset by a proportional decrease in the weights (according to the original weight ratios between these evaluation measures) of the affected evaluation measures. The weights of evaluation measures not affected by the weight change of the evaluation measure being analyzed remained constant.

To conduct the sensitivity analysis, evaluation measure weights were varied from their minimum possible values (0) to their maximum possible values (1), with analysis being conducted at every tenth. This provided specific intervals (every tenth) along the range of possible evaluation measure weights where the ranking of alternatives could be examined. In this manner, the sensitivity analysis provided valuable insight into the ranking of alternatives, as the global weight of each evaluation measure increased or decreased.

The remainder of this section highlights the sensitivity analysis conducted as it affected the evaluation measures of each of the three primary objectives. Only the evaluation measures that yielded changes in the recommended alternative (to or from Alternative F) will be discussed here. The complete results of the sensitivity analysis are contained in Appendix E.

Responsiveness

Sensitivity analysis was first conducted on the ten evaluation measures falling under the primary objective of "Responsiveness." To increase the clarity of the analysis, the ten evaluation measures were analyzed separately, according to the second tier objectives to which they related.

Location of Personnel

The five evaluation measures relating to the "Location of Personnel" were analyzed first. The global weight of "Location of Personnel" was calculated to be 0.0907 (local weight of "Location of Personnel" multiplied by the local weight of

"Responsiveness" – see Appendix B for more details); hence the maximum possible global weight of each of these evaluation measures was 0.0907. The ranges of possible weights for each of these five evaluation measures, as well as the weight assigned to each by the decision maker's representative are illustrated in Fig 4.33. The evaluation measure weight assigned by the decision maker's representative for CONUS [Personnel] was approximately 50% of its maximum possible weight, while the weight assigned to each of the other four evaluation measures was less than 25% of the maximum. Consequently, the effect of the changes in weight of CONUS [Personnel] was found to have the most affect on alternatives.

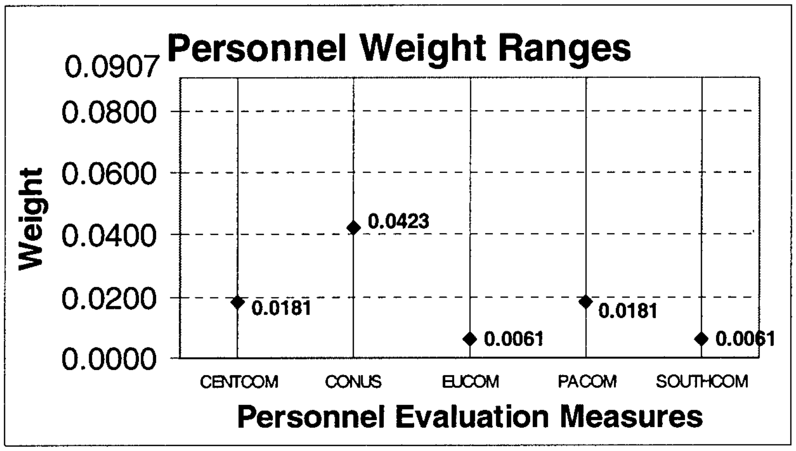


Fig 4.33 – Weight Ranges of "Location of Personnel" Evaluation Measures

The sensitivity analysis varied the weight of each evaluation measure along the entire range of its possible weights, with the weights of the remaining four evaluation measures being offset proportionally, according to the original weight ratios established by the decision maker's representative. These ratios are reflected in Tbl 4.3. For "Location of Personnel," the weight of CONUS was worth the most – seven times that of EUCOM or

Tbl 4.3 – "Location of Personnel" Evaluation Measures Weight Ratios

	Location of Personnel				
	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM
CENTCOM	-----	3 : 7	3 : 1	1 : 1	3 : 1
CONUS	7 : 3	-----	7 : 1	7 : 3	7 : 1
EUCOM	1 : 3	1 : 7	-----	1 : 3	1 : 1
PACOM	1 : 1	3 : 7	3 : 1	-----	3 : 1
SOUTHCOM	1 : 3	1 : 7	1 : 1	1 : 3	-----

PACOM, and 2.3 (a 7:3 ratio) times that of CENTCOM or SOUTHCOM. Similarly, the weight of PACOM and CENTCOM were equal, and worth 3 times the weight of EUCOM and SOUTHCOM. The weights of EUCOM and SOUTHCOM were equal.

Fig 4.34 depicts the "Location of Personnel" evaluation measures and their global weights. The gray boxes indicate the evaluation measures that yielded changes to the recommended alternative during sensitivity analysis. Alternative F remained dominant throughout the entire range of possible weights for the other two "Location of Personnel" evaluation measures (CENTCOM and PACOM); the sensitivity analyses for these evaluation measures are discussed in Appendix E.

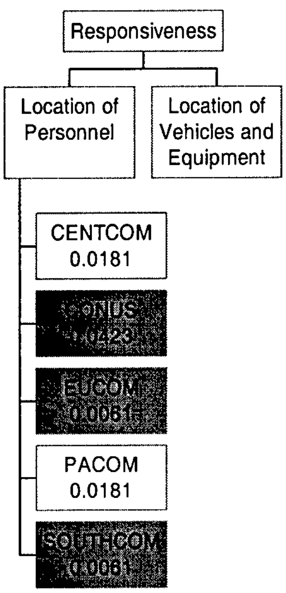


Fig 4.34 – Global Weights for "Location of Personnel" Evaluation Measures

Increasing the global weight of locating personnel within the CONUS beyond 7.3% resulted in a change in preferred alternatives from Alternative F to Alternative D. This was to be expected, as Alternative D places an additional squadron equivalent in the CONUS (over Alternative F). Increasing the importance of placing personnel in CONUS increases the flexibility of RED HORSE, the characteristic deemed by the decision maker as contributing the most to responsiveness [26]. Therefore, this increase in global weight is possible.

Boosting the global weights of "EUCOM" or "SOUTHCOM" to 4.6% also changed the recommended alternative, this time from Alternative F to Alternative G. This was logical as Alternative G called for more squadron equivalents to be placed in these theaters than any other alternative. Consequently, this alternative became preferred as the importance of locating personnel in either of these theaters increased. The global weight escalation of either of these alternatives is unlikely however; neither of these theaters is likely to escalate into an unforeseen contingency requiring the immediate presence of personnel [28].

Location of Vehicles and Equipment

The five evaluation measures relating to the "Location of Vehicles and Equipment" were analyzed next. The global weight of "Location of Vehicles and Equipment" was calculated to be 0.3273; hence the maximum possible global weight of each of these evaluation measures was 0. 3273. The ranges of possible weights for each of these five evaluation measures, as well as the weight assigned to each by the decision maker's representative are illustrated in Fig 4.35. The evaluation measure weights assigned by the decision maker's representative for CONUS [Vehicles and Equipment] was approximately 30% of its maximum possible weight, while the weight assigned to each of the other four evaluation measures was less than 25% of the maximum. As such, the effect of the changes in weight of CONUS [Vehicles and Equipment] was found to have the most affect on alternatives.

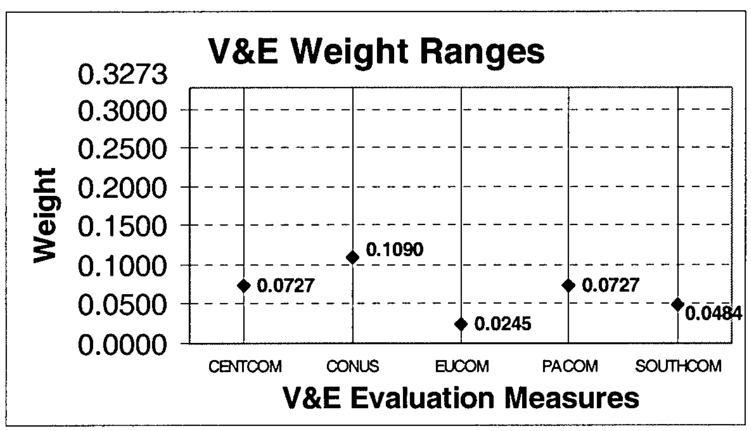


Fig 4.35 – Weight Ranges of "Location of Vehicles and Equipment" Evaluation Measures

The weight ratios for the "Location of Vehicles and Equipment" evaluation measures are reflected in Tbl 4.4. Similar to the "Location of Personnel" evaluation measures, the weight of CONUS was worth the most – in this instance, 4.5 times (a 9:2 ratio) the weight of EUCOM, 2.25 times (a 9:4 ratio) the weight of SOUTCOM, and 1.5 times (a 3:2 ratio) the weight of CENTCOM and PACOM. The weights of CENTCOM and PACOM were equal, and worth 3 times the weight of EUCOM and SOUTHCOM, whose weights were equal.

Tbl 4.4 – "Location of Vehicles and Equipment" Evaluation Measures Weight Ratios

	Location of Vehicles and Equipment				
	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM
CENTCOM	-----	2 : 3	3 : 1	1 : 1	3 : 2
CONUS	3 : 2	-----	9 : 2	3 : 2	9 : 4
EUCOM	1 : 3	2 : 9	-----	1 : 3	1 : 2
PACOM	1 : 1	2 : 3	3 : 1	-----	3 : 2
SOUTHCOM	2 : 3	4 : 9	1 : 1	2 : 3	-----

The gray boxes in Fig 4.36 indicate the "Location of Vehicles and Equipment" evaluation measures that yielded changes to the recommended alternative during sensitivity analysis. The model's preferred alternative changed from Alternative F to Alternative D as a result of increasing or decreasing the global weights each of these evaluation measures – CENTCOM, CONUS, EUCOM, PACOM, and SOUTHCOM.

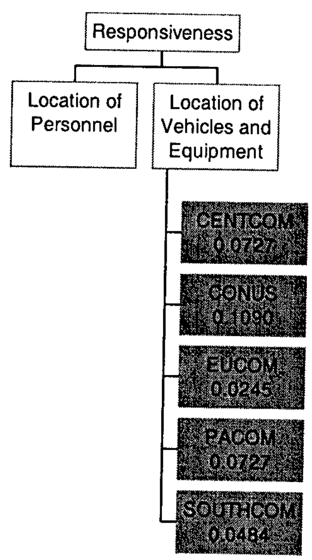


Fig 4.36 – Global Weights for "Location of Vehicles and Equipment" Evaluation Measures

Increasing the global weight of "CENTCOM [V&E]" to 14.2% switched the model's recommended alternative from Alternative F to Alternative D. Although an increase in the importance of locating vehicles and equipment in CENTCOM is possible, doubling this importance (required to change the preferred alternative) is not likely.

Boosting the importance of locating vehicles and equipment in CONUS beyond 12.5% also changed the recommended alternative from Alternative F to Alternative D. This increase in importance is possible, as locating vehicles and equipment in CONUS provides flexibility to the decision maker; indicated by the decision maker's representative as the vital element in allowing RED HORSE to be responsive [27].

Decreasing the global weight of "EUCOM [V&E]" to 1.5% also changed the recommended alternative from Alternative F to Alternative D. This was also seen as a possible occurrence, as the European theater is not likely to experience any unforeseen contingencies requiring the immediate presence of vehicles and equipment.

Diminishing the importance of locating vehicles and equipment in PACOM also caused a change in the recommended alternative. This diminished importance is not likely to happen however, as PACOM is seen as one of the world's foremost "hot spots," requiring the immediate availability of vehicles and equipment.

Finally, increasing the global weight of "SOUTHCOM [V&E]" resulted in a change in the preferred alternative. This scenario is also not likely to happen. As with EUCOM, SOUTHCOM is not likely to experience any unforeseen contingency that would require the immediate presence of vehicles and equipment.

Readiness

Sensitivity analysis was next conducted on the five evaluation measures falling under the primary objective of "Readiness." As the global weight of this objective was

0.250, the maximum possible global weight of each of the "Readiness" evaluation measures was 0.250. The ranges of possible weights for each of these five evaluation measures, as well as the weight assigned to each by the decision maker's representative are illustrated in Fig 4.37. The evaluation measure weight assigned by the decision maker's representative for CONUS [Readiness] was the largest; here holding 50% of its maximum possible weight, while the weight assigned to each of the other four evaluation measures was only 12.5% of the maximum. As such, variations in the weight assigned to CONUS [Readiness] were found to have the most affect on alternatives.

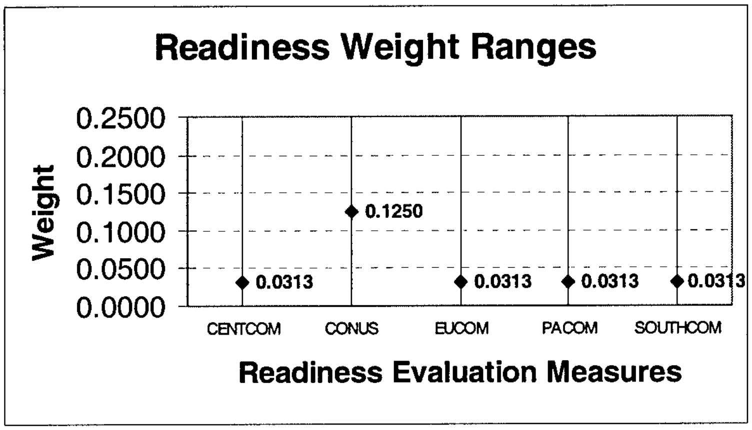


Fig 4.37 – Weight Ranges of "Readiness" Evaluation Measures

The ratios for the "Readiness" evaluation measures are reflected in Tbl 4.5. Similar to the evaluation measures relating to "Location of Personnel" and those addressing "Location of Vehicles and Equipment," the weight of CONUS was worth the most – 4 times the weight of any other "Readiness" evaluation measure. The weights of each of the other four evaluation measures were equal.

Tbl 4.5 – "Readiness" Evaluation Measures Weight Ratios

Readiness					
	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM
CENTCOM	-----	1 : 4	1 : 1	1 : 1	1 : 1
CONUS	4 : 1	-----	4 : 1	4 : 1	4 : 1
EUCOM	1 : 1	1 : 4	-----	1 : 1	1 : 1
PACOM	1 : 1	1 : 4	1 : 1	-----	1 : 1
SOUTHCOM	1 : 1	1 : 4	1 : 1	1 : 1	-----

The sensitivity analysis for the "Readiness" evaluation measures did not yield changes to the recommended alternative in any instance; that is, Alternative F remained dominant throughout the entire range of weights for each of the evaluation measures. The sensitivity analyses for all of the "Readiness" evaluation measures are discussed in Appendix E.

Political Considerations

Finally, sensitivity analysis was conducted on the nine evaluation measures falling under the primary objective of "Political Considerations." In order to conduct sensitivity analysis on each of these objectives, the global weight of the means objectives to which each evaluation measure directly related had to be determined. Of the nine evaluation measures, eight related to 4^{th}-tier means objectives (two evaluation measures per 4^{th}-tier means objective), while one evaluation measure (Global Constraints) related to the primary objective of "Political Considerations." Since each of the evaluation measures related to different means objectives, the maximum weight (and hence the range of possible weights) varied for each evaluation measure. The ranges of possible weights for these nine evaluation measures, as well as the weight assigned to each by the decision maker's representative, are illustrated in Fig 4.38.

The 4^{th} tier means objectives to which evaluation measures related were "State Influences" ("ARC Units" and "AD Units"), "DoD Influences" ("MAJCOMs & Higher HQs" and "NAF & OCONUS Bases"), "Streamlined Command" ("Unity of Command"

and "Matching Structures"), and "Level of Command" ("Command Level" and "Rank of Command"). However, since each of the "Political Considerations" evaluation measures directly affected only one other evaluation measure, they were related linearly; more specifically, the increase in the weight of the evaluation measure being analyzed was offset by a decrease in the weight of the affected evaluation measure. As such, ratios between evaluation measures did not have to be established to conduct sensitivity analysis.

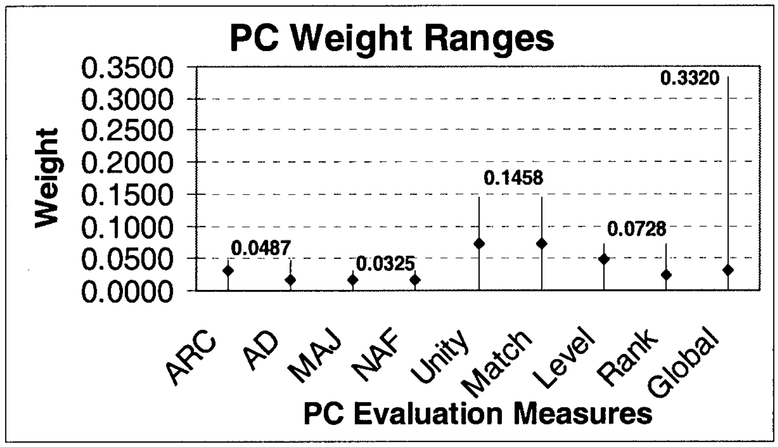


Fig 4.38 – Weight Ranges of "Political Considerations" Evaluation Measures

The sensitivity analysis for the "Political Considerations" evaluation measures yielded changes to the recommended alternative in all four means objectives – "State Influences," "DoD Influences," "Streamlined Command," and "Level of Command." Sensitivity analysis also resulted in changes to the recommended alternative in the "Global Constraints" evaluation measure. In each instance, the recommended alternative changed from Alternative F to Alternative D. The evaluation measures affecting these means objectives, as well as the "Global Constraints" evaluation measure, are discussed below. The sensitivity analyses for all of the "Political Considerations" evaluation measures are discussed in Appendix E.

Fig 4.39 depicts the evaluation measures assessing "State Influences" and their global weights. Sensitivity analysis performed on these evaluation measures demonstrated that decreasing the global weight of "ARC Units" to 1.9% (simultaneously increasing the global weight of "Active Duty Units" to 3%) changed the recommended alternative. This shift in importance is not a likely one however, as impacting ARC units will result in more severe political repercussions than those arising as a result of affecting AD units.

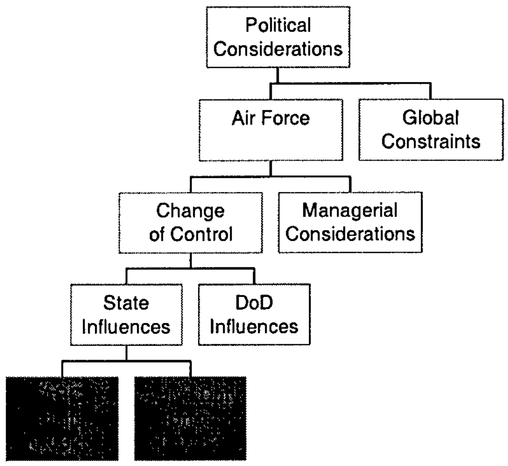


Fig 4.39 – Global Weights for "State Influences" Evaluation Measures

Fig 4.40 depicts the global weights of the two evaluation measures relating to "DoD Influences". Boosting the penalties associated with affecting MAJCOMs and higher HQs to 2.1% (simultaneously decreasing the penalties associated with affecting NAFs and OCONUS bases to 1.2%) changed the preferred alternative. This shift in global weights is possible, as MAJCOMs and higher HQs have slightly more political pull than NAFs and OCONUS bases. This greater amount of political pull could result in a more severe penalty as a result of affecting those organizations.

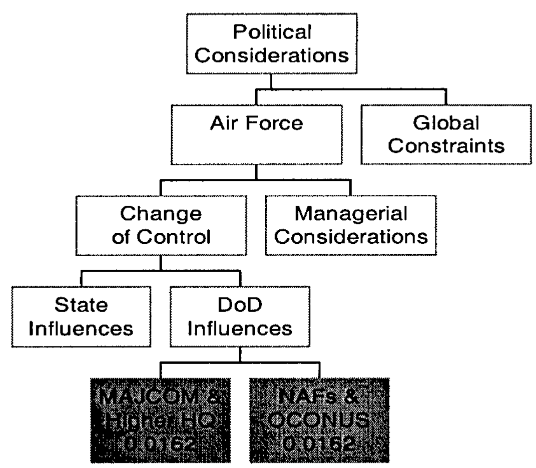


Fig 4.40 – Global Weights for "DoD Influences" Evaluation Measures

The global weights of the two evaluation measures used to assess the "Streamlined Command" means objective are depicted in Fig 4.41. Sensitivity analysis performed on these evaluation measures demonstrated that increasing the global weight of "Unity of Command" to 7.8% (simultaneously decreasing the global weight of "Matching Structures" to 6.8%) changed the recommended alternative. This shift in importance is possible, but is entirely dependent upon the decision maker's (or the decision maker's representative's) preferences – i.e. it is dependent upon whichever evaluation measure the decision maker envisions as contributing the most to achieving a streamlined command structure.

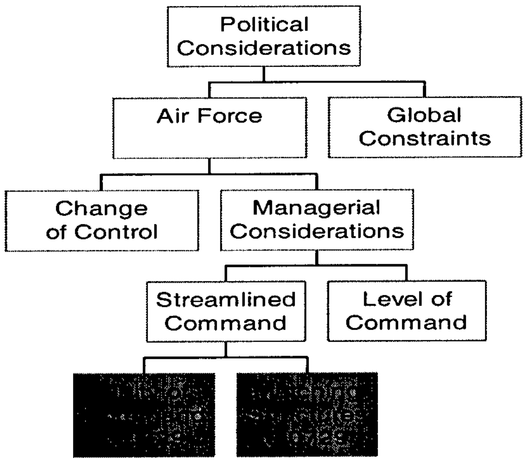


Fig 4.41 – Global Weights of "Streamlined Command" Evaluation Measures

Fig 4.42 depicts the global weights of the two evaluation measures relating to the "Level of Command" means objective. Sensitivity analysis accomplished on these evaluation measures ascertained that boosting the global weight of "Command Level" to 5.5% (simultaneously decreasing the global weight of "Rank of Command" to 1.8%) changed the recommended alternative. Similar to the "Streamlined Command" evaluation measures, this shift in importance is possible, but is entirely

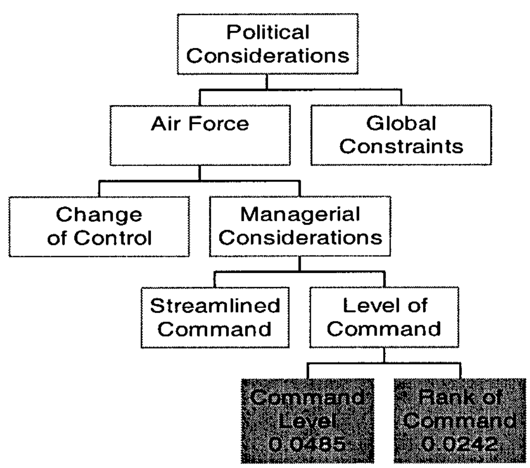


Fig 4.42 – Global Weights of "Level of Command" Evaluation Measures

dependent upon the decision maker's (or the decision maker's representative's) preferences – i.e. it is dependent upon whichever evaluation measure the decision maker envisions as contributing the most to enabling RED HORSE to have the appropriate command authority.

Finally, the global weights of the means objective ("Air Force") and evaluation measure ("Global Constraints") used to assess the primary objective of "Political Considerations" are illustrated in Fig 4.43. Sensitivity analysis demonstrated that decreasing the global weight of "Air Force" to 28.4% (simultaneously increasing the global weight of "Global Constraints" to 4.8%) changed the recommended alternative. This shift in importance is possible, as the future threats and organizational climates (global, as well as those internal to the USAF) could mandate a change in priorities.

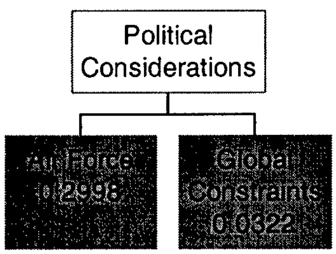


Fig 4.43 – Global Weights of "Political Considerations" Objectives/Measures

"What-if" Analysis

"What-if" analysis was performed on the three primary objectives in the decision maker's representative's value hierarchy. This type of analysis assessed the effect on the model's ranking of alternatives as a result of altering the order of importance of the three primary objectives. As previously discussed, the order of primary objective importance (heaviest weight) was "Responsiveness" (weight of 0.418), "Political Considerations" (weight of 0.332), and "Readiness" (weight of 0.25). The order of importance of the three primary objectives was varied such that the alternatives could be evaluated according to each possible combination of importance of the primary objectives. These combinations, along with their results are shown in Tbl 4.6. The first row in Tbl 4.6 depicts the relative importance of the three primary objectives as established by the

Tbl 4.6 – "What-if" Results

Order of Importance			Results	
First 0.418	Second 0.332	Third 0.25	Preferred Alternative	Other Top 5 Changes
Responsiveness	PC	Readiness	F	N/A
Responsiveness	Readiness	PC	F	None
PC	Responsiveness	Readiness	D	None
PC	Readiness	Responsiveness	D	None
Readiness	Responsiveness	PC	F	None
Readiness	PC	Responsiveness	D	None

decision maker's representative. The remaining rows illustrate how the preferred alternative was dependent on the order of importance of the primary objectives. More specifically, Alternative F remained the preferred alternative when the weight of "Responsiveness" exceeded the weight of "Political Considerations." Conversely, when the weight of "Political Considerations" exceeded the weight of "Responsiveness," Alternative D was preferred. There were no other changes in the rank of the top five alternatives as a result of these changes. In addition, the model was evaluated with all three primary objectives equal in importance. Alternative F was again preferred in this instance, again without a change in the top five ranked alternatives.

Summary

Based upon the decision maker's representative's preferences, Alternative F was the recommended alternative. However, sensitivity analysis indicated that fluctuations in the global weights of the majority of evaluation measures affected the ranking of alternatives, resulting in changes to the preferred alternative 65% (13 out of 20) of the time. In addition, "what-if" analysis showed that the preferred alternative was dependent on the relative importance of "Responsiveness" and "Political Considerations;" Alternative F was preferred as "Responsiveness" was the heavier weighted of the two primary objectives, while Alternative D was preferred otherwise. The model indicates that Alternative F best achieves the objectives of the decision maker's representative, as defined in the value hierarchy. However, the model's extreme sensitivity suggests that further research is required in order to identify the best macroscopic organizational structure for RED HORSE.

V. Findings, Conclusions, and Recommendations

This chapter encapsulates the thrust of this research effort. It summarizes the analysis performed and results discovered, provides conclusions and recommendations, posits areas of additional study, and discusses additional considerations that should be accounted for in any future endeavors.

This study used decision analysis (DA) tools to examine the macroscopic organizational structure of RED HORSE; that is, the manner in which RED HORSE resources (personnel and equipment) are organized collectively, above the unit (squadron or flight) level. This thesis built on the findings of the Air Combat Command sponsored RED HORSE 2010 Strategic Study. This research focused on issues of geographic location and chain of command above the unit level, as these two topics were determined by the RED HORSE 2010 Strategic Study to be vital to the accomplishment of the RED HORSE mission. Working in direct cooperation with ACC, this thesis used value focused thinking (VFT) to identify a qualified decision maker's representative (ACC/CEX). It then created a hierarchical model (value hierarchy) depicting the decision maker's representative's multiple objectives that contribute to a determination of the macroscopic organizational structure of RED HORSE. The value hierarchy illustrated the relative importance of each of these goals and objectives, as well as their presence in the decision opportunity. Twenty alternatives were generated and measured against the evaluation criteria present in the value hierarchy. Finally, the model was tested to determine the change in preferred alternatives due to fluctuations in the relative importance of each of the objectives.

Summary of Analysis and Results

Tbl 5.1 presents the three highest-ranking alternatives, based on the preferences of the decision maker's representative. The model indicated that Alternative F was

Tbl 5.1 – Top 3 Alternatives

Alternative	Title	Description
F	As-is Diversified	All units remain located as-is. Each AD unit reports to a different NAF/theater command for both ADCON and OPCON. ARC command structure remains as-is.
D	Super Unit	All personnel and equipment (AD and ARC) belong to a single RED HORSE organization (probably a wing structure, composed of ARC and AD groups), and are co-located in CONUS at a single existing AD location. This organization reports to a single MAJCOM for ADCON and OPCON.
L	Study MTW Relocation II	Relocate according to the recommendations from RH 2010 Strategic Study. Co-located units would form RED HORSE groups (comprised of AD and ARC squadrons) commanded by an AD Col. All groups report to a different theater command (except for EUCOM) for ADCON and OPCON. Remaining ARC Units and 31 RHF remain as-is, but are responsible for EUCOM Ops.

preferred according to the weights solicited from the decision maker's representative. The sensitivity analysis indicated that the model was highly reactive to fluctuations in the global weights of the objectives and evaluation measures, recommending changes in the preferred alternative 65% (13 out of 20) of the time. Eleven of these preference changes alternated between Alternatives F and D. The only other alternatives shown to be preferred were Alternatives G and I; the former only occurred when the weights of locating personnel in the European or Southern theaters exceeded 67% of the total weight given to locating personnel – an unlikely scenario, according to the decision maker's representative [28]. Alternative I was only recommended when the global weight of locating vehicles and equipment in CENTCOM was doubled to 14.2%. Although it is possible that the global weight of this measure would increase, it is not likely that it would double in importance, making this an unlikely scenario as well.

This sensitivity analysis illustrated that changes in the weights of "Responsiveness" and "Political Considerations" evaluation measures yielded changes in the preferred alternative. Sensitivity analyses conducted in the arena of "Readiness," defined as the ability of RED HORSE units to adequately train and familiarize themselves with their vehicles and equipment [27], did not produce any changes. The majority of preference changes occurred within the realm of "Responsiveness" – the branch of the value hierarchy defined as the ability of RED HORSE to quickly arrive at a contingency location with its required resources [26]. Three times the preferred alternative was switched due to fluctuations in the "Location of Personnel" measures. Increasing the importance of locating personnel in CONUS resulted in alternative preference switching from Alternative F to Alternative D. Increasing the importance of placing personnel in EUCOM or SOUTHCOM resulted in the recommendation changing from Alternative F to Alternative G.

Also within the arena of "Responsiveness," the preferred alternative changed five times due to sensitivity analyses conducted on "Location of Vehicles and Equipment" measures. Increasing the importance of locating vehicles and equipment in CENTCOM changed the recommended alternative from Alternative F to Alternative D. Continued increases in the global weight of this measure produced another change in the recommended alternative, this time from Alternative D to Alternative I. Additionally, increasing the importance of locating vehicles and equipment in CONUS or SOUTHCOM, or decreasing the importance of locating vehicles and equipment in EUCOM or PACOM resulted in changing the preferred alternative from Alternative F to Alternative D.

The remaining five preference changes occurred within the realm of "Political Considerations" – defined as the organizational and governmental influences that affect the reorganization process [26]. The model recommended switching from Alternative F to Alternative D for each of the sensitivity analyses conducted within this arena, according to the following five scenarios:

- Increasing the penalties for relocating Active Duty units, while diminishing the consequences for relocating Air Reserve Component (ARC) units
- Minimizing the repercussions of changing the influences of Numbered Air Forces (NAFs) and overseas bases on RED HORSE, while amplifying the penalties associated with lessening the influence of Major Commands (MAJCOMs), the Air Force Civil Engineer and Services Agency (AFCESA), and ILE
- Boosting the importance of possessing a unified chain of command for all RED HORSE units, while decreasing the importance of having all AD units report to the same units for Administrative Control (ADCON) and Operational Control (OPCON).
- Increasing the significance of holding command of a RED HORSE organization at a specified level (MAJCOM, NAF, or base), while diminishing the importance of having AD Colonel slots within a macroscopic organizational structure
- Lessening the importance of Air Force organizational influences, while increasing the impact of global considerations

According to the decision maker's representative, the three fundamental criteria (and their relative importance in the overall decision situation) in developing an organizational structure for RED HORSE are Responsiveness (41.8%), Political Considerations (33.2%), and Readiness (25%). Conducting simple "what-if" analysis indicated changes in alternative preference dependent on the relative weights of these primary objectives. Alternative F was preferred when the weight of "Responsiveness" was equal to or greater than the weight of "Political Considerations." Conversely, Alternative D was preferred as the weight of "Political Considerations" exceeded the weight of "Responsiveness."

Conclusions and Recommendations

The first research objective that was addressed by this study was:

- What organizational structure is most suitable for the heavy construction and contingency engineering capabilities provided by RED HORSE?

Alternative F was most preferred, based upon the preferences of the decision maker's representative. This alternative consistently ranked as one of the top two alternatives throughout the sensitivity analyses. Alternative F recommended maintaining all RED HORSE units at their current locations. The lack of any required relocations increases the feasibility of this alternative, as this change would be solely an administrative one.

Alternative F also proposes realigning RED HORSE's command structure. It calls for each RED HORSE unit to report to a different theater command or NAF for both OPCON and ADCON, alleviating the conflicting ADCON/OPCON structure that currently exists. Fig 5.1 shows one potential macroscopic organizational structure, as

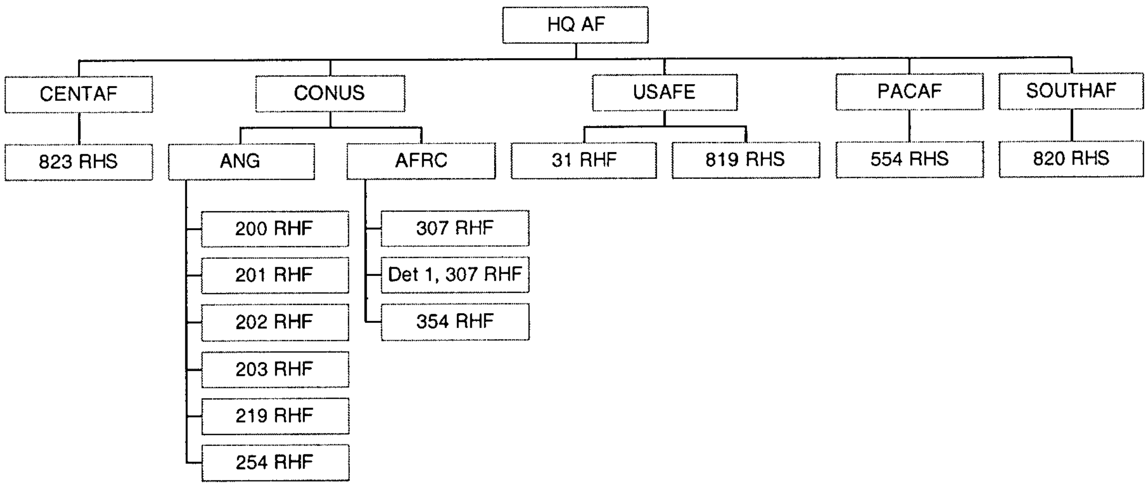


Fig 5.1 – Possible Macroscopic Organizational Structure for Alternative F

recommended by this proposal. This proposed structure provides clearly defined regions of responsibility for each of the RED HORSE units, streamlining the accomplishment of theater requirements. By providing a matching command structure for each RED HORSE unit, this alternative allows units to train as they "go to war," thus reducing the training load of RED HORSE units by enabling each one to train for the specific, theater-dependent requirements that they would be called upon to accomplish.

The greatest disadvantage to Alternative F is that it eliminates a central organization that provides ongoing, standardized support for RED HORSE specific concerns (i.e. UTC authorizations, adequacy of training, relevance of ConOps, vehicle and equipment replacement, pilot units, etc.). This alternative would reduce also any potential for a streamlined command for RED HORSE, as each unit would take orders from different theater commands.

The second most preferred organizational structure was found to be Alternative D. This alternative also consistently ranked as one of the top two alternatives throughout the sensitivity analyses. Alternative D proposed co-locating all RED HORSE units (AD and

ARC units) at a single CONUS location that currently supports an Active Duty RED HORSE unit. Based on climate, available space, and the vicinity of seaports, this location would probably be Nellis AFB, NV (currently home to 820 RHS). Malmstrom AFB, MT (home to 819 RHS) would not be feasible, as its northern tier location is not conducive to year-round operations. In addition, the logistics of vehicle and equipment transport is further complicated by the installation's location, as it is not near any seaports. Hurlburt Field, FL (home to 823 RHS) is near several seaports (Jacksonville, Mobile, New Orleans,) and experiences weather conducive to year-round training. However, its location on the base does not allow for further expansion, especially of the magnitude that would be required of this proposed co-location.

Co-locating all RED HORSE units and their assets (personnel, vehicles, and equipment) would enable the force to take advantage of both increased labor pools and vehicle fleets. If and when presidential call-up of the reserves occurs, the personnel would be well trained due to their exposure to ongoing operations throughout the year. In addition, vehicles and equipment currently reserved for ARC units could be utilized in support of global contingencies. The flexibility of an increased labor pool and vehicle fleet would tremendously improve RED HORSE's ability to support global contingencies.

Alternative D also proposes to realign RED HORSE's command structure, providing a single command for all units. Fig 5.2 illustrates this proposed structure. The single command alleviates the conflicting ADCON/OPCON structure that currently exists. This single command would be located at the MAJCOM level – probably ACC or AMC, as these are the two CONUS commands with the largest contingent of CE

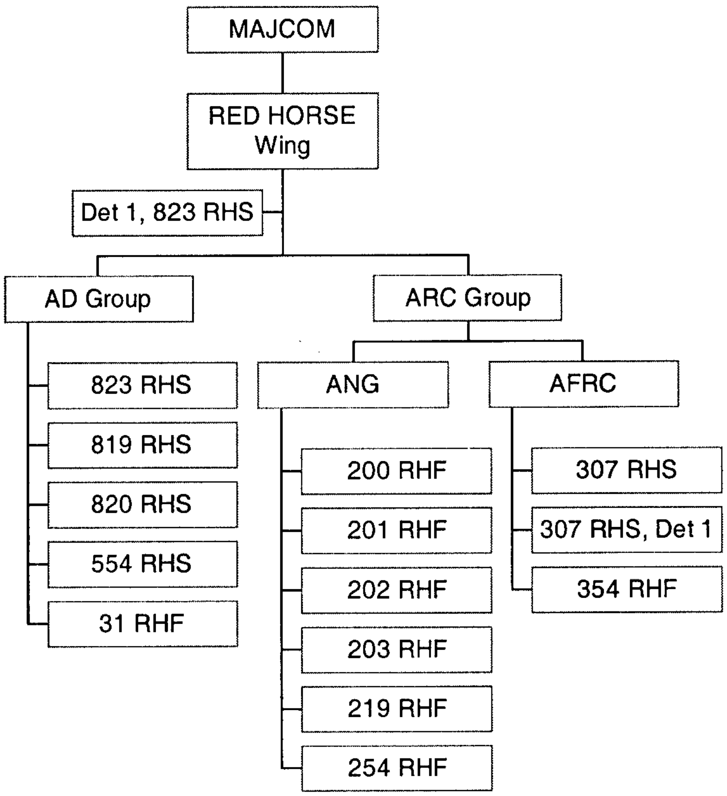


Fig 5.2 – Potential Macroscopic Organizational Structure for Alternative D

personnel. These two stateside commands are also the most involved in overseas operations, and neither faces imminent A-76 studies that could recommend reducing its CE manpower.

The most difficult aspect of implementing Alternative D would be achieving concurrence to relocate ARC units, 31 RHF (currently stationed at Camp Darby, Italy), and 554 RHS (currently stationed at Osan AB, ROK). The logistics and political ramifications of relocating these units could make this scenario highly unlikely, if not entirely infeasible.

One alternative of note is Alternative C. This was the highest-ranking alternative that prescribed placing all active duty CONUS RED HORSE units under one chain of command without relocating ARC units. This alternative offered an increased amount of flexibility by providing a single chain of command for all active duty RED HORSE units. However, this alternative only ranked eighth, primarily because it only placed 6 squadron equivalents and 6 equipment sets in CONUS. Additionally, it placed a RED HORSE unit under the command of a base (31 RHF reporting to 31 FW), allowed for 5 separate chains of command (ARC Units, CONUS active duty units, 7 AF, PACAF, and 31 RHF), and recommended maintaining only one Colonel within the active duty RED HORSE community.

Also of interest is the ranking of Alternative A – the "Status Quo" alternative. This alternative reflected the RED HORSE macroscopic organizational structure as it currently exists, and ranked 14th out of 20. This low ranking indicates that RED HORSE's current structure is failing to meet the objectives as identified by the decision maker's representative. This alternative specifically suffered because it did not propose matching peacetime and wartime command structure for any of the AD RED HORSE units, as well as recommending that the command for 31 RHF (Camp Darby, Italy) continue to be held at the base level (31 FW, Aviano AB, Italy). The analysis indicates that this structure should be changed to become commensurate with the objectives of RED HORSE leadership.

Based upon the rankings of the alternatives, combined with need to continually address RED HORSE-specific issues, the recommendation of this study is to implement Alternative F, with one caveat. This caveat would be the formation of a standardization organization, designed to address RED HORSE issues outside the scope of this research – i.e. vehicle and equipment replacement, UTC breakdown, pilot units for various engineering technologies, etc. This organization would operate similar to AFCESA. Whereas AFCESA provides a means to continually address issues specific to Civil Engineering, this proposed organization would continually address issues specific to RED HORSE, as well as provide a level of standardization among RED HORSE units. Fig 5.3 depicts a possible command structure for this recommendation.

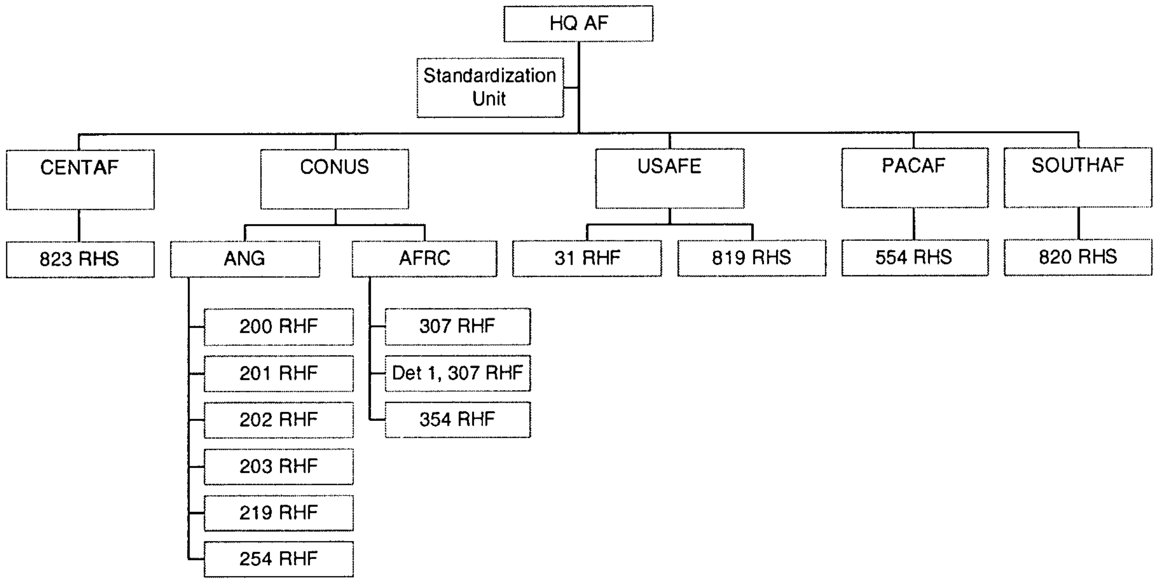


Fig 5.3 – Recommended Macroscopic Organizational Structure for RED HORSE

The second research objective addressed by this thesis was:

- What criteria are most important in developing an optimal organizational structure for RED HORSE?

The criteria that were determined to be most important to a decision addressing the macroscopic organizational structure of RED HORSE were encompassed by the three primary objectives. These primary objectives were:

- **Responsiveness** – the ability of RED HORSE to quickly arrive at a contingency location with its required resources (personnel, vehicles, equipment)
- **Political Considerations** – the organizational and governmental influences that affect the decision making process
- **Readiness** – the ability of RED HORSE to adequately train and familiarize themselves with their designated vehicles and equipment

Of these three, "Responsiveness" was determined to be most important, accounting for over 40% of the total weight of the decision opportunity. This was not surprising however, as this primary objective measured RED HORSE's ability to accomplish its contingency tasks in a timely manner. This coincided with the results put forth by the RED HORSE 2010 Strategic Study, citing that meeting RED HORSE mission requirements were of primary concern (accounted for by "Responsiveness" in this study).

For this study, the "CONUS [Readiness]" evaluation measure possessed the greatest global weight. This evaluation measure related to the "Readiness" primary objective. This evaluation measure was not significant however, as most of the alternatives did not prescribe locating unequipped personnel in the CONUS. "CONUS [Vehicles and Equipment]" possessed the second "heaviest" global weight, and related to the "Responsiveness" primary objective of the decision maker's representative's value hierarchy. The global weight of the "Streamlined Command" evaluation measures ("Matching Structures" and "Unity of Command") were the third most heavily weighted in the model. These evaluation measures further defined the primary objective of "Political Considerations." Sensitivity analysis indicated that subtle changes in the latter three evaluation measures ("CONUS [Vehicles and Equipment]," "Matching Structures," and "Unity of Command") directly affected the preferred alternative. As such, these three evaluation measures were the primary reason that the alternatives ranked as they did. The three evaluation measures proven to affect alternative ranking are highlighted in Fig 5.4.

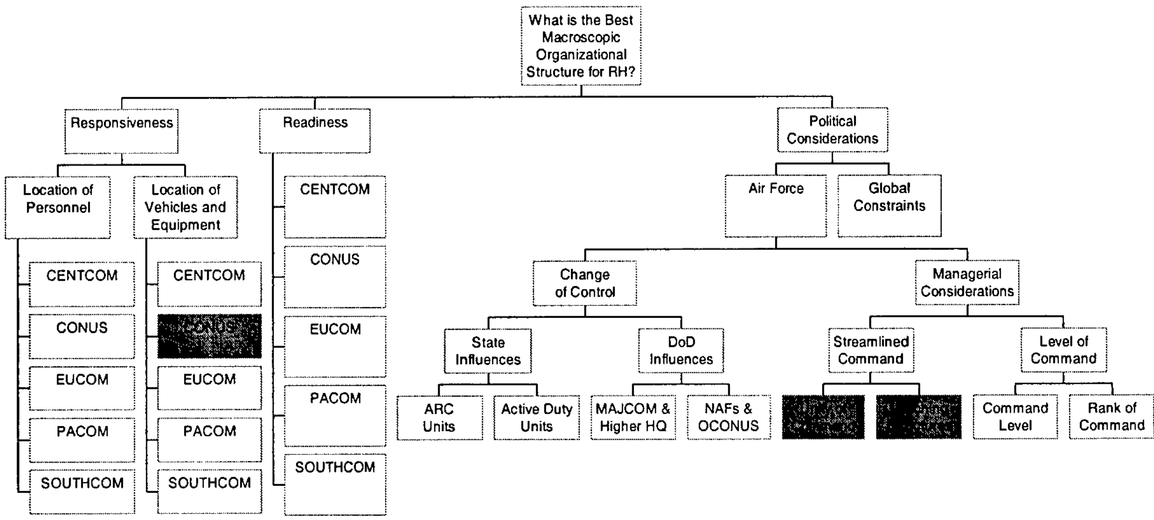


Fig 5.4 – Evaluation Measures Affecting Ranking of Alternatives

Scope and Limitations

Due to the complexity of the RED HORSE organizational structure, it is impossible to conceive and account for every subtle nuance and variable that contributes to the decision-making process. To focus this study on one specific, manageable aspect of the overall decision scenario, logical assumptions were made, the thesis scope was refined, and the VFT process was utilized. By focusing the thesis on one facet of the decision opportunity however, these techniques inevitably limited the overall research effort.

To guide this thesis effort, assumptions were made to simplify and guide the modeling and analysis process; these assumptions are presented and discussed in chapter 3. However, these assumptions limited the ability of the model to address each relevant topic. One of the most obvious omissions from this research was the issue of cost. It was assumed that all required funds would be available to fulfill any requirements arising from reorganization processes – an unlikely scenario. In addition, this research effort assumed that the RED HORSE ConOps would remain as it is. However, increasing sentiment among the USAF CE community that RED HORSE's ConOps is outdated could invalidate this assumption. Finally, this study assumed that RED HORSE would be adequately trained to accomplish any mission in any theater. However, an inexperienced USAF CE labor pool, an aged vehicle fleet within the RED HORSE community, and an increased operations tempo threaten the ability of RED HORSE to be properly trained at all times.

The research presented in this thesis was concerned with macroscopic issues of structure – i.e. how should the RED HORSE force be organized above the unit level. It did not address microscopic, unit-level issues such as the UTC distribution within a squadron, the training aspects of individual squadrons to ensure its personnel are capable of performing their contingency tasks, or the vehicle fleet existing within a unit. Instead, this research focused on issues of geographic location and chain of command – two of the issues highlighted as concerns by the RED HORSE 2010 Strategic Study. In order to identify the best macroscopic organizational structure of the RED HORSE force these squadron level issues must be addressed, as they dictate the manning and resource requirements for RED HORSE units – essential considerations when addressing organizational structuring.

Finally, the VFT process is one that relies heavily on the input of one group or individual. Any biases inherent in the thinking of that individual may manifest themselves in the attitudes, preferences, and values of the decision maker (or decision maker's representative). These personal biases could be imparted to the DA model and factor into the results generated by the model. Attempts to minimize biases are made during the objective solicitation processes by identifying a qualified decision maker (or decision maker's representative) and soliciting the objectives and evaluation measures from him/her. Sensitivity analysis also tries to identify and reduce the impact of erratic biases on the model by evaluating the model along the entire spectrum of possible preferences. Due to the initially subjective nature of this process however, not all of the biases may have been accounted for and/or eliminated, and may have affected the results posited by this study.

Areas of Further Study

This research effort highlighted the need for additional areas of study concerning the issue of RED HORSE macroscopic organizational structure. These include further investigation into model variables, the opportunity to partner with other military contingency units (within the USAF as well as among the sister services), the effect of changing squadron size limits, and the ability of RED HORSE to maintain an adequately trained force. Investigation into any of these areas would provide further insight into the broad spectrum of the decision opportunity, highlighting additional opportunities for differences between potential alternatives. This clarification would provide additional, more detailed alternatives that would further satisfy the values and objectives of a decision maker.

The sensitivity analysis indicated that the model was highly reactive to changes in the weights of different evaluation measures. Each of these evaluation measures should be explored more in-depth to ascertain the level of their effects on the model. Of particular interest is the stationing of resources (personnel and vehicles and equipment) in various theaters around the globe, as fluctuation in the weights pertaining to these aspects yielded the most changes in alternative preference. A time-based scale (i.e. time zones crossed or transport time required to respond to a contingency) for these "Responsiveness" measures could provide further insight into the most beneficial locations at which resources should be located. The evaluation measures relating to "Political Considerations" should also be investigated further, as each of these measures produced fluctuations in the model as well. The "Responsiveness" measures were found to be most influential on the model however, and additional efforts should begin there.

In addition, there are opportunities for RED HORSE to work with other, existing USAF contingency forces. Although this research addressed RED HORSE's ability to accomplish its contingency engineering mission, USAF requirements may be better satisfied through an overarching analysis that includes all of its various contingency engineering units. The 49 Material Maintenance Group (MMG) is another highly mobile USAF contingency engineering unit stationed at Holloman AFB, NM. It has been called on with increasing frequency to conduct beddown and bare base operations around the globe. Although troop training is not its primary mission, it is capable of training personnel in these operations – a role previously reserved for Prime BEEF. The inclusion of 49 MMG into the fold of RED HORSE operations poses interesting possibilities, and could be included in the model developed for this research effort. It would serve to increase the active duty labor pool, equipment inventory, and vehicle fleet of RED HORSE, potentially making it more flexible and responsive. The actual effect on such a merger has not been researched however. Similar results could be achieved via joint operations with Prime BEEF units. To accomplish this, the existing ConOps for RED HORSE and Prime BEEF would have to be readdressed.

On a broader scale, perhaps the contingency requirements of the US military as a whole could best be achieved by combining the contingency engineering forces of all the services. Additional research could explore the possibility of RED HORSE partnering with the contingency forces of sister military services. Both the US Navy and the US Army possess contingency engineering capability on a much larger scale than the USAF, in the Navy SEABEES and Army Construction Battalions (CBs). The US Marine Corps also possesses a contingency engineering capability (Marine CBs), albeit on a much smaller scale than the other three military services. Comparisons between contingency engineering capabilities among the four services have been made previously, and USAF contingency engineering (particularly RED HORSE) has looked to the SEABEES for benchmarking opportunities as recently as the RED HORSE 2010 Strategic Study. Additional areas of study could include the possibility of merging the contingency engineering capabilities of each of the services into a joint organization, providing a massive labor pool and vehicle fleet from which the US military could draw.

Further, RED HORSE was initially authorized to be half the size of an Army CB [27]. This study assumed that its size (in the means of manning or other resources) would be held constant. However, the reduction in force and continued drawdown of the US military opens the door for the size aspects of RED HORSE to fluctuate, in manning or other resources. In response to the increased demand of RED HORSE, the USAF has stood up 819 RHS and 219 RHF at Malmstrom AFB, MT, and restored 554 RHS (ROK) to full strength (from caretaker status). While the demand for RED HORSE contingency engineering services has not leveled-off, the continued outsourcing of USAF CE provides additional military manpower to the CE community that could be used to augment RED

HORSE's existing capabilities. These two phenomena allow for the possibility of increasing the size of existing RED HORSE units. As such, the effects of increasing the size of existing units beyond the 404-person limit should be explored. Rather than standing up new units, this scenario would provide additional flexibility to existing units. Conversely, these size increases could make RED HORSE even heavier, adversely affecting RED HORSE's ability to be responsive.

This research effort assumed that all personnel were adequately trained to conduct their mission. However, the lack of an experienced labor pool, an aged vehicle fleet, an increased operations tempo, and a ConOps that has been deemed out of date present serious challenges to validating that assumption. In addition, only experienced CE personnel were eligible for RED HORSE assignment in the past; currently, Airmen Basics fresh out of tech school and newly commissioned Second Lieutenants are being assigned to RED HORSE units. The impact of all these issues could be playing a role in the ability of a REDHORSE unit to maintain a fully trained contingent of personnel. Research aimed at identifying the level and adequacy of training existing in RED HORSE units should be conducted to address these challenges.

Finally, the issue of cost should quantified and incorporated into any additional study aimed at identifying an appropriate structure for RED HORSE. As with all government organizations, cost is a limiting parameter in any effort undertaken by RED HORSE, including reorganization. Several alternatives proposed relocating existing units, from state to state, from OCONUS to CONUS, and from CONUS to OCONUS. It is likely that these relocations would be very costly – a fact that would be accounted for when making a reorganization decision.

Additional Considerations

Of additional consideration is the interactive role the US military's contingency engineering services must play with one another. Within the USAF, this means that RED HORSE and Prime BEEF must be organized and managed in such as way as to allow each to maintain a "separate but equal" identity [26]. Outside of the USAF, this implies that each service is given ample opportunity to showcase its engineering capabilities. There is a continual requirement for US military assistance abroad. Organizing the various military contingency units to meet this demand must be accomplished in such a way as to allow each service to receive their "...share of the pie [26]."

Finally, the US military has been supporting contingency operations since its inception. Lessons learned from previous deployments have been used for planning purposes to posture military units and capabilities for future engagements. Any proposed organizational structure should be analyzed to ensure that it satisfies the requirements realized from previous contingencies.

APPENDIX A: WEIGHT CALCULATIONS

This section depicts the swing-weight method used to assign weights to each for the twenty-four evaluation measures identified in this research effort. This process is described in-depth in the methodology chapter (chapter 3), under "Assessing Weights," p.3-22. The steps depicted here were used to calculate the local weights of each objective or evaluation measure. Tbl A.1 indicates the global weight of each objective or evaluation measure at each level of the hierarchy.

For all weight calculations:

W – Local weight
G(W) – Global weight

In addition, the following relationships apply:

- The sum of all local weights must equal 1
- Global weights are calculated by multiplying each local weight existing on that portion of the hierarchy, as they ascend through the hierarchy (beginning at the bottom) to the point of interest.

Responsiveness Weights

The ratio of the weight of CONUS [Personnel] (COP) to the weight of CENTCOM [Personnel] (CP) is 7:3:

$$W_{COP} = 2.333W_{CP}$$

The ratio of the weight of EUCOM [Personnel] (EP) to the weight of CENTCOM [Personnel] (CP) is 1:3:

$$W_{EP} = 0.333W_{CP}$$

The ratio of the weight of PACOM [Personnel] (PP) to the weight of CENTCOM [Personnel] (CP) is 1:1:

$$W_{PP} = W_{CP}$$

The ratio of the weight of SOUTHCOM [Personnel] (SP) to the weight of CENTCOM [Personnel] (CP) is 1:3:

$$W_{SP} = 0.333W_{CP}$$

$$W_{CP} + W_{COP} + W_{EP} + W_{PP} + W_{SP} = 1$$
$$W_{CP} + 2.333W_{CP} + 0.333W_{CP} + W_{CP} + 0.333W_{CP} = 1$$
$$\mathbf{W_{CP} = 0.2}$$
$$\mathbf{W_{COP} = 0.466}$$
$$\mathbf{W_{EP} = 0.067}$$
$$\mathbf{W_{PP} = 0.2}$$
$$\mathbf{W_{SP} = 0.067}$$

The ratio of the weight of CONUS [Vehicles & Equipment] (COV) to the weight of CENTCOM [Vehicles & Equipment] (CV) is 3:2:

$$W_{COV} = 1.5W_{CV}$$

The ratio of the weight of EUCOM [Vehicles & Equipment] (EV) to the weight of CENTCOM [Vehicles & Equipment] (CV) is 1:3:

$$W_{EV} = 0.333W_{CV}$$

The ratio of the weight of PACOM [Vehicles & Equipment] (PV) to the weight of CENTCOM [Vehicles & Equipment] (CV) is 1:1:

$$W_{PV} = W_{CV}$$

The ratio of the weight of SOUTHCOM [Vehicles & Equipment] (SV) to the weight of CENTCOM [Vehicles & Equipment] (CV) is 2:3:

$$W_{SV} = 0.667W_{CV}$$

$$W_{CV} + W_{COV} + W_{EV} + W_{PV} + W_{SV} = 1$$
$$W_{CV} + 1.5W_{CV} + 0.333W_{CV} + W_{CV} + 0.667W_{CV} = 1$$
$$\mathbf{W_{CP} = 0.222}$$
$$\mathbf{W_{COP} = 0.333}$$
$$\mathbf{W_{EP} = 0.075}$$
$$\mathbf{W_{PP} = 0.222}$$
$$\mathbf{W_{SP} = 0.148}$$

To quantify the relationship between the 2nd tier means objectives of Location of Personnel (LP) and Location of Vehicles and Equipment (LV), the evaluation measures of CENTCOM [Personnel] (CP) and CENTCOM [Vehicles & Equipment] (CV) were compared. The ratio between the 2nd tier global weight of CENTCOM [Vehicles & Equipment] (CV) and CENTCOM [Personnel] (CP) is 4:1:

$$G(W_{CV}) = 4G(W_{CP})$$

$$G(W_{CV}) = W_{CV}*W_{LV} = 0.222*W_{LV}$$
$$G(W_{CP}) = W_{CP}*W_{LP} = 0.2*W_{LP}$$

$$0.222*W_{LV} = 4*0.2*W_{LP}$$
$$W_{LV} = 3.604*W_{LP}$$

$$W_{LV} + W_{LP} = 1$$
$$3.604W_{LP} + W_{LP} = 1$$
$$\mathbf{W_{LP} = 0.217}$$

$$\mathbf{W_{LV} = 0.783}$$

Readiness Weights

The ratio of the weight of CONUS (CO) to the weight of CENTCOM (C) is 4:1:

$$W_{CO} = 4W_C$$

The ratio of the weight of EUCOM (E) to the weight of CENTCOM (C) is 1:1:

$$W_E = W_C$$

The ratio of the weight of PACOM (P) to the weight of CENTCOM (C) is 1:1:

$$W_P = W_C$$

The ratio of the weight of SOUTHCOM (S) to the weight of CENTCOM (C) is 1:1:

$$W_S = W_C$$

$$W_C + W_{CO} + W_E + W_P + W_S = 1$$
$$W_C + 4W_C + W_C + W_C + W_C = 1$$
$$\mathbf{W_C = 0.125}$$
$$\mathbf{W_{CO} = 0.5}$$
$$\mathbf{W_E = 0.125}$$
$$\mathbf{W_P = 0.125}$$
$$\mathbf{W_S = 0.125}$$

Political Considerations Weights

The weight of Command Level (CL) is worth twice the weight of Rank of Command (RC):

$W_{CL} = 2W_{RC}$

$W_{CL} + W_{RC} = 1$
$2W_{RC} + W_{RC} = 1$
$\mathbf{W_{RC} = 0.333}$

$\mathbf{W_{CL} = 0.667}$

The weight of Unity of Command (UC) is equal to the weight of Matching Structures (MS):

$W_{UC} = W_{MS}$

$W_{UC} + W_{MS} = 1$
$W_{MS} + W_{MS} = 1$
$\mathbf{W_{MS} = 0.5}$

$\mathbf{W_{UC} = 0.5}$

To quantify the relationship between the 4th tier means objectives of Streamlined Command (SC) and Level of Command (LC), the evaluation measures of Matching Structures (MS) and Command Level (CL) were compared. The 4th tier global weight of Matching Structures (MS) is worth 1.5 times the 4th tier global weight of Command Level (CL):

$G(W_{MS}) = 1.5G(W_{CL})$

$G(W_{MS}) = W_{MS} * W_{SC} = 0.5 * W_{SC}$
$G(W_{CL}) = W_{CL} * W_{LC} = 0.667 * W_{LC}$

$0.5*W_{SC} = 1.5*0.667*W_{LC}$
$W_{SC} = 2*W_{LC}$

$W_{SC} + W_{LC} = 1$
$2W_{LC} + W_{LC} = 1$
$\mathbf{W_{LC} = 0.333}$

$\mathbf{W_{SC} = 0.667}$

The weight of MAJCOMs & Higher HQs (MH) is equal to the weight of NAFs & OCONUS Bases (NO):

$W_{MH} = W_{NO}$

$W_{MH} + W_{NO} = 1$
$W_{NO} + W_{NO} = 1$
$\mathbf{W_{NO} = 0.5}$

$\mathbf{W_{MH} = 0.5}$

The weight of ARC Units (AU) is worth twice the weight of Active Duty Units (AD):

$W_{AU} = 2W_{AD}$

$W_{AU} + W_{AD} = 1$
$2W_{AD} + W_{AD} = 1$
$\mathbf{W_{AD} = 0.333}$

$\mathbf{W_{AU} = 0.667}$

To quantify the relationship between the 4th tier means objectives of State Influences (SI) and DoD Influences (DI), the evaluation measures of ARC Units (AU) and MAJCOMs & Higher HQs (MH) were compared. The 4th tier global weight of ARC Units (AU) is worth twice the 4th tier global weight of MAJCOMs & Higher HQs (MH):

$G(W_{AU}) = 2G(W_{MH})$

$G(W_{AU}) = W_{AU} * W_{SI} = 0.667 * W_{SI}$
$G(W_{MH}) = W_{MH} * W_{DI} = 0.5 * W_{DI}$

$0.667*W_{SI} = 2*0.5*W_{DI}$
$W_{SI} = 1.5*W_{DI}$

$W_{SI} + W_{DI} = 1$
$1.5W_{DI} + W_{DI} = 1$
$\mathbf{W_{DI} = 0.4}$

$\mathbf{W_{SI} = 0.6}$

To quantify the relationship between the 3rd tier means objectives of Change of Control (CC) and Management Considerations (MC), the evaluation measures of ARC Units (AU) and Command Level (CL) were compared. The 3rd tier global weight of Command Level (CL) is worth 1.5 times the 3rd tier global weight of ARC Units (AU):

$G(W_{CL}) = 1.5G(W_{AU})$

$G(W_{CL}) = W_{CL} * W_{LC} * W_{MC} = 0.667*0.333*W_{MC} = 0.222*W_{MC}$
$G(W_{AU}) = W_{AU} * W_{SI} * W_{CC} = 0.667*0.6*W_{CC} = 0.4*W_{CC}$

$0.222*W_{MC} = 1.5*0.4*W_{CC}$
$W_{MC} = 2.7*W_{CC}$

$W_{MC} + W_{CC} = 1$
$2.7W_{CC} + W_{CC} = 1$
$\mathbf{W_{CC} = 0.271}$

$\mathbf{W_{MC} = 0.729}$

To quantify the relationship between the 2nd tier means objectives of Air Force (AF) and Global Constraints (GC), the evaluation measures of Command Level (CL) and Global Constraints (GC) were compared. The 2nd tier global weight of Command Level (CL) is worth 1.5 times the weight of Global Constraints (GC):

$G(W_{CL}) = 1.5W_{GC}$

$G(W_{CL}) = W_{CL}*W_{LC}*W_{MC}*W_{AF} = 0.222*0.729*W_{AF} = 0.162*W_{AF}$

$0.162*W_{AF} = 1.5*W_{GC}$
$W_{AF} = 9.259*W_{GC}$

$W_{AF} + W_{GC} = 1$
$9.259W_{GC} + W_{GC} = 1$
$\mathbf{W_{GC} = 0.097}$

$\mathbf{W_{AF} = 0.903}$

Primary Objectives Weights

To quantify the relationship between the primary objectives of Responsiveness (RES), Readiness (REA), and Political Considerations (PC), the evaluation measures of CENTCOM [Vehicles & Equipment] (CV), CENTCOM [Readiness] (CR), and Command Level (CL) were compared. The ratio of the global weight of CENTCOM [Readiness] (CR) to the global weight of CENTCOM [Vehicles & Equipment] (CV) is 3:7:

$$G(W_{CR}) = 0.429*G(W_{CV}) \qquad G(W_{CR}) = W_{CR} * W_{REA} = 0.125 *W_{REA}$$

$$G(W_{CV}) = W_{CV}*W_{LV}*W_{RES} = 0.222*0.783*W_{RES} = 0.174*W_{RES}$$

$$0.125*W_{REA} = 0.429*0.174*W_{RES}$$

$$W_{REA} = 0.597*W_{RES}$$

The ratio of the global weight of Command Level (CL) to the global weight of CENTCOM [Vehicles & Equipment] (CV) is 2:3:

$$G(W_{CL}) = 0.667*G(W_{CV}) \qquad G(W_{CL}) = W_{CL}*W_{LC}*W_{MC}*W_{AF}*W_{PC} = 0.162*0.903*W_{PC} = 0.146*W_{PC}$$

$$G(W_{CV}) = 0.174*W_{RES}$$

$$0.146*W_{PC} = 0.667*0.174*W_{RES}$$

$$W_{PC} = 0.795*W_{RES}$$

$$W_{RES} + W_{REA} + W_{PC} = 1$$

$$W_{RES} + 0.597*W_{RES} + 0.795*W_{RES} = 1$$

$$\mathbf{W_{RES} = 0.418}$$

$$\mathbf{W_{REA} = 0.250}$$

$$\mathbf{W_{PC} = 0.332}$$

Tbl A.1 - Global and Local Weights for Objectives and Evaluation Measures

Objectives and Evaluation Measures	Weights				
	Local	Global			
		4th Tier	3rd Tier	2nd Tier	1st Tier
Responsiveness	0.418				0.4180
Location of Personnel	0.217				0.0907
CENTCOM	0.200			0.0434	0.0181
CONUS	0.466			0.1011	0.0423
EUCOM	0.067			0.0145	0.0061
PACOM	0.200			0.0434	0.0181
SOUTHCOM	0.067			0.0145	0.0061
Location of V & E	0.783				0.3273
CENTCOM	0.222			0.1738	0.0727
CONUS	0.333			0.2607	0.1090
EUCOM	0.075			0.0587	0.0245
PACOM	0.222			0.1738	0.0727
SOUTHCOM	0.148			0.1159	0.0484
Readiness	0.250				0.2500
CENTCOM	0.125				0.0313
CONUS	0.500				0.1250
EUCOM	0.125				0.0313
PACOM	0.125				0.0313
SOUTHCOM	0.125				0.0313
Political Considerations	0.332				0.3320
Air Force	0.903				0.2998
Change of Control	0.271			0.2447	0.0812
State Influences	0.600		0.1626	0.1468	0.0487
ARC Units	0.667	0.4002	0.1085	0.0979	0.0325
AD Units	0.333	0.1998	0.0541	0.0489	0.0162
DoD Influences	0.400		0.1084	0.0979	0.0325
MAJCOM and Higher HQ	0.500	0.2000	0.0542	0.0489	0.0162
NAFs and OCONUS	0.500	0.2000	0.0542	0.0489	0.0162
Managerial Considerations	0.729			0.6583	0.2186
Streamlined Command	0.667		0.4862	0.4391	0.1458
Unity of Command	0.500	0.3335	0.2431	0.2195	0.0729
Matching Structures	0.500	0.3335	0.2431	0.2195	0.0729
Level of Command	0.333		0.2428	0.2192	0.0728
Command Level	0.667	0.2221	0.1619	0.1462	0.0485
Command Rank	0.333	0.1109	0.0808	0.0730	0.0242
Global Constraints	0.097				0.0322

APPENDIX B: STRATEGY GENERATION TABLE

This section presents the strategy generation table (Tbl B.2) used to develop the majority of alternatives analyzed in this research. This table lists each of the evaluation measures across the top row, and lists all the possible outcomes for each evaluation measure in the columns underneath the appropriate evaluation measure. Alternatives were then generated by tracing a path (from left to right) through the strategy generation table, selecting various outcomes for each evaluation measure. This technique of alternative generation is described in more detail in the methodology chapter (Chapter 3), under "Identify Alternatives," p. 3-7.

The only additional constraint used in developing alternatives with the strategy generation table concerned the outcomes for each of the "Responsiveness" measures. This study assumed that no resources (personnel or vehicles and equipment) would be added or removed from those currently existing in the RED HORSE inventory. Therefore, the total number of squadron equivalents (located in all theaters) for an alternative had to equal seven. Similarly, the total number of equipment sets had to sum to nine.

There were 6 alternatives included in this research that did not use this approach. These alternatives, and the reasons for their inclusion are given in Tbl B.1 below.

Tbl B.1 – Non-Generated Alternatives

Alternative	Title	Reason for Inclusion
A	Status Quo	Decision Analysis Requirement
C	As-is Unified	Posited by Decision Maker
K	Study MTW Relocation I	Posited by RED HORSE 2010 Strategic Study
L	Study MTW Relocation II	Posited by RED HORSE 2010 Strategic Study
M	Study MTW Relocation III	Posited by RED HORSE 2010 Strategic Study
T	No RED HORSE	Decision Analysis Requirement

Tbl B.2 - Strategy Generation Table

RESPONSIVENESS										**Readiness** (unequipped personnel in theater)					**Political Considerations**								
															Air Force								Global Constraints
															Change of Control				Managerial Considerations				
Location of Personnel (Squadron Equivalents)					**Location of Vehicle and Equipment** (Equipment Sets)										State Influences		DoD Influences		Streamlined Command		Level of Command		
CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	ARC	AD	MAJCOM	NAFs	Unity	Matching	Level	Rank	Constraints
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	Base	0	CENTCOM
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	NAF	1	CONUS
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	MAJCOM	2	EUCOM
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3		3	PACOM
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		4	4	5	4			SOUTHCOM
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		5	5	6				
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		6	6	7				
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7				8				
					8	8	8	8	8						8				9				
					9	9	9	9	9														

APPENDIX C: EVALUATION MEASURE OUTCOMES FOR ALTERNATIVES

This section presents the evaluation measure outcomes table (Tbl C.1) used to assign values for each alternative. This table depicts the outcomes for each alternative for all twenty-four evaluation measures. For example, Alternative A ("Status Quo") recommends that all squadron equivalents remain as they currently exist – 0 in CENTCOM, 6 in CONUS, 0 in EUCOM, 1 in PACOM, 0 in SOUTHCOM. These outcomes are reflected in the appropriate columns of the row entitled "Alternative A." Similarly, this table reflects the outcomes for all twenty alternatives with respect to each evaluation measure. These evaluation measure outcomes were then used to score the alternatives according to the evaluation measure value functions solicited from the decision maker's representative. This technique of alternative scoring is described in more detail in the results and analysis chapter (Chapter 4), under "Alternative Scoring and Ranking," p. 4-48.

Tbl C.1 - Evaluation Measure Outcomes for Alternatives

		RESPONSIVENESS									
		Location of Personnel (Squadron Equivalents)					**Location of Vehicle and Equipment** (Equipment Sets)				
Alternative	**Description**	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM
A	Status Quo	0	6	0	1	0	0	6	2	1	0
B	As-is Semi-Unified	0	6	0	1	0	0	6	2	1	0
C	As-is Unified	0	6	0	1	0	0	6	2	1	0
D	Super Unit	0	7	0	0	0	0	9	0	0	0
E	Semi Super-Unit	0	7	0	0	0	0	9	0	0	0
F	As-is Diversified	0	6	0	1	0	0	6	2	1	0
G	Diversified	1	3	1	1	1	1	5	1	1	1
H	Dispersed Equip	0	7	0	0	0	2	2	2	2	1
I	MTW Diversified	1	3	1	1	1	2	3	1	2	1
J	Semi-MTW	1	5	0	1	0	2	5	0	2	0
K	MTW Geared	2	3	0	2	0	2	3	2	2	0
L	Study MTW Relocation I	0	6	0	1	0	0	6	2	1	0
M	Study MTW Relocation II	0	6	0	1	0	0	6	2	1	0
N	Study MTW Relocation III	0	6	0	1	0	1	4	2	1	1
O	OOTW Geared	0	7	0	0	0	2	1	2	2	2
P	Study Co-location	0	6	0	1	0	0	6	2	1	0
Q	Co-located Diversification	0	6	0	1	0	0	6	2	1	0
R	Study Heavy OOTW Hybri	1	4	0.5	1	0.5	2	4	1	1.5	0.5
S	Super Personnel	0	7	0	0	0	2	3	1	2	1
T	No RED HORSE	0	6	0	1	0	0	6	2	1	0

	Readiness (unequipped personnel in theater)					**Political Considerations**								
						Air Force								
						Change of Control				Managerial Considerations				
						State Influences		DoD Influences		Streamlined Command		Level of Command		Global
Alternative	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	ARC	AD	MAJCOM	NAFs	Unity	Matching	Level	Rank	Constraints
A	0	0	0	0	0	0	0	0	0	7	0	Base	3	PACOM
B	0	0	0	0	0	0	0	0	2	4	0	Base	3	PACOM
C	0	0	0	0	0	0	0	0	2	5	3	Base	1	PACOM
D	0	0	0	0	0	8	2	3	6	1	4	MAJCOM	1	CONUS
E	0	0	0	0	0	8	2	2	5	2	4	MAJCOM	1	CONUS
F	0	0	0	0	0	0	0	3	0	5	4	NAF	3	PACOM
G	0	0	0	0	0	0	3	1	3	5	4	MAJCOM	3	CENTCOM
H	0	5	0	0	0	0	1	2	1	2	4	MAJCOM	1	CENTCOM
I	0	0	0	0	0	0	3	1	2	5	4	NAF	3	CENTCOM
J	0	0	0	0	0	0	1	1	3	6	2	NAF	3	CENTCOM
K	0	0	0	0	0	0	3	2	1	6	4	NAF	2	CENTCOM
L	0	0	0	0	0	4	2	0	3	4	3	MAJCOM	3	PACOM
M	0	0	0	0	0	4	2	3	0	7	4	NAF	3	PACOM
N	0	2	0	0	0	4	2	3	0	7	4	NAF	3	PACOM
O	0	6	0	0	0	8	2	3	4	5	4	NAF	1	CENTCOM
P	0	0	0	0	0	1	1	0	0	7	0	Base	3	PACOM
Q	0	0	0	0	0	7	0	3	0	6	4	NAF	3	PACOM
R	0	0	0	0	0	0	3	0	0	7	0	NAF	3	CENTCOM
S	0	4	0	0	0	8	2	2	6	1	4	MAJCOM	1	CENTCOM
T	0	6	0	1	0	8	3	6	6	9	0	Base	0	PACOM

APPENDIX D: RESULTS

This section presents the results table (Tbl D.1) used to identify the preferred alternative for this research. This table lists the twenty alternatives in the leftmost column and each of the evaluation measures across the top row. Each row indicates the scores achieved by that alternative for each evaluation measure. These scores represent the value assigned by the decision maker's representative to the outcome of that alternative, as identified at Appendix C in Tbl C.1. The total score for each alternative is listed in the last column, under "Total." It was calculated by multiplying the global weight of each evaluation measure (given in the gray boxes in the row directly underneath the evaluation measures), by the score for that evaluation measure, and summing the products. This method of alternative scoring and ranking is described in more detail in the results and analysis chapter (Chapter 4), under "Alternative Scoring and Ranking," p. 4-48.

The first row under the "Total" column of Tbl D.1 reflects the total possible score of an alternative as 1. This score is the sum of the evaluation measures' global weights, and could only be achieved if an alternative recommended the decision maker's representative's maximum value outcomes for each evaluation measure. Due to the constraints of this research effort however, this was not possible; more specifically, utilizing only existing RED HORSE resources (personnel and vehicles and equipment) meant that only seven squadron equivalents and nine equipment sets could be recommended by any alternative. Hence, it was impossible to attain the maximum value outcome for each of the "Responsiveness" evaluation measures, which would require all squadron equivalents and equipment sets be placed in each theater. Similarly, it was impossible to achieve the maximum value outcome for each of the "Political Considerations" measures, as increasing the value outcome for one would decrease the value outcome of another. Consequently, no alternative achieved the maximum possible score of 1.

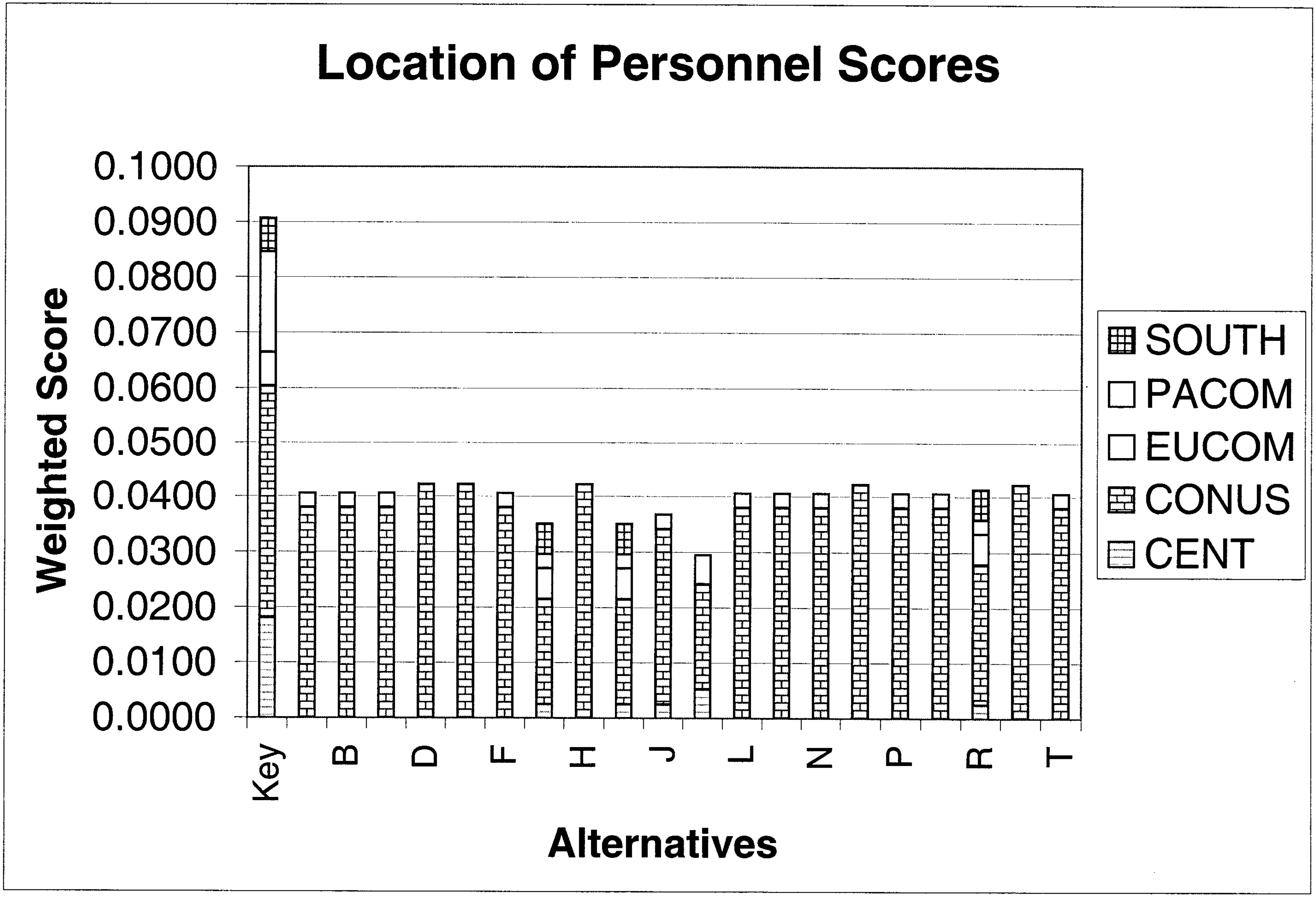
Figs D.1 – D.4 illustrate how each alternative scored in each evaluation measure with respect to the maximum possible score. The leftmost bar, labeled "Key," in each figure depicts the maximum possible total score for each alternative. It is comprised of separate sections, each section indicating the maximum possible score for an evaluation measure. Comparing the twenty alternative bars to the "Key" bar illustrates how each alternative scored against the maximum possible total score. It also reveals how each alternative scored with respect to the maximum possible score for each evaluation measure, shown by the separate sections comprising each bar. For clarity, each figure only depicts the alternative scores with respect to a subset of evaluation measures, as follows:

Fig D.1 – Scores for "Location of Personnel" Evaluation Measures
Fig D.2 – Scores for "Location of Vehicles and Equipment" Evaluation Measures
Fig D.3 – Scores for "Readiness" Evaluation Measures
Fig D.4– Scores for "Political Considerations" Evaluation Measures

Also for clarity purposes, the horizontal axis of each figure only shows labels for every other alternative.

Tbl D.1 - Alternative Results

	RESPONSIVENESS										**Readiness** (unequipped personnel in theater)					**Political Considerations**									
																Air Force									
																Change of Control				Managerial Considerations					
	Location of Personnel (Squadron Equivalents)					**Location of Vehicle and Equipment** (Equipment Sets)										State Influences		DoD Influences		Streamlined Command		Level of Command		Global Constraints	
	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	CENTCOM	CONUS	EUCOM	PACOM	SOUTHCOM	ARC	AD	MAJCOM	NAFs	Unity	Matching	Level	Rank		Total
Alternatives	**0.0181**	**0.0423**	**0.0061**	**0.0181**	**0.0061**	**0.0727**	**0.1090**	**0.0245**	**0.0727**	**0.0484**	**0.0313**	**0.1250**	**0.0313**	**0.0313**	**0.0313**	**0.0325**	**0.0162**	**0.0162**	**0.0162**	**0.0729**	**0.0729**	**0.0485**	**0.0242**	**0.0322**	1.0000
A	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	1	1	1	1	0.06	0	0	1	0.7	**0.54870**
B	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	1	1	1	0.9	0.25	0	0	1	0.7	**0.56092**
C	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	1	1	1	0.6	0.15	0.75	0	0.333	0.7	**0.58726**
D	0	1	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0.333	0.5	0	1	1	1	0.333	1	**0.64938**
E	0	1	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0.333	0.6	0.1	0.65	1	1	0.333	1	**0.62712**
F	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	1	1	0.5	1	0.15	1	0.7	1	0.7	**0.65400**
G	0.14	0.45	0.908	0.14	0.908	0.11	0.75	0.5	0.11	0.11	1	1	1	1	1	1	0	0.9	0.5	0.15	1	1	1	0	**0.61233**
H	0	1	0	0	0	0.22	0.3	0.8	0.22	0.11	1	0.25	1	1	1	1	0.667	0.6	0.9	0.65	1	1	0.333	0	**0.53274**
I	0.14	0.45	0.908	0.14	0.908	0.22	0.45	0.5	0.22	0.11	1	1	1	1	1	1	0	0.9	0.6	0.15	1	0.7	1	0	**0.58268**
J	0.14	0.75	0	0.14	0	0.22	0.75	0	0.22	0	1	1	1	1	1	1	0.667	0.9	0.5	0.1	0.5	0.7	1	0	**0.56853**
K	0.29	0.45	0	0.29	0	0.22	0.45	0.8	0.22	0	1	1	1	1	1	1	0	0.6	0.9	0.1	1	0.7	0.667	0	**0.56740**
L	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	0.5	0.333	1	0.5	0.25	0.75	1	1	0.7	**0.63055**
M	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	0.5	0.333	0.5	1	0.06	1	0.7	1	0.7	**0.62036**
N	0	0.9	0	0.14	0	0.11	0.6	0.8	0.11	0.11	1	0.7	1	1	1	0.5	0.333	0.5	1	0.06	1	0.7	1	0.7	**0.56348**
O	0	1	0	0	0	0.22	0.15	0.8	0.22	0.22	1	0.1	1	1	1	0	0.333	0.5	0.4	0.15	1	0.7	0.333	0	**0.40428**
P	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	0.9	0.667	1	1	0.06	0	0	1	0.7	**0.54004**
Q	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	1	1	1	1	0.1	1	0.5	1	0.1	1	0.7	1	0.7	**0.62109**
R	0.14	0.6	0.9	0.14	0.9	0.22	0.6	0.5	0.17	0.06	1	1	1	1	1	1	0	1	1	0.06	0	0.7	1	0	**0.52789**
S	0	1	0	0	0	0.22	0.45	0.5	0.22	0.11	1	0.4	1	1	1	0	0.333	0.6	0	1	1	1	0.333	0	**0.53343**
T	0	0.9	0	0.14	0	0	0.9	0.8	0.11	0	1	0.1	1	0.857	1	0	0	0	0	0	0	0	0	0.7	**0.32188**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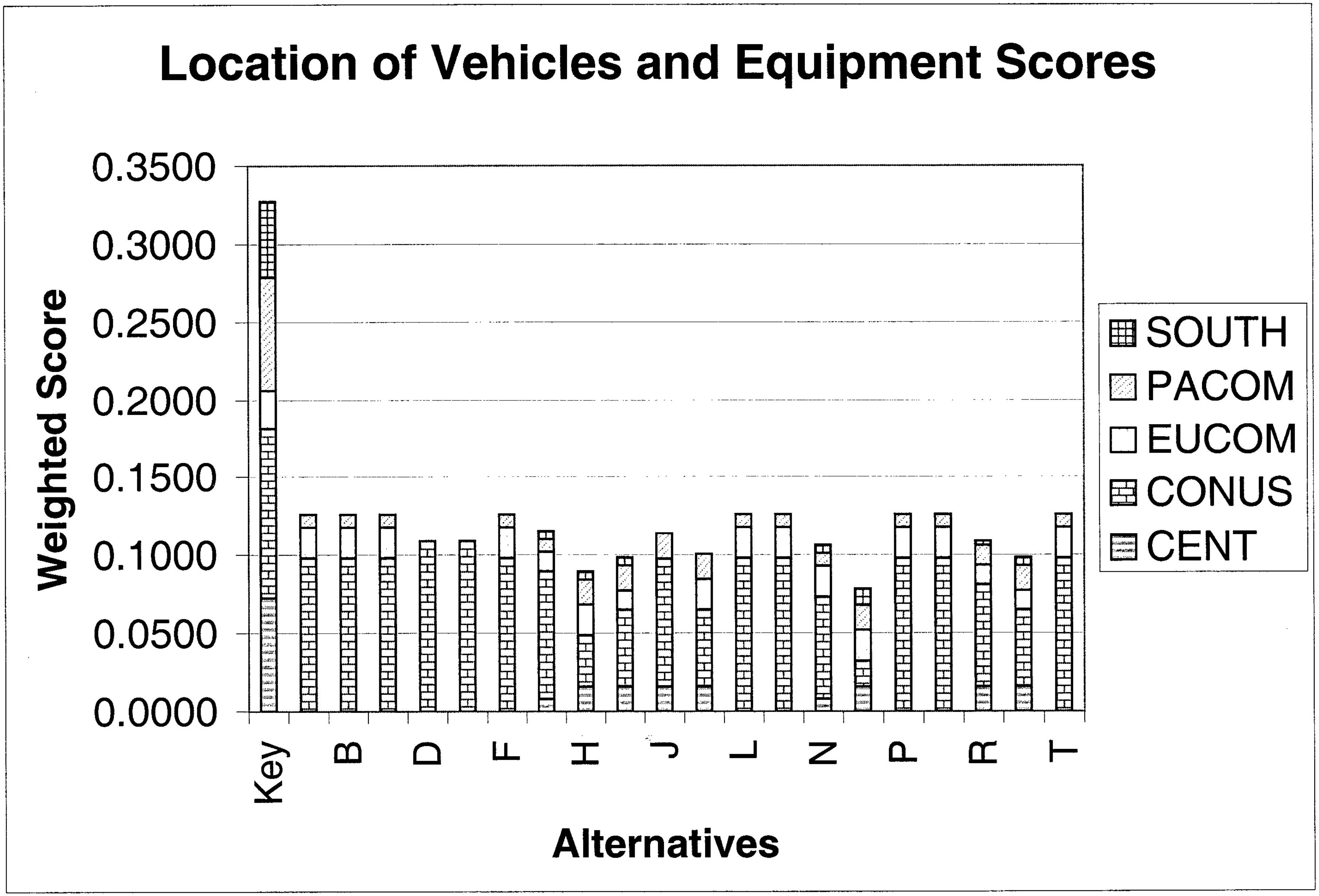
0.0800
0.0700
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
Key
B
D
F
H
J
L
N
P
R
T
Alternatives
SOUTH
PACOM
EUCOM
CONUS
CENT


Location of Vehicles and Equipment Scores
Weighted Score
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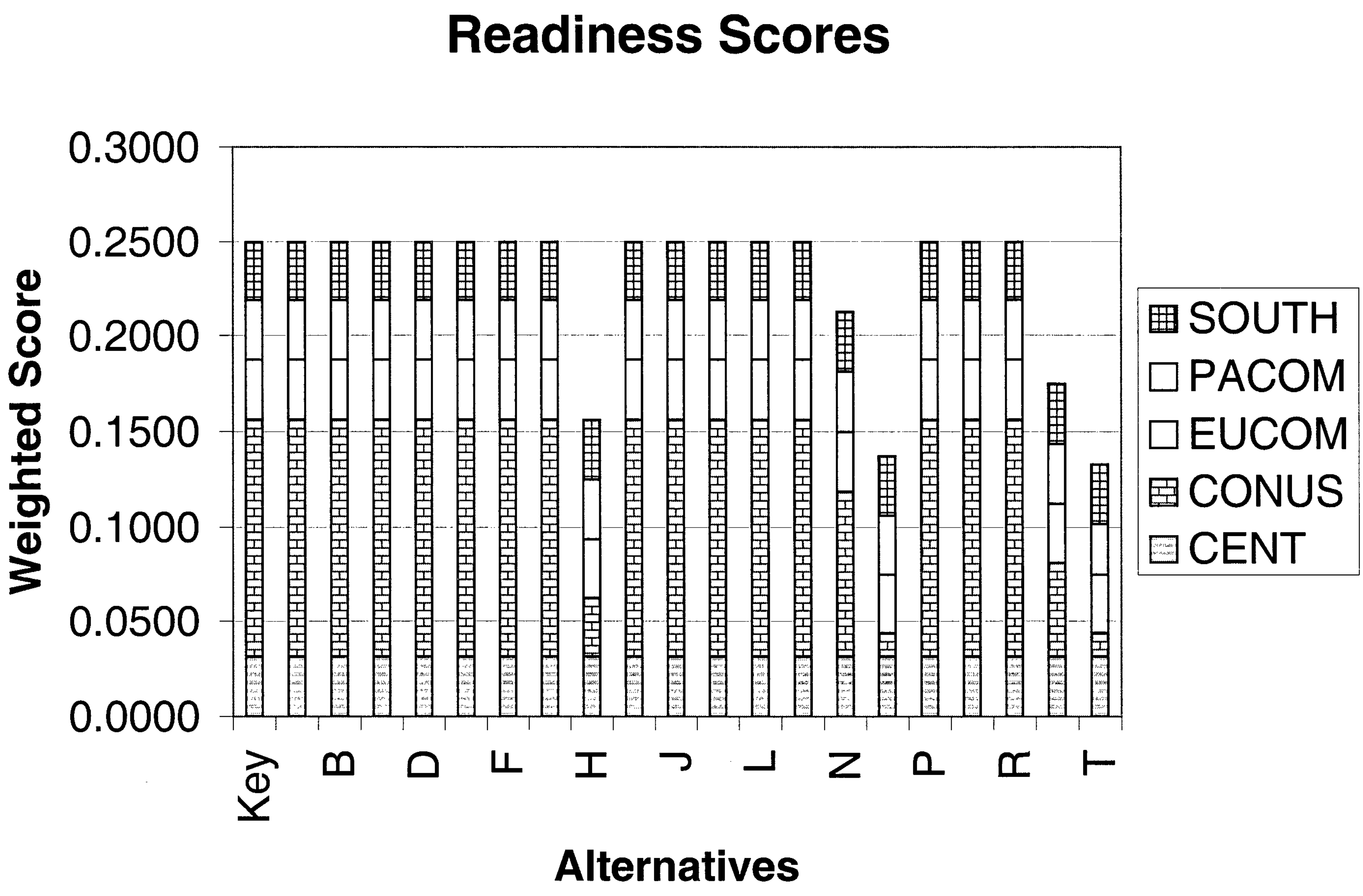
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
Key
B
D
F
H
J
L
N
P
R
T
Alternatives
SOUTH
PACOM
EUCOM
CONUS
CENT


Readiness Scores
Weighted Score
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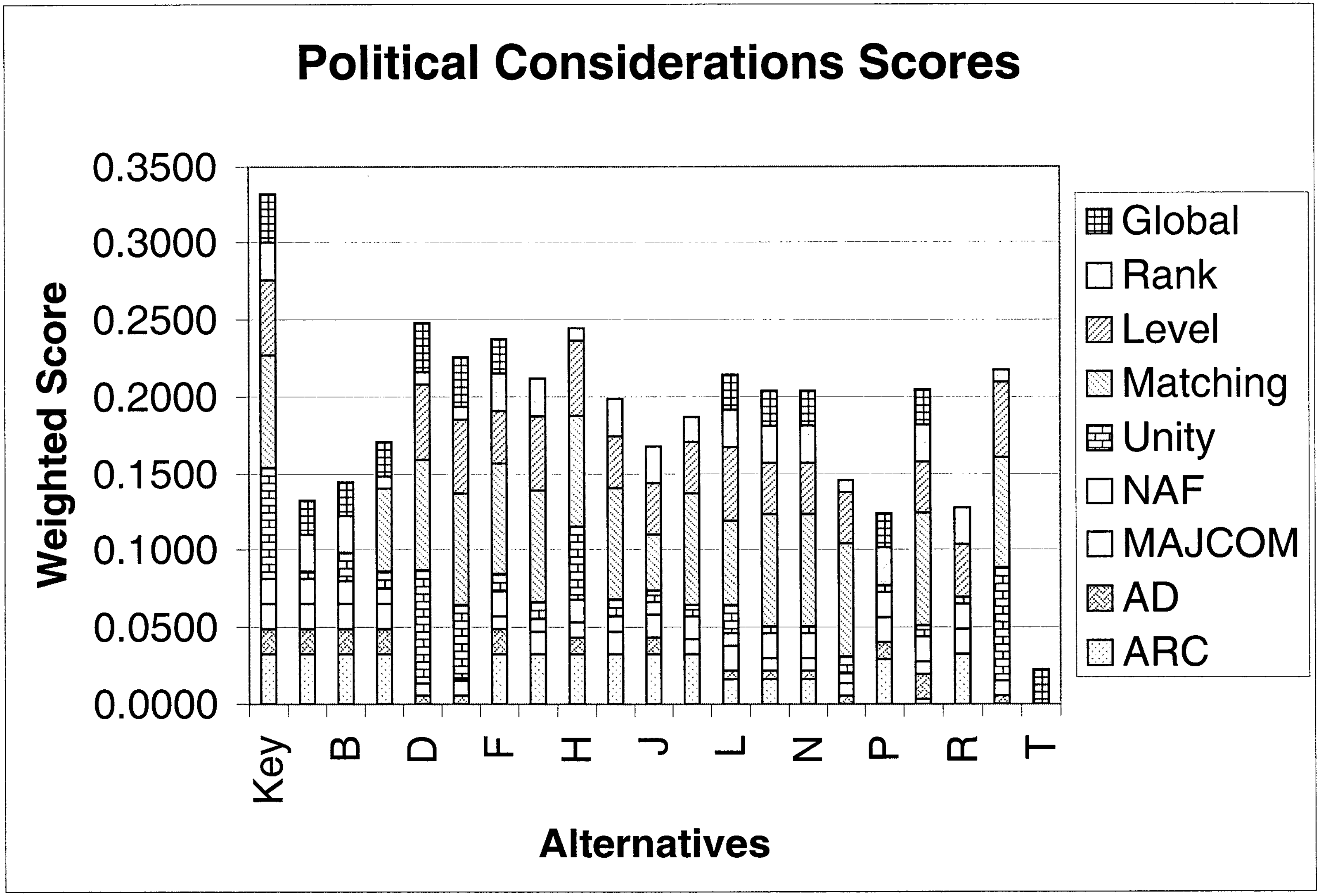
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
Key
B
D
F
H
J
L
N
P
R
T
Alternatives
SOUTH
PACOM
EUCOM
CONUS
CENT


Political Considerations Scores
Weighted Score
0.3500
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
Key
B
D
F
H
J
L
N
P
R
T
Alternatives
Global
Rank
Level
Matching
Unity
NAF
MAJCOM
AD
ARC

APPENDIX E: SENSITIVITY ANALYSIS

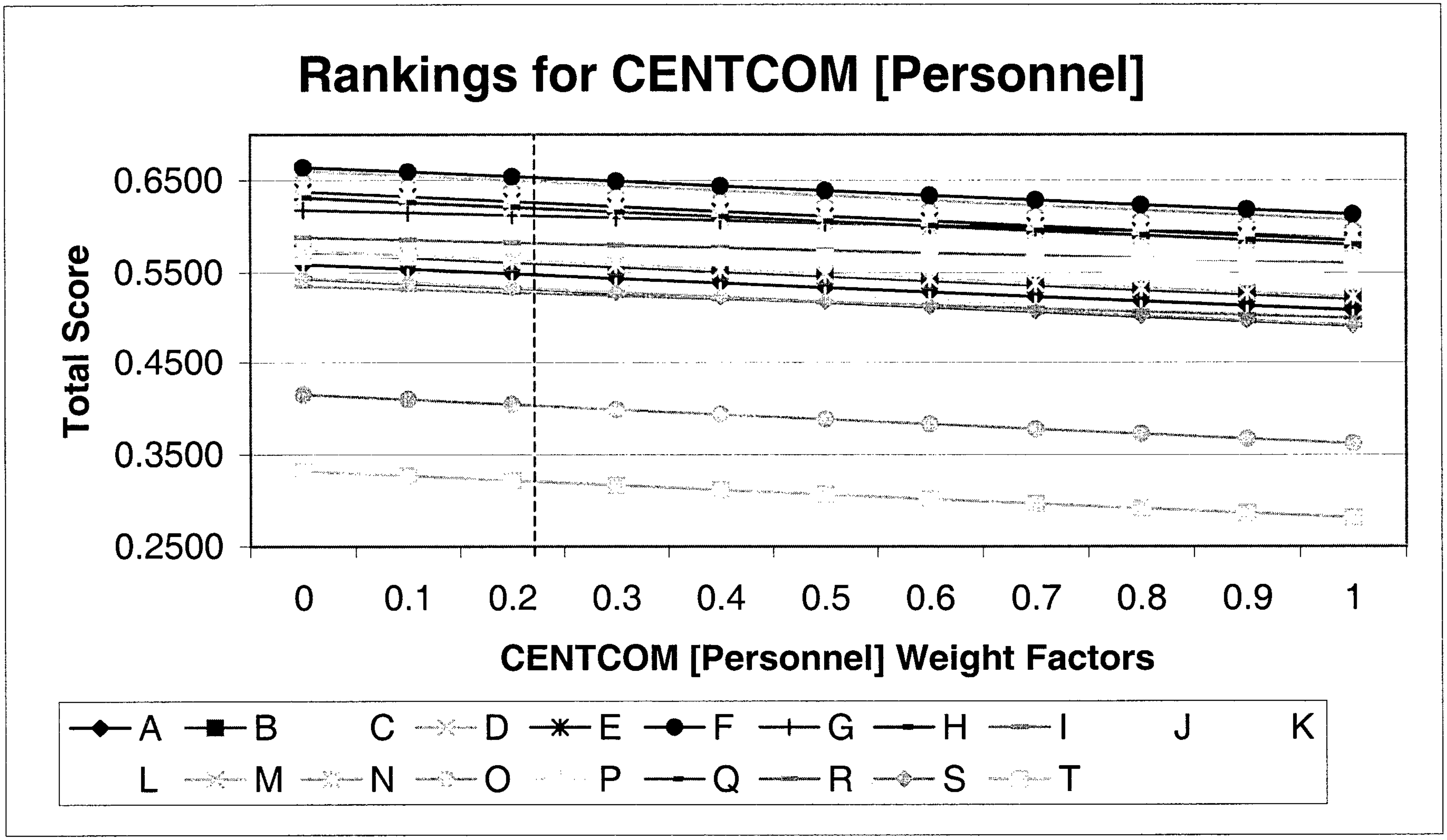
This section presents the sensitivity analysis used to identify variations in the preferred alternative as a result of fluctuations in the evaluation measure weights. Tables E.1 – E.20 show the adjusted evaluation measure weights as a result of increasing the overall weight of a specific evaluation measure from 0 to 1. In addition, these tables also show the overall score of each alternative as a result of these fluctuating weights. The bottom row of each table indicates the preferred alternative based upon the evaluation measure weights at each specified interval along the spectrum of possible weights, as indicated in the tables. Figures E.1 – E.20 illustrate how the overall scores for the alternatives changed over the entire range of fluctuating weights. To provide additional insight, the dotted line in each figure indicated the point associated with the weights assigned by the decision maker's representative. The method of conducting sensitivity analysis is described in more detail in the results and analysis chapter (Chapter 4), under "Sensitivity Analysis," p. 4-50.

There was no change to the preferred alternative for seven of the evaluation measures; that is, Alternative F remained dominant throughout the entire range of possible evaluation measure weights. However, the model did recommended different alternatives as a result of fluctuating weights in thirteen instances. These were described in detail in the results and analysis chapter (Chapter 4), under "Location of Personnel," p. 4-51; "Location of Vehicles and Equipment," p.4-54; and "Political Considerations," p. 4-58. The tables and figures depicting the sensitivity analysis for all twenty-four evaluation measures are contained here.

APPENDIX E

Tbl E.1 - Sensitivity Analysis for CENTCOM [Personnel]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
CENTCOM	0.0000	0.0091	0.0181	0.0272	0.0363	0.0454	0.0544	0.0635	0.0726	0.0816	0.0907
CONUS	0.0529	0.0476	0.0423	0.0370	0.0317	0.0265	0.0212	0.0159	0.0106	0.0053	0.0000
EUCOM	0.0076	0.0068	0.0060	0.0053	0.0045	0.0038	0.0030	0.0023	0.0015	0.0008	0.0000
PACOM	0.0227	0.0204	0.0181	0.0159	0.0136	0.0113	0.0091	0.0068	0.0045	0.0023	0.0000
SOUTHCOM	0.0076	0.0068	0.0060	0.0053	0.0045	0.0038	0.0030	0.0023	0.0015	0.0008	0.0000
Alternatives											
A	0.5589	0.5538	0.5488	0.5437	0.5386	0.5335	0.5284	0.5234	0.5183	0.5132	0.5081
B	0.5711	0.5661	0.5610	0.5559	0.5508	0.5457	0.5407	0.5356	0.5305	0.5254	0.5203
C	0.5975	0.5924	0.5873	0.5822	0.5772	0.5721	0.5670	0.5619	0.5568	0.5518	0.5467
D	0.6600	0.6547	0.6494	0.6441	0.6389	0.6336	0.6283	0.6230	0.6177	0.6124	0.6071
E	0.6378	0.6325	0.6272	0.6219	0.6166	0.6113	0.6060	0.6007	0.5954	0.5901	0.5848
F	0.6642	0.6591	0.6541	0.6490	0.6439	0.6388	0.6337	0.6287	0.6236	0.6185	0.6134
G	0.6179	0.6151	0.6123	0.6095	0.6067	0.6039	0.6011	0.5983	0.5955	0.5927	0.5899
H	0.5434	0.5381	0.5328	0.5275	0.5222	0.5169	0.5116	0.5063	0.5011	0.4958	0.4905
I	0.5883	0.5854	0.5826	0.5798	0.5770	0.5742	0.5714	0.5686	0.5658	0.5630	0.5602
J	0.5746	0.5716	0.5686	0.5656	0.5625	0.5595	0.5565	0.5535	0.5505	0.5475	0.5444
K	0.5682	0.5678	0.5674	0.5670	0.5666	0.5662	0.5658	0.5654	0.5650	0.5646	0.5642
L	0.6408	0.6357	0.6306	0.6255	0.6204	0.6154	0.6103	0.6052	0.6001	0.5950	0.5900
M	0.6306	0.6255	0.6204	0.6153	0.6103	0.6052	0.6001	0.5950	0.5899	0.5849	0.5798
N	0.5737	0.5686	0.5635	0.5585	0.5534	0.5483	0.5432	0.5381	0.5331	0.5280	0.5229
O	0.4149	0.4096	0.4043	0.3991	0.3938	0.3885	0.3832	0.3779	0.3726	0.3673	0.3620
P	0.5503	0.5452	0.5401	0.5350	0.5299	0.5249	0.5198	0.5147	0.5096	0.5045	0.4995
Q	0.6313	0.6262	0.6211	0.6161	0.6110	0.6059	0.6008	0.5957	0.5907	0.5856	0.5805
R	0.5350	0.5315	0.5279	0.5243	0.5207	0.5171	0.5135	0.5100	0.5064	0.5028	0.4992
S	0.5441	0.5388	0.5335	0.5282	0.5229	0.5176	0.5123	0.5070	0.5017	0.4964	0.4912
T	0.3321	0.3270	0.3219	0.3169	0.3118	0.3067	0.3016	0.2965	0.2915	0.2864	0.2813
Maximum Score	0.6642	0.6591	0.6541	0.6490	0.6439	0.6388	0.6337	0.6287	0.6236	0.6185	0.6134
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for CENTCOM [Personnel]
Total Score
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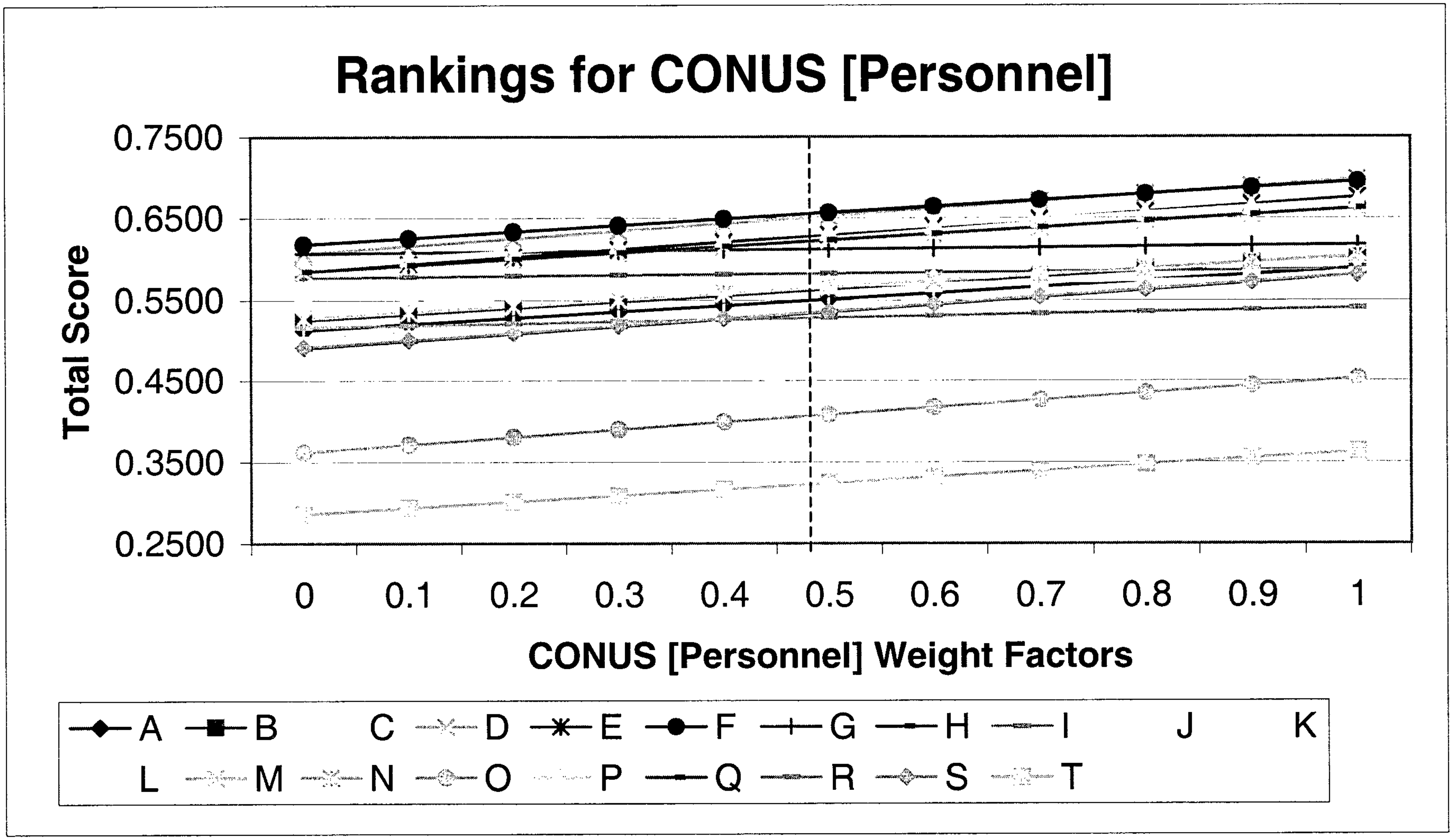
0.5500
0.4500
0.3500
0.2500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CENTCOM [Personnel] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

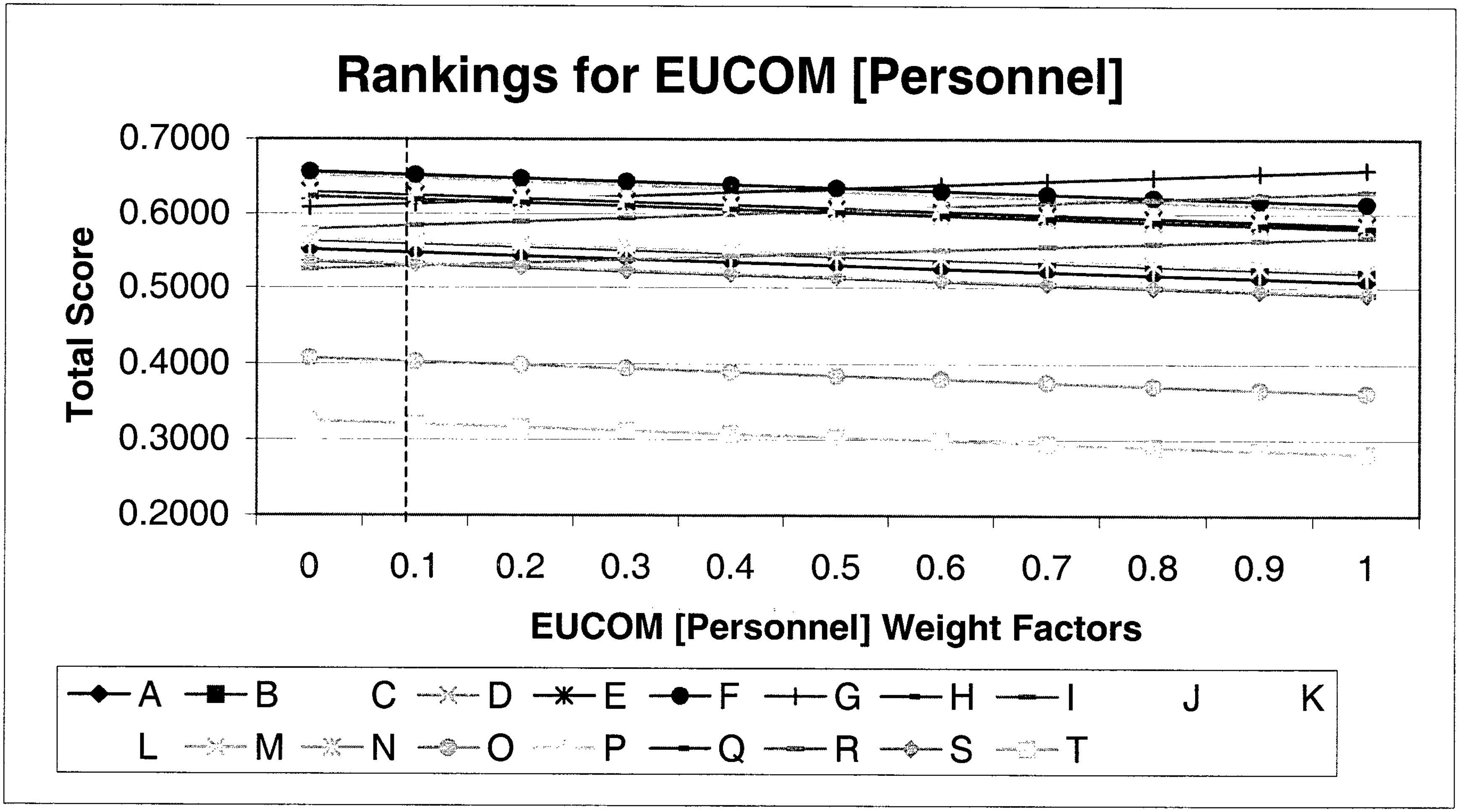
Tbl E.2 - Sensitivity Analysis for CONUS [Personnel]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
CONUS	0.0000	0.0091	0.0181	0.0272	0.0363	0.0454	0.0544	0.0635	0.0726	0.0816	0.0907
CENTCOM	0.0340	0.0306	0.0272	0.0238	0.0204	0.0170	0.0136	0.0102	0.0068	0.0034	0.0000
EUCOM	0.0113	0.0102	0.0091	0.0079	0.0068	0.0057	0.0045	0.0034	0.0023	0.0011	0.0000
PACOM	0.0340	0.0306	0.0272	0.0238	0.0204	0.0170	0.0136	0.0102	0.0068	0.0034	0.0000
SOUTHCOM	0.0113	0.0102	0.0091	0.0079	0.0068	0.0057	0.0045	0.0034	0.0023	0.0011	0.0000
Alternatives											
A	0.5129	0.5206	0.5283	0.5359	0.5436	0.5513	0.5590	0.5667	0.5744	0.5821	0.5898
B	0.5251	0.5328	0.5405	0.5482	0.5559	0.5635	0.5712	0.5789	0.5866	0.5943	0.6020
C	0.5514	0.5591	0.5668	0.5745	0.5822	0.5899	0.5976	0.6052	0.6129	0.6206	0.6283
D	0.6071	0.6162	0.6253	0.6343	0.6434	0.6525	0.6615	0.6706	0.6797	0.6887	0.6978
E	0.5848	0.5939	0.6030	0.6121	0.6211	0.6302	0.6393	0.6483	0.6574	0.6665	0.6756
F	0.6182	0.6259	0.6336	0.6412	0.6489	0.6566	0.6643	0.6720	0.6797	0.6874	0.6951
G	0.6073	0.6084	0.6094	0.6105	0.6116	0.6127	0.6137	0.6148	0.6159	0.6169	0.6180
H	0.4905	0.4995	0.5086	0.5177	0.5268	0.5358	0.5449	0.5540	0.5630	0.5721	0.5812
I	0.5777	0.5787	0.5798	0.5809	0.5819	0.5830	0.5841	0.5851	0.5862	0.5873	0.5884
J	0.5413	0.5471	0.5530	0.5588	0.5647	0.5705	0.5764	0.5822	0.5881	0.5939	0.5998
K	0.5576	0.5597	0.5618	0.5639	0.5660	0.5681	0.5702	0.5724	0.5745	0.5766	0.5787
L	0.5947	0.6024	0.6101	0.6178	0.6255	0.6332	0.6408	0.6485	0.6562	0.6639	0.6716
M	0.5845	0.5922	0.5999	0.6076	0.6153	0.6230	0.6307	0.6383	0.6460	0.6537	0.6614
N	0.5277	0.5353	0.5430	0.5507	0.5584	0.5661	0.5738	0.5815	0.5892	0.5968	0.6045
O	0.3620	0.3711	0.3802	0.3892	0.3983	0.4074	0.4164	0.4255	0.4346	0.4436	0.4527
P	0.5042	0.5119	0.5196	0.5273	0.5350	0.5427	0.5503	0.5580	0.5657	0.5734	0.5811
Q	0.5853	0.5930	0.6006	0.6083	0.6160	0.6237	0.6314	0.6391	0.6468	0.6545	0.6621
R	0.5164	0.5189	0.5213	0.5238	0.5262	0.5287	0.5311	0.5336	0.5360	0.5385	0.5409
S	0.4912	0.5002	0.5093	0.5184	0.5274	0.5365	0.5456	0.5547	0.5637	0.5728	0.5819
T	0.2861	0.2937	0.3014	0.3091	0.3168	0.3245	0.3322	0.3399	0.3476	0.3552	0.3629
Maximum Score	0.6182	0.6259	0.6336	0.6412	0.6489	0.6566	0.6643	0.6720	0.6797	0.6887	0.6978
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**D**	**D**


Rankings for CONUS [Personnel]
Total Score
0.7500
0.6500
0.5500
0.4500
0.3500
0.2500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CONUS [Personnel] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

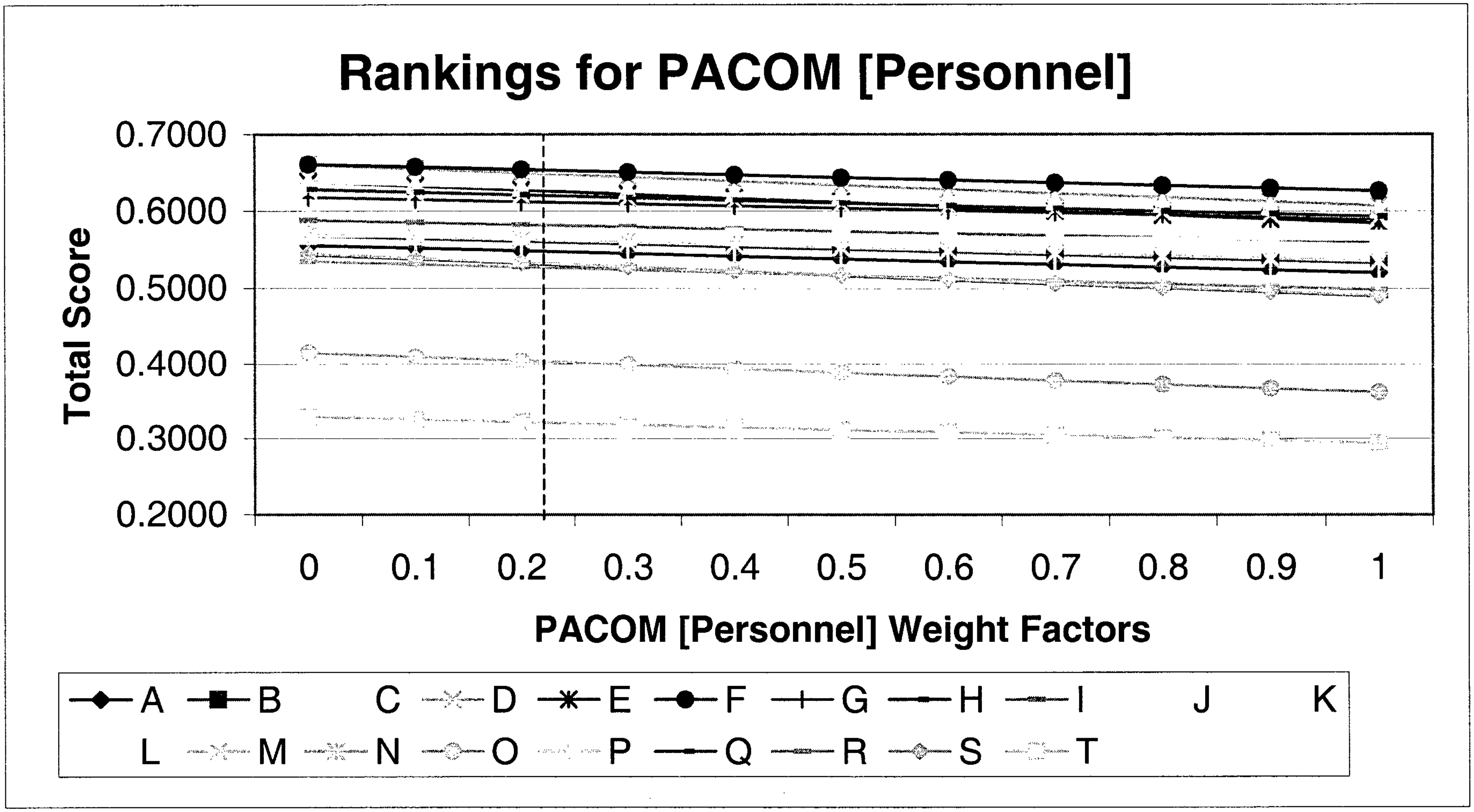
Tbl E.3 - Sensitivity Analysis for EUCOM [Personnel]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
EUCOM	0.0000	0.0091	0.0181	0.0272	0.0363	0.0454	0.0544	0.0635	0.0726	0.0816	0.0907
CENTCOM	0.0194	0.0175	0.0155	0.0136	0.0117	0.0097	0.0078	0.0058	0.0039	0.0019	0.0000
CONUS	0.0454	0.0408	0.0363	0.0317	0.0272	0.0227	0.0181	0.0136	0.0091	0.0045	0.0000
PACOM	0.0194	0.0175	0.0155	0.0136	0.0117	0.0097	0.0078	0.0058	0.0039	0.0019	0.0000
SOUTHCOM	0.0065	0.0058	0.0052	0.0045	0.0039	0.0032	0.0026	0.0019	0.0013	0.0006	0.0000
Alternatives											
A	0.5517	0.5473	0.5429	0.5386	0.5342	0.5299	0.5255	0.5212	0.5168	0.5125	0.5081
B	0.5639	0.5595	0.5552	0.5508	0.5465	0.5421	0.5378	0.5334	0.5290	0.5247	0.5203
C	0.5902	0.5859	0.5815	0.5772	0.5728	0.5684	0.5641	0.5597	0.5554	0.5510	0.5467
D	0.6525	0.6479	0.6434	0.6389	0.6343	0.6298	0.6253	0.6207	0.6162	0.6116	0.6071
E	0.6302	0.6257	0.6211	0.6166	0.6121	0.6075	0.6030	0.5985	0.5939	0.5894	0.5848
F	0.6570	0.6526	0.6482	0.6439	0.6395	0.6352	0.6308	0.6265	0.6221	0.6178	0.6134
G	0.6089	0.6140	0.6190	0.6241	0.6292	0.6342	0.6393	0.6444	0.6494	0.6545	0.6595
H	0.5358	0.5313	0.5268	0.5222	0.5177	0.5132	0.5086	0.5041	0.4995	0.4950	0.4905
I	0.5793	0.5843	0.5894	0.5945	0.5995	0.6046	0.6096	0.6147	0.6198	0.6248	0.6299
J	0.5712	0.5673	0.5633	0.5594	0.5554	0.5515	0.5475	0.5436	0.5396	0.5357	0.5317
K	0.5695	0.5664	0.5632	0.5600	0.5569	0.5537	0.5505	0.5474	0.5442	0.5410	0.5379
L	0.6335	0.6291	0.6248	0.6204	0.6161	0.6117	0.6074	0.6030	0.5987	0.5943	0.5900
M	0.6233	0.6190	0.6146	0.6103	0.6059	0.6015	0.5972	0.5928	0.5885	0.5841	0.5798
N	0.5664	0.5621	0.5577	0.5534	0.5490	0.5447	0.5403	0.5360	0.5316	0.5273	0.5229
O	0.4074	0.4028	0.3983	0.3938	0.3892	0.3847	0.3802	0.3756	0.3711	0.3665	0.3620
P	0.5430	0.5386	0.5343	0.5299	0.5256	0.5212	0.5169	0.5125	0.5082	0.5038	0.4995
Q	0.6240	0.6197	0.6153	0.6110	0.6066	0.6023	0.5979	0.5936	0.5892	0.5849	0.5805
R	0.5250	0.5293	0.5336	0.5379	0.5423	0.5466	0.5509	0.5552	0.5595	0.5638	0.5681
S	0.5365	0.5320	0.5274	0.5229	0.5184	0.5138	0.5093	0.5048	0.5002	0.4957	0.4912
T	0.3248	0.3205	0.3161	0.3118	0.3074	0.3031	0.2987	0.2944	0.2900	0.2856	0.2813
Maximum Score	0.6570	0.6526	0.6482	0.6439	0.6395	0.6352	0.6393	0.6444	0.6494	0.6545	0.6595
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**G**	**G**	**G**	**G**	**G**


Rankings for EUCOM [Personnel]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
EUCOM [Personnel] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

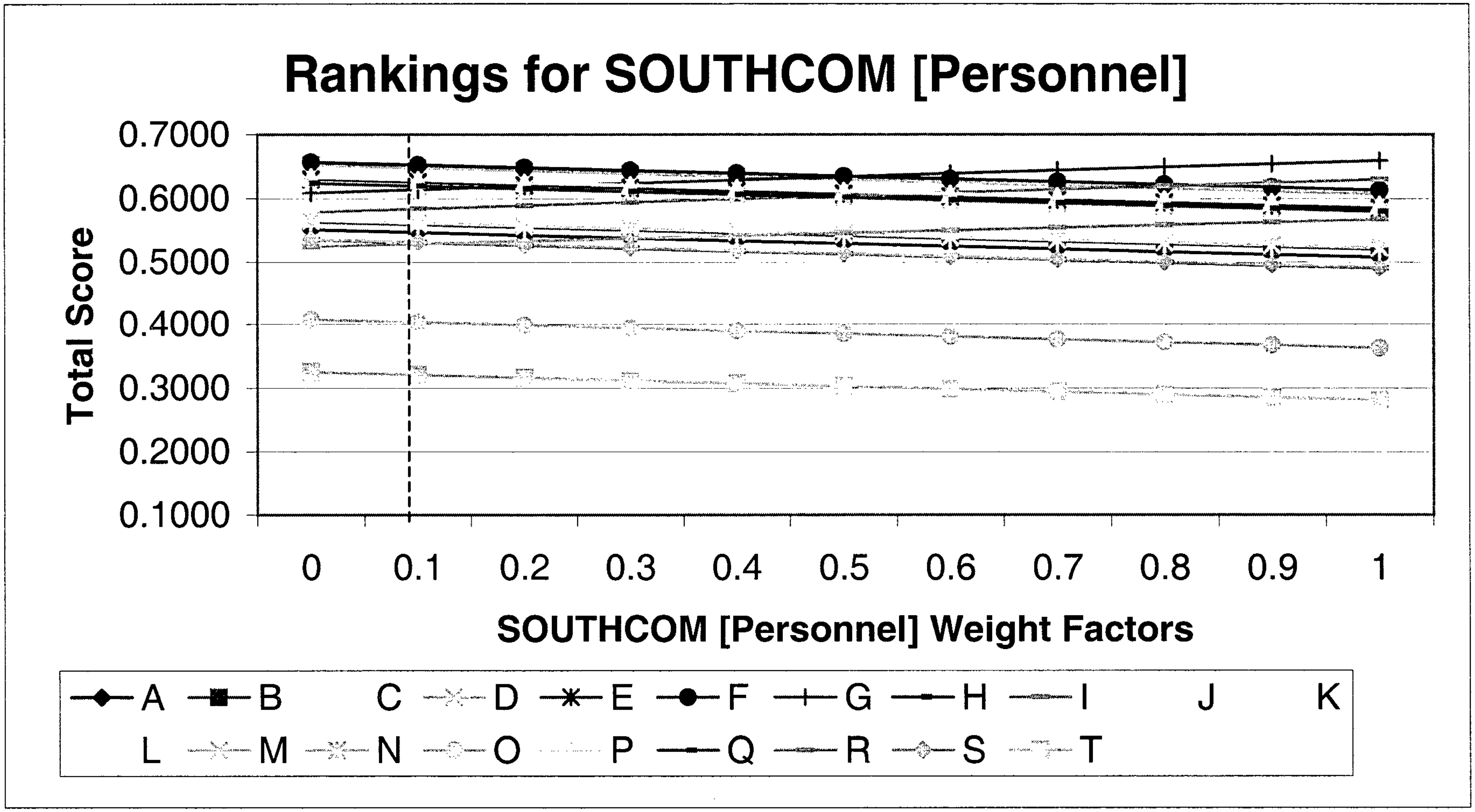
Tbl E.4 - Sensitivity Analysis for PACOM [Personnel]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
PACOM	0.0000	0.0091	0.0181	0.0272	0.0363	0.0454	0.0544	0.0635	0.0726	0.0816	0.0907
CENTCOM	0.0227	0.0204	0.0181	0.0159	0.0136	0.0113	0.0091	0.0068	0.0045	0.0023	0.0000
CONUS	0.0529	0.0476	0.0423	0.0370	0.0317	0.0265	0.0212	0.0159	0.0106	0.0053	0.0000
EUCOM	0.0076	0.0068	0.0060	0.0053	0.0045	0.0038	0.0030	0.0023	0.0015	0.0008	0.0000
SOUTHCOM	0.0076	0.0068	0.0060	0.0053	0.0045	0.0038	0.0030	0.0023	0.0015	0.0008	0.0000
Alternatives											
A	0.5557	0.5522	0.5488	0.5453	0.5418	0.5383	0.5348	0.5313	0.5278	0.5243	0.5208
B	0.5680	0.5645	0.5610	0.5575	0.5540	0.5505	0.5470	0.5435	0.5400	0.5365	0.5330
C	0.5943	0.5908	0.5873	0.5838	0.5803	0.5768	0.5733	0.5699	0.5664	0.5629	0.5594
D	0.6600	0.6547	0.6494	0.6441	0.6389	0.6336	0.6283	0.6230	0.6177	0.6124	0.6071
E	0.6378	0.6325	0.6272	0.6219	0.6166	0.6113	0.6060	0.6007	0.5954	0.5901	0.5848
F	0.6610	0.6575	0.6541	0.6506	0.6471	0.6436	0.6401	0.6366	0.6331	0.6296	0.6261
G	0.6179	0.6151	0.6123	0.6095	0.6067	0.6039	0.6011	0.5983	0.5955	0.5927	0.5899
H	0.5434	0.5381	0.5328	0.5275	0.5222	0.5169	0.5116	0.5063	0.5011	0.4958	0.4905
I	0.5883	0.5854	0.5826	0.5798	0.5770	0.5742	0.5714	0.5686	0.5658	0.5630	0.5602
J	0.5746	0.5716	0.5686	0.5656	0.5625	0.5595	0.5565	0.5535	0.5505	0.5475	0.5444
K	0.5682	0.5678	0.5674	0.5670	0.5666	0.5662	0.5658	0.5654	0.5650	0.5646	0.5642
L	0.6376	0.6341	0.6306	0.6271	0.6236	0.6201	0.6166	0.6131	0.6096	0.6062	0.6027
M	0.6274	0.6239	0.6204	0.6169	0.6134	0.6099	0.6064	0.6029	0.5995	0.5960	0.5925
N	0.5705	0.5670	0.5635	0.5600	0.5565	0.5531	0.5496	0.5461	0.5426	0.5391	0.5356
O	0.4149	0.4096	0.4043	0.3991	0.3938	0.3885	0.3832	0.3779	0.3726	0.3673	0.3620
P	0.5471	0.5436	0.5401	0.5366	0.5331	0.5296	0.5261	0.5226	0.5191	0.5156	0.5122
Q	0.6281	0.6246	0.6211	0.6177	0.6142	0.6107	0.6072	0.6037	0.6002	0.5967	0.5932
R	0.5350	0.5315	0.5279	0.5243	0.5207	0.5171	0.5135	0.5100	0.5064	0.5028	0.4992
S	0.5441	0.5388	0.5335	0.5282	0.5229	0.5176	0.5123	0.5070	0.5017	0.4964	0.4912
T	0.3289	0.3254	0.3219	0.3184	0.3149	0.3115	0.3080	0.3045	0.3010	0.2975	0.2940
Maximum Score	0.6610	0.6575	0.6541	0.6506	0.6471	0.6436	0.6401	0.6366	0.6331	0.6296	0.6261
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for PACOM [Personnel]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
PACOM [Personnel] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

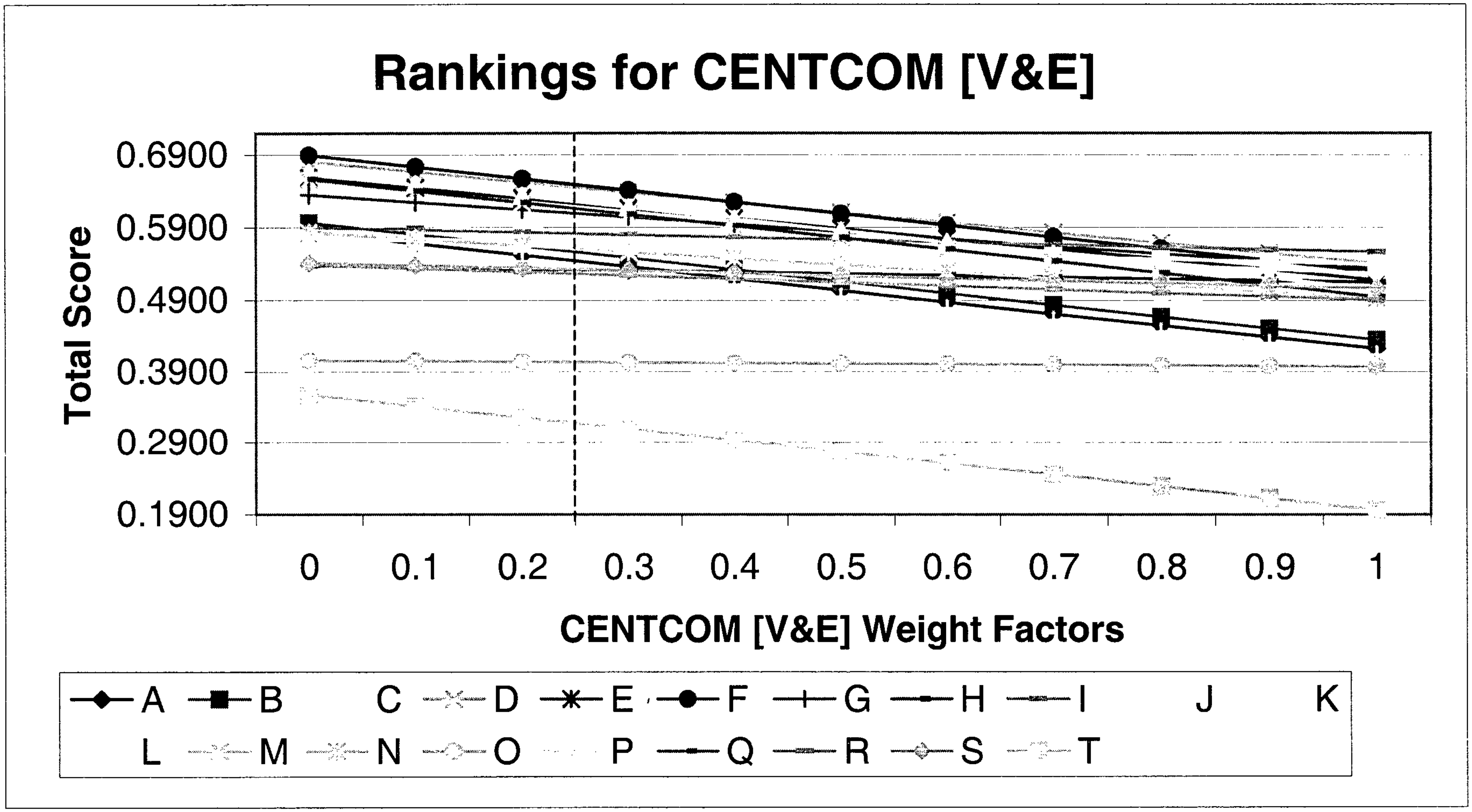
Tbl E.5 - Sensitivity Analysis for SOUTHCOM [Personnel]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
SOUTHCOM	0.0000	0.0091	0.0181	0.0272	0.0363	0.0454	0.0544	0.0635	0.0726	0.0816	0.0907
CENTCOM	0.0194	0.0175	0.0155	0.0136	0.0117	0.0097	0.0078	0.0058	0.0039	0.0019	0.0000
CONUS	0.0454	0.0408	0.0363	0.0317	0.0272	0.0227	0.0181	0.0136	0.0091	0.0045	0.0000
EUCOM	0.0065	0.0058	0.0052	0.0045	0.0039	0.0032	0.0026	0.0019	0.0013	0.0006	0.0000
PACOM	0.0194	0.0175	0.0155	0.0136	0.0117	0.0097	0.0078	0.0058	0.0039	0.0019	0.0000
Alternatives											
A	0.5517	0.5473	0.5429	0.5386	0.5342	0.5299	0.5255	0.5212	0.5168	0.5125	0.5081
B	0.5639	0.5595	0.5552	0.5508	0.5465	0.5421	0.5378	0.5334	0.5290	0.5247	0.5203
C	0.5902	0.5859	0.5815	0.5772	0.5728	0.5684	0.5641	0.5597	0.5554	0.5510	0.5467
D	0.6525	0.6479	0.6434	0.6389	0.6343	0.6298	0.6253	0.6207	0.6162	0.6116	0.6071
E	0.6302	0.6257	0.6211	0.6166	0.6121	0.6075	0.6030	0.5985	0.5939	0.5894	0.5848
F	0.6570	0.6526	0.6482	0.6439	0.6395	0.6352	0.6308	0.6265	0.6221	0.6178	0.6134
G	0.6089	0.6140	0.6190	0.6241	0.6292	0.6342	0.6393	0.6444	0.6494	0.6545	0.6595
H	0.5358	0.5313	0.5268	0.5222	0.5177	0.5132	0.5086	0.5041	0.4995	0.4950	0.4905
I	0.5793	0.5843	0.5894	0.5945	0.5995	0.6046	0.6096	0.6147	0.6198	0.6248	0.6299
J	0.5712	0.5673	0.5633	0.5594	0.5554	0.5515	0.5475	0.5436	0.5396	0.5357	0.5317
K	0.5695	0.5664	0.5632	0.5600	0.5569	0.5537	0.5505	0.5474	0.5442	0.5410	0.5379
L	0.6335	0.6291	0.6248	0.6204	0.6161	0.6117	0.6074	0.6030	0.5987	0.5943	0.5900
M	0.6233	0.6190	0.6146	0.6103	0.6059	0.6015	0.5972	0.5928	0.5885	0.5841	0.5798
N	0.5664	0.5621	0.5577	0.5534	0.5490	0.5447	0.5403	0.5360	0.5316	0.5273	0.5229
O	0.4074	0.4028	0.3983	0.3938	0.3892	0.3847	0.3802	0.3756	0.3711	0.3665	0.3620
P	0.5430	0.5386	0.5343	0.5299	0.5256	0.5212	0.5169	0.5125	0.5082	0.5038	0.4995
Q	0.6240	0.6197	0.6153	0.6110	0.6066	0.6023	0.5979	0.5936	0.5892	0.5849	0.5805
R	0.5250	0.5293	0.5336	0.5379	0.5423	0.5466	0.5509	0.5552	0.5595	0.5638	0.5681
S	0.5365	0.5320	0.5274	0.5229	0.5184	0.5138	0.5093	0.5048	0.5002	0.4957	0.4912
T	0.3248	0.3205	0.3161	0.3118	0.3074	0.3031	0.2987	0.2944	0.2900	0.2856	0.2813
Maximum Score	0.6570	0.6526	0.6482	0.6439	0.6395	0.6352	0.6393	0.6444	0.6494	0.6545	0.6595
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**G**	**G**	**G**	**G**	**G**


Rankings for SOUTHCOM [Personnel]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
SOUTHCOM [Personnel] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

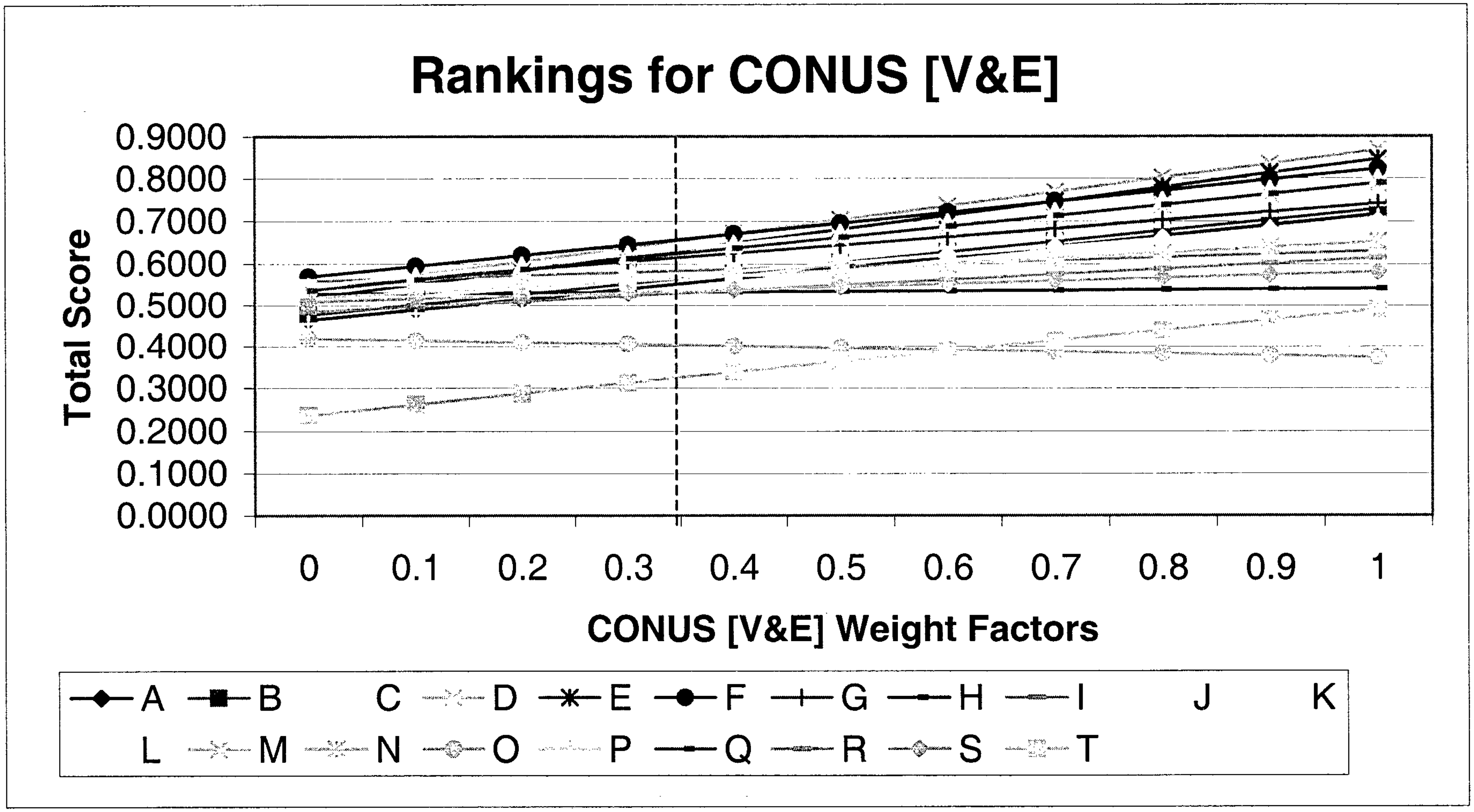
Tbl E.6 - Sensitivity Analysis for CENTCOM [Vehicles and Equipment]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
CENTCOM	0.0000	0.0327	0.0655	0.0982	0.1309	0.1636	0.1964	0.2291	0.2618	0.2946	0.3273
CONUS	0.1403	0.1262	0.1122	0.0982	0.0842	0.0701	0.0561	0.0421	0.0281	0.0140	0.0000
EUCOM	0.0312	0.0281	0.0249	0.0218	0.0187	0.0156	0.0125	0.0094	0.0062	0.0031	0.0000
PACOM	0.0935	0.0842	0.0748	0.0655	0.0561	0.0468	0.0374	0.0281	0.0187	0.0094	0.0000
SOUTHCOM	0.0623	0.0561	0.0499	0.0436	0.0374	0.0312	0.0249	0.0187	0.0125	0.0062	0.0000
Alternatives											
A	0.5844	0.5683	0.5521	0.5360	0.5199	0.5037	0.4876	0.4714	0.4553	0.4391	0.4230
B	0.5967	0.5805	0.5644	0.5482	0.5321	0.5159	0.4998	0.4836	0.4675	0.4513	0.4352
C	0.6230	0.6069	0.5907	0.5746	0.5584	0.5423	0.5261	0.5100	0.4938	0.4777	0.4615
D	0.6807	0.6666	0.6526	0.6386	0.6246	0.6105	0.5965	0.5825	0.5684	0.5544	0.5404
E	0.6584	0.6444	0.6303	0.6163	0.6023	0.5883	0.5742	0.5602	0.5462	0.5322	0.5181
F	0.6897	0.6736	0.6575	0.6413	0.6252	0.6090	0.5929	0.5767	0.5606	0.5444	0.5283
G	0.6349	0.6247	0.6145	0.6043	0.5942	0.5840	0.5738	0.5636	0.5534	0.5432	0.5330
H	0.5376	0.5353	0.5331	0.5308	0.5286	0.5263	0.5241	0.5218	0.5196	0.5174	0.5151
I	0.5902	0.5868	0.5834	0.5800	0.5765	0.5731	0.5697	0.5663	0.5629	0.5595	0.5561
J	0.5806	0.5752	0.5698	0.5645	0.5591	0.5537	0.5483	0.5430	0.5376	0.5322	0.5268
K	0.5754	0.5717	0.5681	0.5644	0.5607	0.5571	0.5534	0.5497	0.5461	0.5424	0.5388
L	0.6663	0.6501	0.6340	0.6179	0.6017	0.5856	0.5694	0.5533	0.5371	0.5210	0.5048
M	0.6561	0.6400	0.6238	0.6077	0.5915	0.5754	0.5592	0.5431	0.5269	0.5108	0.4946
N	0.5834	0.5744	0.5653	0.5563	0.5473	0.5383	0.5292	0.5202	0.5112	0.5022	0.4931
O	0.4059	0.4051	0.4043	0.4035	0.4026	0.4018	0.4010	0.4002	0.3993	0.3985	0.3977
P	0.5758	0.5596	0.5435	0.5273	0.5112	0.4951	0.4789	0.4628	0.4466	0.4305	0.4143
Q	0.6568	0.6407	0.6245	0.6084	0.5923	0.5761	0.5600	0.5438	0.5277	0.5115	0.4954
R	0.5384	0.5336	0.5289	0.5242	0.5194	0.5147	0.5099	0.5052	0.5005	0.4957	0.4910
S	0.5409	0.5375	0.5341	0.5307	0.5273	0.5239	0.5205	0.5171	0.5136	0.5102	0.5068
T	0.3576	0.3415	0.3253	0.3092	0.2930	0.2769	0.2607	0.2446	0.2284	0.2123	0.1962
Maximum Score	0.6897	0.6736	0.6575	0.6413	0.6252	0.6105	0.5965	0.5825	0.5684	0.5595	0.5561
Recommend	**F**	**F**	**F**	**F**	**F**	**D**	**D**	**D**	**D**	**I**	**I**


Rankings for CENTCOM [V&E]
Total Score
0.6900
0.5900
0.4900
0.3900
0.2900
0.1900
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CENTCOM [V&E] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

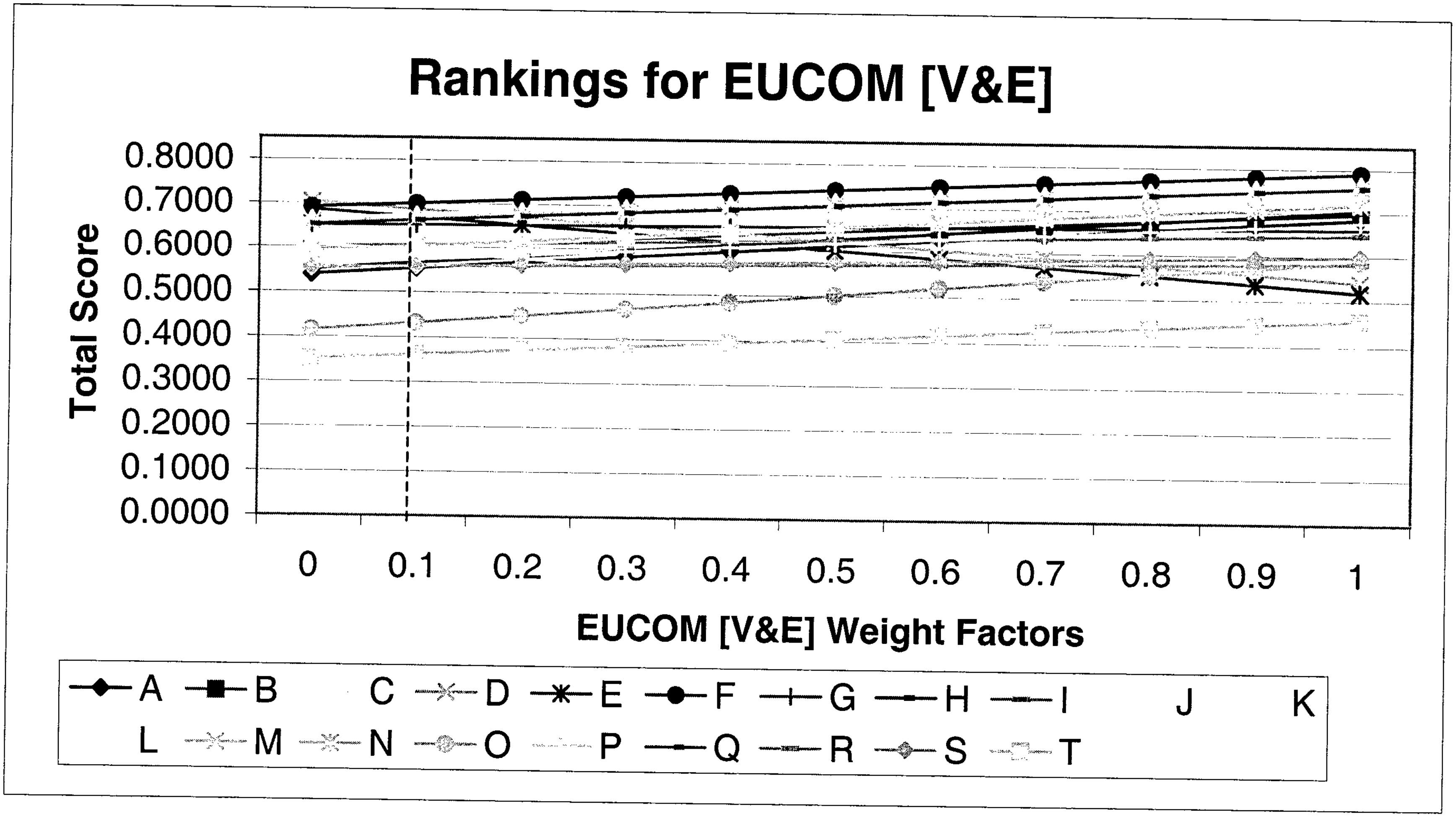
Tbl E.7 - Sensitivity Analysis for CONUS [Vehicles and Equipment]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
CONUS	0.0000	0.0327	0.0655	0.0982	0.1309	0.1636	0.1964	0.2291	0.2618	0.2946	0.3273
CENTCOM	0.1091	0.0982	0.0873	0.0764	0.0655	0.0545	0.0436	0.0327	0.0218	0.0109	0.0000
EUCOM	0.0364	0.0327	0.0291	0.0255	0.0218	0.0182	0.0145	0.0109	0.0073	0.0036	0.0000
PACOM	0.1091	0.0982	0.0873	0.0764	0.0655	0.0545	0.0436	0.0327	0.0218	0.0109	0.0000
SOUTHCOM	0.0727	0.0655	0.0582	0.0509	0.0436	0.0364	0.0291	0.0218	0.0145	0.0073	0.0000
Alternatives											
A	0.4641	0.4894	0.5148	0.5401	0.5655	0.5908	0.6162	0.6415	0.6668	0.6922	0.7175
B	0.4763	0.5016	0.5270	0.5523	0.5777	0.6030	0.6284	0.6537	0.6791	0.7044	0.7298
C	0.5026	0.5280	0.5533	0.5787	0.6040	0.6294	0.6547	0.6801	0.7054	0.7308	0.7561
D	0.5404	0.5731	0.6058	0.6386	0.6713	0.7040	0.7368	0.7695	0.8022	0.8350	0.8677
E	0.5181	0.5509	0.5836	0.6163	0.6490	0.6818	0.7145	0.7472	0.7800	0.8127	0.8454
F	0.5694	0.5947	0.6201	0.6454	0.6708	0.6961	0.7215	0.7468	0.7721	0.7975	0.8228
G	0.5472	0.5667	0.5862	0.6058	0.6253	0.6448	0.6644	0.6839	0.7034	0.7229	0.7425
H	0.5282	0.5295	0.5308	0.5321	0.5334	0.5348	0.5361	0.5374	0.5387	0.5400	0.5413
I	0.5582	0.5656	0.5729	0.5802	0.5875	0.5948	0.6021	0.6094	0.6167	0.6240	0.6313
J	0.5028	0.5226	0.5423	0.5621	0.5818	0.6016	0.6213	0.6410	0.6608	0.6805	0.7003
K	0.5438	0.5509	0.5579	0.5649	0.5719	0.5789	0.5860	0.5930	0.6000	0.6070	0.6140
L	0.5459	0.5713	0.5966	0.6220	0.6473	0.6727	0.6980	0.7233	0.7487	0.7740	0.7994
M	0.5357	0.5611	0.5864	0.6118	0.6371	0.6625	0.6878	0.7132	0.7385	0.7639	0.7892
N	0.5182	0.5318	0.5453	0.5588	0.5723	0.5859	0.5994	0.6129	0.6265	0.6400	0.6535
O	0.4188	0.4144	0.4100	0.4056	0.4012	0.3968	0.3924	0.3880	0.3836	0.3792	0.3748
P	0.4554	0.4808	0.5061	0.5315	0.5568	0.5821	0.6075	0.6328	0.6582	0.6835	0.7089
Q	0.5365	0.5618	0.5872	0.6125	0.6379	0.6632	0.6885	0.7139	0.7392	0.7646	0.7899
R	0.4841	0.4972	0.5103	0.5235	0.5366	0.5497	0.5628	0.5760	0.5891	0.6022	0.6154
S	0.5090	0.5163	0.5236	0.5309	0.5382	0.5455	0.5529	0.5602	0.5675	0.5748	0.5821
T	0.2372	0.2626	0.2879	0.3133	0.3386	0.3640	0.3893	0.4147	0.4400	0.4654	0.4907
Maximum Score	0.5694	0.5947	0.6201	0.6454	0.6713	0.7040	0.7368	0.7695	0.8022	0.8350	0.8677
Recommend	**F**	**F**	**F**	**F**	**D**	**D**	**D**	**D**	**D**	**D**	**D**


Rankings for CONUS [V&E]
Total Score
0.9000
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CONUS [V&E] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

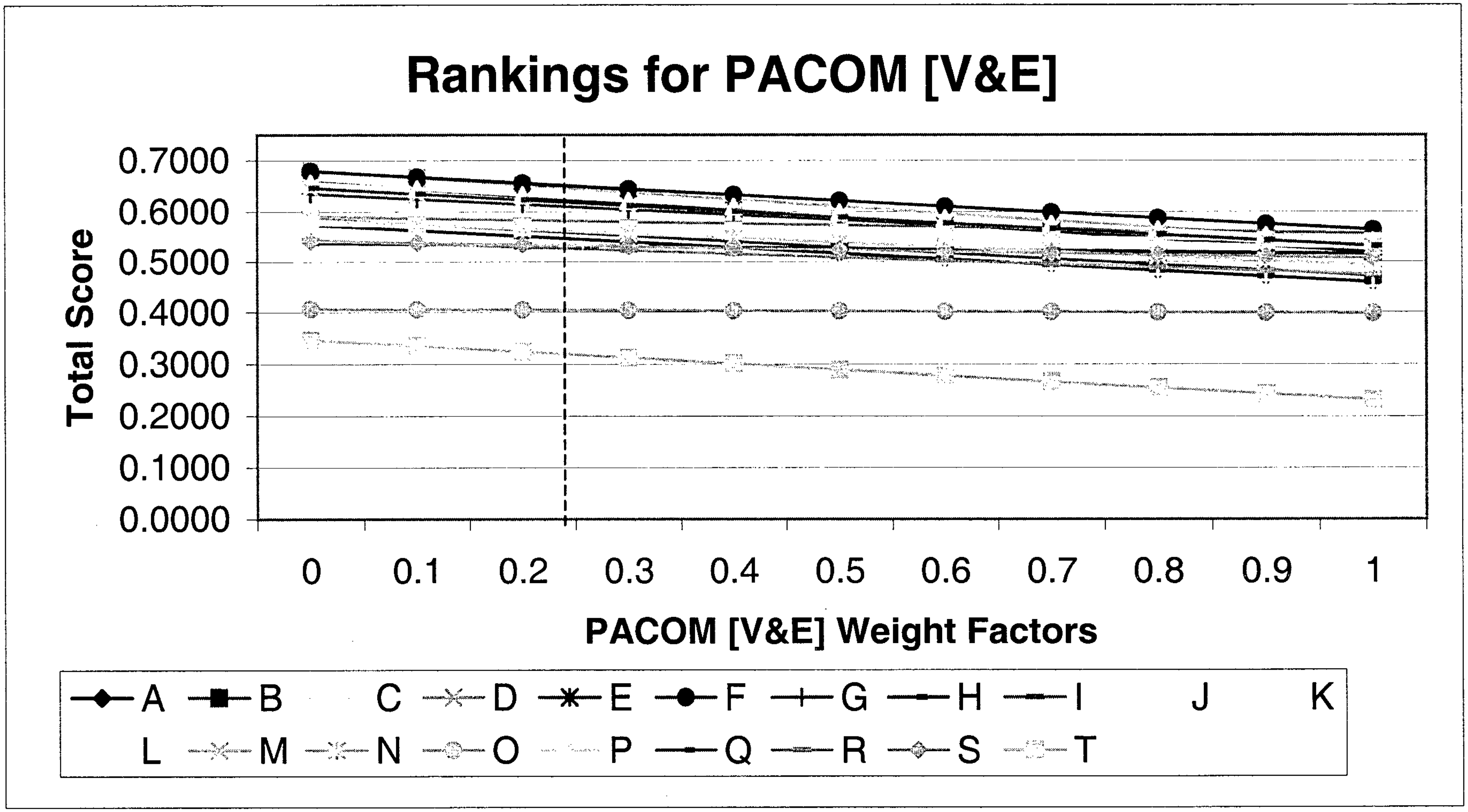
Tbl E.8 - Sensitivity Analysis for EUCOM [Vehicles and Equipment]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
EUCOM	0.0000	0.0327	0.0655	0.0982	0.1309	0.1636	0.1964	0.2291	0.2618	0.2946	0.3273
CENTCOM	0.0786	0.0707	0.0628	0.0550	0.0471	0.0393	0.0314	0.0236	0.0157	0.0079	0.0000
CONUS	0.1178	0.1060	0.0943	0.0825	0.0707	0.0589	0.0471	0.0353	0.0236	0.0118	0.0000
PACOM	0.0786	0.0707	0.0628	0.0550	0.0471	0.0393	0.0314	0.0236	0.0157	0.0079	0.0000
SOUTHCOM	0.0524	0.0471	0.0419	0.0367	0.0314	0.0262	0.0209	0.0157	0.0105	0.0052	0.0000
Alternatives											
A	0.5377	0.5524	0.5671	0.5818	0.5965	0.6112	0.6260	0.6407	0.6554	0.6701	0.6848
B	0.5918	0.6023	0.6128	0.6234	0.6339	0.6444	0.6549	0.6655	0.6760	0.6865	0.6970
C	0.6191	0.6295	0.6399	0.6504	0.6608	0.6712	0.6817	0.6921	0.7025	0.7129	0.7234
D	0.7032	0.6869	0.6706	0.6543	0.6380	0.6218	0.6055	0.5892	0.5729	0.5567	0.5404
E	0.6857	0.6690	0.6522	0.6354	0.6187	0.6019	0.5852	0.5684	0.5516	0.5349	0.5181
F	0.6910	0.7009	0.7108	0.7207	0.7306	0.7405	0.7505	0.7604	0.7703	0.7802	0.7901
G	0.6499	0.6510	0.6521	0.6532	0.6542	0.6553	0.6564	0.6574	0.6585	0.6596	0.6606
H	0.5489	0.5645	0.5801	0.5957	0.6113	0.6269	0.6425	0.6581	0.6737	0.6893	0.7049
I	0.6007	0.6054	0.6101	0.6148	0.6195	0.6242	0.6289	0.6336	0.6383	0.6430	0.6477
J	0.6056	0.5905	0.5754	0.5603	0.5453	0.5302	0.5151	0.5000	0.4850	0.4699	0.4548
K	0.5810	0.5958	0.6105	0.6253	0.6400	0.6548	0.6696	0.6843	0.6991	0.7138	0.7286
L	0.6640	0.6743	0.6845	0.6948	0.7051	0.7153	0.7256	0.7359	0.7461	0.7564	0.7667
M	0.6577	0.6675	0.6774	0.6873	0.6972	0.7071	0.7169	0.7268	0.7367	0.7466	0.7565
N	0.5898	0.6027	0.6156	0.6285	0.6414	0.6544	0.6673	0.6802	0.6931	0.7061	0.7190
O	0.4152	0.4324	0.4497	0.4669	0.4841	0.5014	0.5186	0.5358	0.5530	0.5703	0.5875
P	0.5595	0.5712	0.5828	0.5945	0.6062	0.6178	0.6295	0.6412	0.6528	0.6645	0.6762
Q	0.6513	0.6619	0.6725	0.6831	0.6937	0.7042	0.7148	0.7254	0.7360	0.7466	0.7572
R	0.5538	0.5567	0.5595	0.5624	0.5653	0.5682	0.5711	0.5740	0.5769	0.5797	0.5826
S	0.5515	0.5562	0.5609	0.5656	0.5703	0.5750	0.5797	0.5844	0.5891	0.5938	0.5985
T	0.3515	0.3621	0.3728	0.3834	0.3941	0.4047	0.4154	0.4260	0.4367	0.4473	0.4580
Maximum Score	0.7032	0.7009	0.7108	0.7207	0.7306	0.7405	0.7505	0.7604	0.7703	0.7802	0.7901
Recommend	**D**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for EUCOM [V&E]
Total Score
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
EUCOM [V&E] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

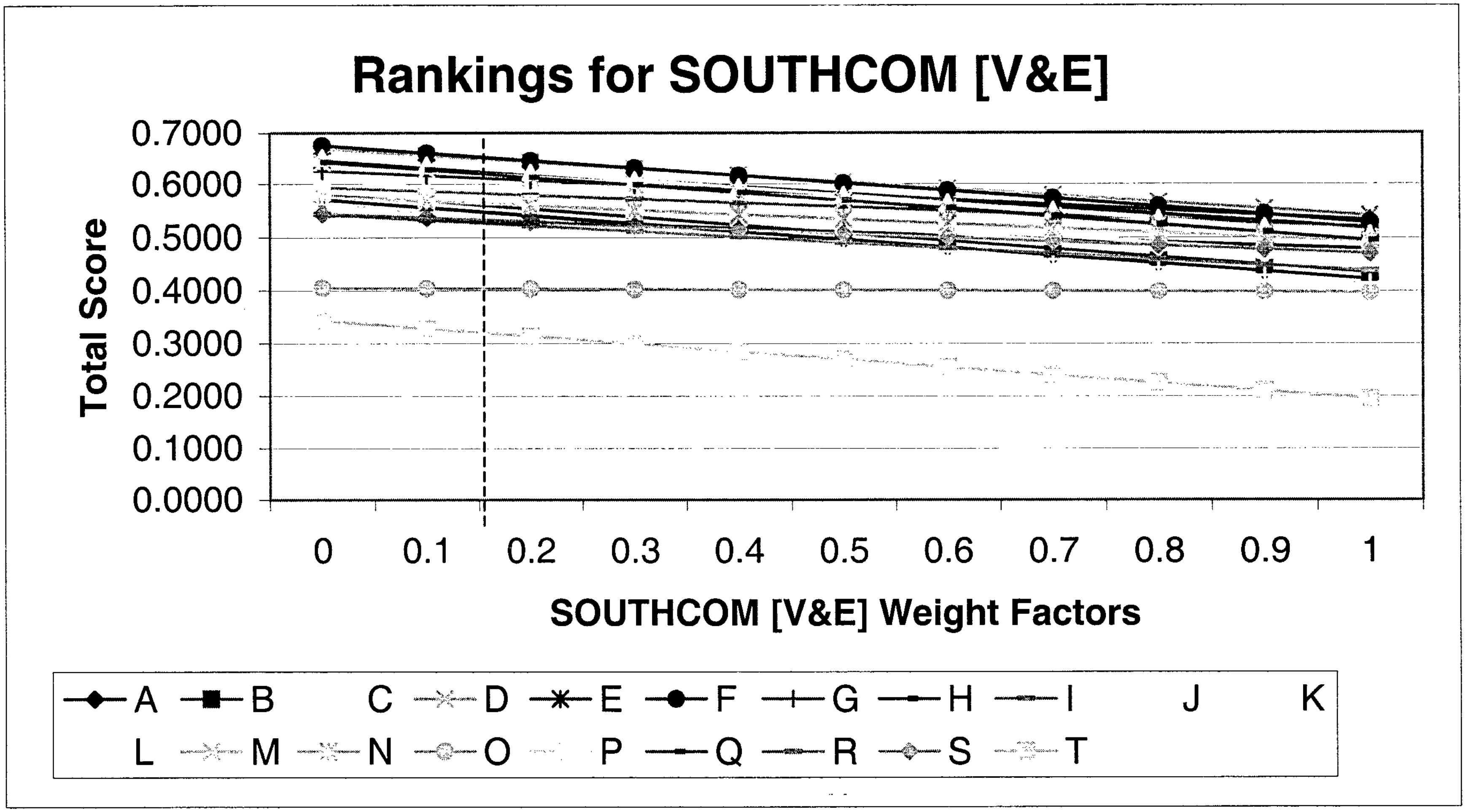
Tbl E.9 - Sensitivity Analysis for PACOM [Vehicles and Equipment]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
PACOM	0.0000	0.0327	0.0655	0.0982	0.1309	0.1636	0.1964	0.2291	0.2618	0.2946	0.3273
CENTCOM	0.0935	0.0842	0.0748	0.0655	0.0561	0.0468	0.0374	0.0281	0.0187	0.0094	0.0000
CONUS	0.1403	0.1262	0.1122	0.0982	0.0842	0.0701	0.0561	0.0421	0.0281	0.0140	0.0000
EUCOM	0.0312	0.0281	0.0249	0.0218	0.0187	0.0156	0.0125	0.0094	0.0062	0.0031	0.0000
SOUTHCOM	0.0623	0.0561	0.0499	0.0436	0.0374	0.0312	0.0249	0.0187	0.0125	0.0062	0.0000
Alternatives											
A	0.5742	0.5626	0.5511	0.5396	0.5281	0.5166	0.5051	0.4935	0.4820	0.4705	0.4590
B	0.5864	0.5749	0.5633	0.5518	0.5403	0.5288	0.5173	0.5058	0.4942	0.4827	0.4712
C	0.6127	0.6012	0.5897	0.5782	0.5666	0.5551	0.5436	0.5321	0.5206	0.5091	0.4975
D	0.6807	0.6666	0.6526	0.6386	0.6246	0.6105	0.5965	0.5825	0.5684	0.5544	0.5404
E	0.6584	0.6444	0.6303	0.6163	0.6023	0.5883	0.5742	0.5602	0.5462	0.5322	0.5181
F	0.6795	0.6679	0.6564	0.6449	0.6334	0.6219	0.6104	0.5988	0.5873	0.5758	0.5643
G	0.6349	0.6247	0.6145	0.6043	0.5942	0.5840	0.5738	0.5636	0.5534	0.5432	0.5330
H	0.5376	0.5353	0.5331	0.5308	0.5286	0.5263	0.5241	0.5218	0.5196	0.5174	0.5151
I	0.5902	0.5868	0.5834	0.5800	0.5765	0.5731	0.5697	0.5663	0.5629	0.5595	0.5561
J	0.5806	0.5752	0.5698	0.5645	0.5591	0.5537	0.5483	0.5430	0.5376	0.5322	0.5268
K	0.5754	0.5717	0.5681	0.5644	0.5607	0.5571	0.5534	0.5497	0.5461	0.5424	0.5388
L	0.6560	0.6445	0.6330	0.6215	0.6099	0.5984	0.5869	0.5754	0.5639	0.5523	0.5408
M	0.6458	0.6343	0.6228	0.6113	0.5997	0.5882	0.5767	0.5652	0.5537	0.5422	0.5306
N	0.5834	0.5744	0.5653	0.5563	0.5473	0.5383	0.5292	0.5202	0.5112	0.5022	0.4931
O	0.4059	0.4051	0.4043	0.4035	0.4026	0.4018	0.4010	0.4002	0.3993	0.3985	0.3977
P	0.5655	0.5540	0.5425	0.5309	0.5194	0.5079	0.4964	0.4849	0.4734	0.4618	0.4503
Q	0.6466	0.6350	0.6235	0.6120	0.6005	0.5890	0.5774	0.5659	0.5544	0.5429	0.5314
R	0.5430	0.5362	0.5294	0.5225	0.5157	0.5088	0.5020	0.4951	0.4883	0.4815	0.4746
S	0.5409	0.5375	0.5341	0.5307	0.5273	0.5239	0.5205	0.5171	0.5136	0.5102	0.5068
T	0.3473	0.3358	0.3243	0.3128	0.3013	0.2897	0.2782	0.2667	0.2552	0.2437	0.2322
Maximum Score	0.6807	0.6679	0.6564	0.6449	0.6334	0.6219	0.6104	0.5988	0.5873	0.5758	0.5643
Recommend	**D**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for PACOM [V&E]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
PACOM [V&E] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

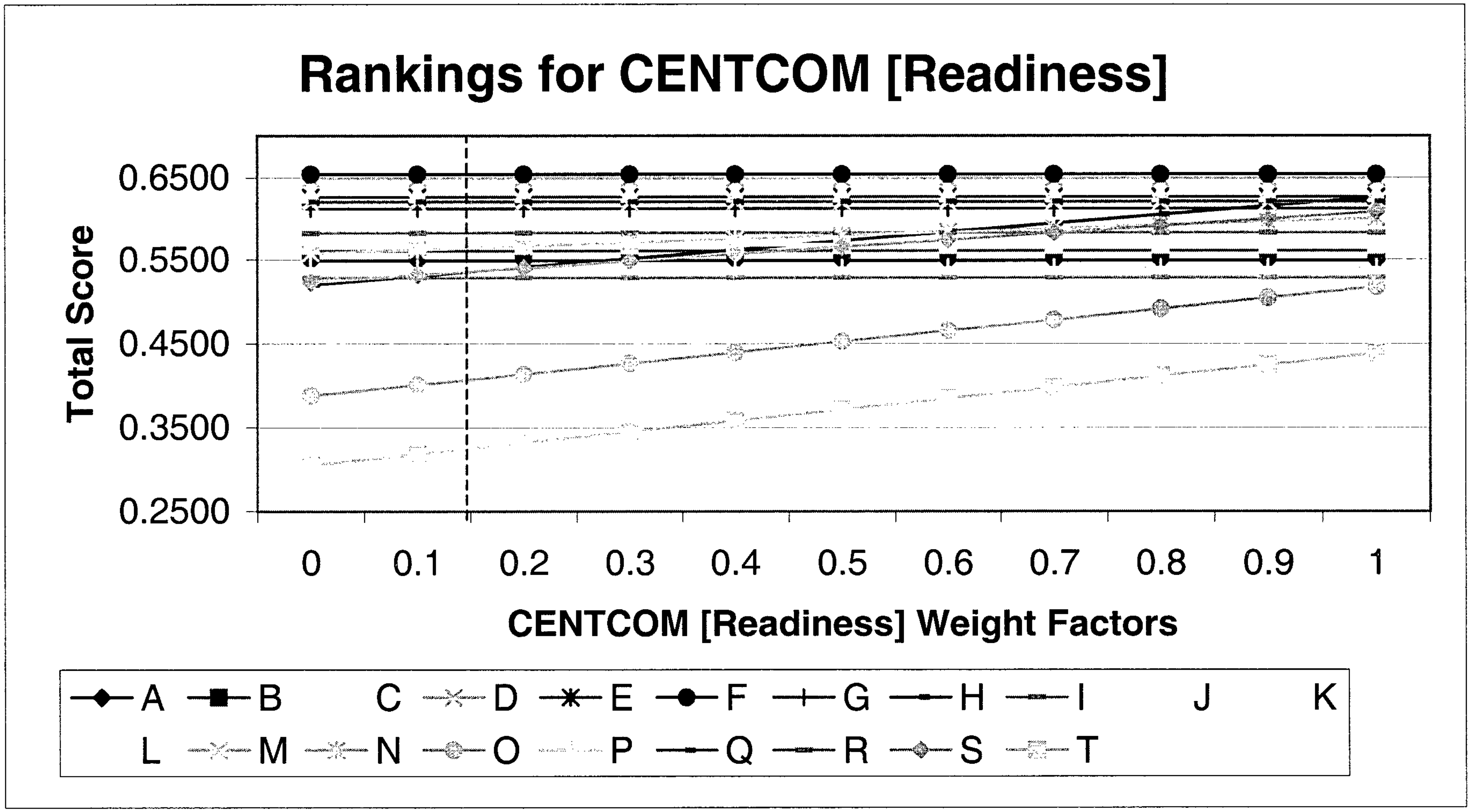
Tbl E.10 - Sensitivity Analysis for SOUTHCOM [Vehicles and Equipment]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
SOUTHCOM	0.0000	0.0327	0.0655	0.0982	0.1309	0.1636	0.1964	0.2291	0.2618	0.2946	0.3273
CENTCOM	0.0854	0.0768	0.0683	0.0598	0.0512	0.0427	0.0342	0.0256	0.0171	0.0085	0.0000
CONUS	0.1281	0.1153	0.1025	0.0897	0.0768	0.0640	0.0512	0.0384	0.0256	0.0128	0.0000
EUCOM	0.0285	0.0256	0.0228	0.0199	0.0171	0.0142	0.0114	0.0085	0.0057	0.0028	0.0000
PACOM	0.0854	0.0768	0.0683	0.0598	0.0512	0.0427	0.0342	0.0256	0.0171	0.0085	0.0000
Alternatives											
A	0.5704	0.5557	0.5409	0.5262	0.5114	0.4967	0.4819	0.4672	0.4525	0.4377	0.4230
B	0.5826	0.5679	0.5531	0.5384	0.5237	0.5089	0.4942	0.4794	0.4647	0.4499	0.4352
C	0.6090	0.5942	0.5795	0.5647	0.5500	0.5353	0.5205	0.5058	0.4910	0.4763	0.4615
D	0.6685	0.6557	0.6428	0.6300	0.6172	0.6044	0.5916	0.5788	0.5660	0.5532	0.5404
E	0.6462	0.6334	0.6206	0.6078	0.5950	0.5822	0.5694	0.5566	0.5437	0.5309	0.5181
F	0.6757	0.6610	0.6462	0.6315	0.6167	0.6020	0.5872	0.5725	0.5578	0.5430	0.5283
G	0.6261	0.6168	0.6075	0.5981	0.5888	0.5795	0.5702	0.5609	0.5516	0.5423	0.5330
H	0.5419	0.5356	0.5293	0.5230	0.5168	0.5105	0.5042	0.4979	0.4917	0.4854	0.4791
I	0.5935	0.5861	0.5788	0.5715	0.5641	0.5568	0.5494	0.5421	0.5347	0.5274	0.5201
J	0.5884	0.5751	0.5617	0.5484	0.5350	0.5216	0.5083	0.4949	0.4815	0.4682	0.4548
K	0.5847	0.5729	0.5611	0.5493	0.5375	0.5257	0.5139	0.5021	0.4903	0.4785	0.4668
L	0.6522	0.6375	0.6228	0.6080	0.5933	0.5785	0.5638	0.5491	0.5343	0.5196	0.5048
M	0.6421	0.6273	0.6126	0.5978	0.5831	0.5683	0.5536	0.5389	0.5241	0.5094	0.4946
N	0.5755	0.5673	0.5591	0.5508	0.5426	0.5343	0.5261	0.5179	0.5096	0.5014	0.4931
O	0.4052	0.4045	0.4037	0.4030	0.4022	0.4014	0.4007	0.3999	0.3992	0.3984	0.3977
P	0.5617	0.5470	0.5323	0.5175	0.5028	0.4880	0.4733	0.4585	0.4438	0.4291	0.4143
Q	0.6428	0.6281	0.6133	0.5986	0.5838	0.5691	0.5543	0.5396	0.5249	0.5101	0.4954
R	0.5434	0.5329	0.5224	0.5119	0.5015	0.4910	0.4805	0.4700	0.4596	0.4491	0.4386
S	0.5442	0.5369	0.5296	0.5222	0.5149	0.5075	0.5002	0.4928	0.4855	0.4782	0.4708
T	0.3436	0.3288	0.3141	0.2994	0.2846	0.2699	0.2551	0.2404	0.2256	0.2109	0.1962
Maximum Score	0.6757	0.6610	0.6462	0.6315	0.6172	0.6044	0.5916	0.5788	0.5660	0.5532	0.5404
Recommend	**F**	**F**	**F**	**F**	**D**	**D**	**D**	**D**	**D**	**D**	**D**


Rankings for SOUTHCOM [V&E]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
SOUTHCOM [V&E] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

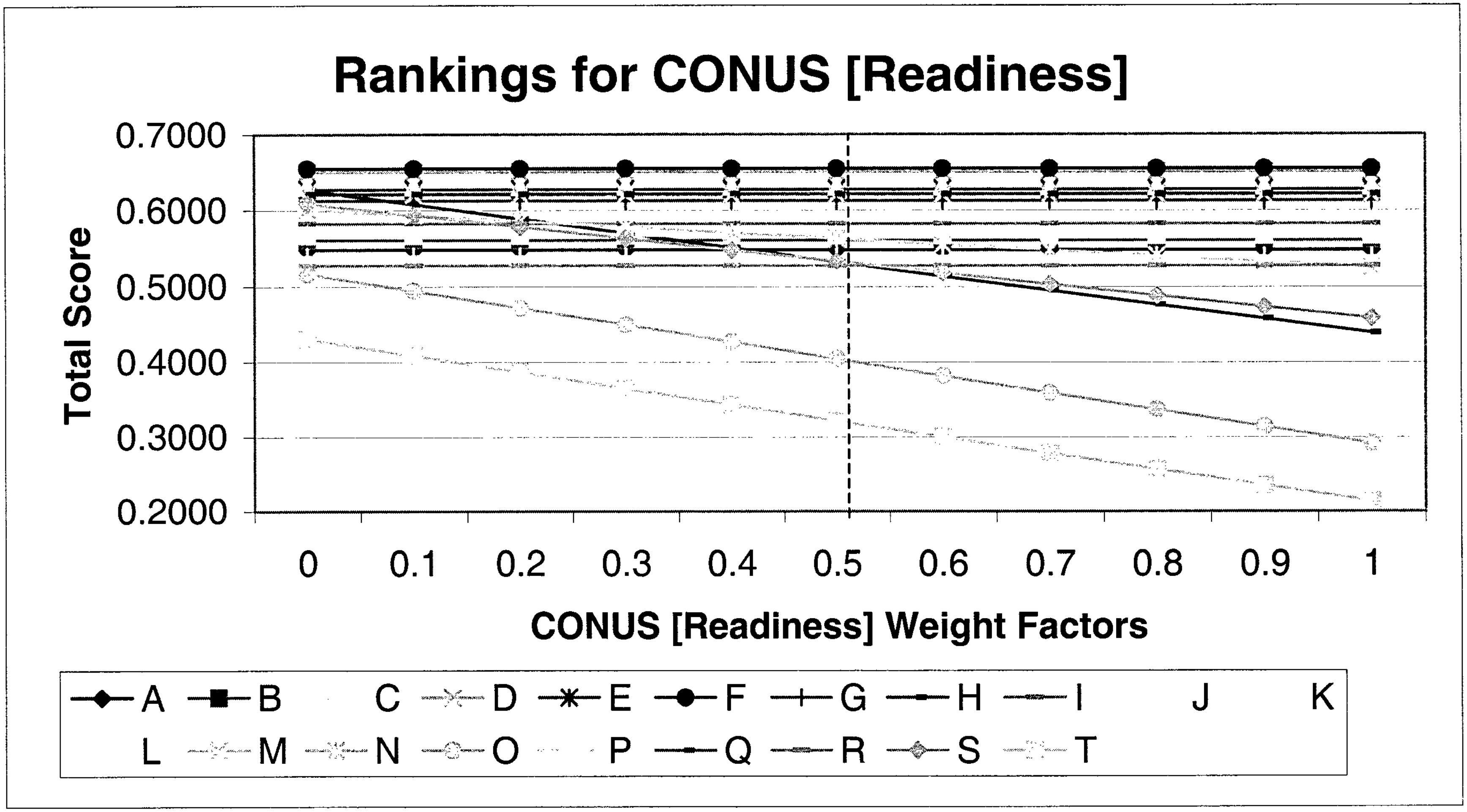
Tbl E.11 - Sensitivity Analysis for CENTCOM [Readiness]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
CENTCOM	0.0000	0.0250	0.0500	0.0750	0.1000	0.1250	0.1500	0.1750	0.2000	0.2250	0.2500
CONUS	0.1429	0.1286	0.1143	0.1000	0.0857	0.0714	0.0571	0.0429	0.0286	0.0143	0.0000
EUCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
PACOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
SOUTHCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123
H	0.5193	0.5301	0.5408	0.5515	0.5622	0.5729	0.5836	0.5943	0.6051	0.6158	0.6265
I	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827
J	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685
K	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674
L	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305
M	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204
N	0.5581	0.5624	0.5667	0.5710	0.5753	0.5796	0.5838	0.5881	0.5924	0.5967	0.6010
O	0.3882	0.4011	0.4139	0.4268	0.4396	0.4525	0.4654	0.4782	0.4911	0.5039	0.5168
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.5227	0.5313	0.5399	0.5484	0.5570	0.5656	0.5741	0.5827	0.5913	0.5999	0.6084
T	0.3052	0.3185	0.3319	0.3453	0.3586	0.3720	0.3854	0.3987	0.4121	0.4255	0.4388
Maximum Score	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for CENTCOM [Readiness]
Total Score
0.6500
0.5500
0.4500
0.3500
0.2500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CENTCOM [Readiness] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

Tbl E.12 - Sensitivity Analysis for CONUS [Readiness]

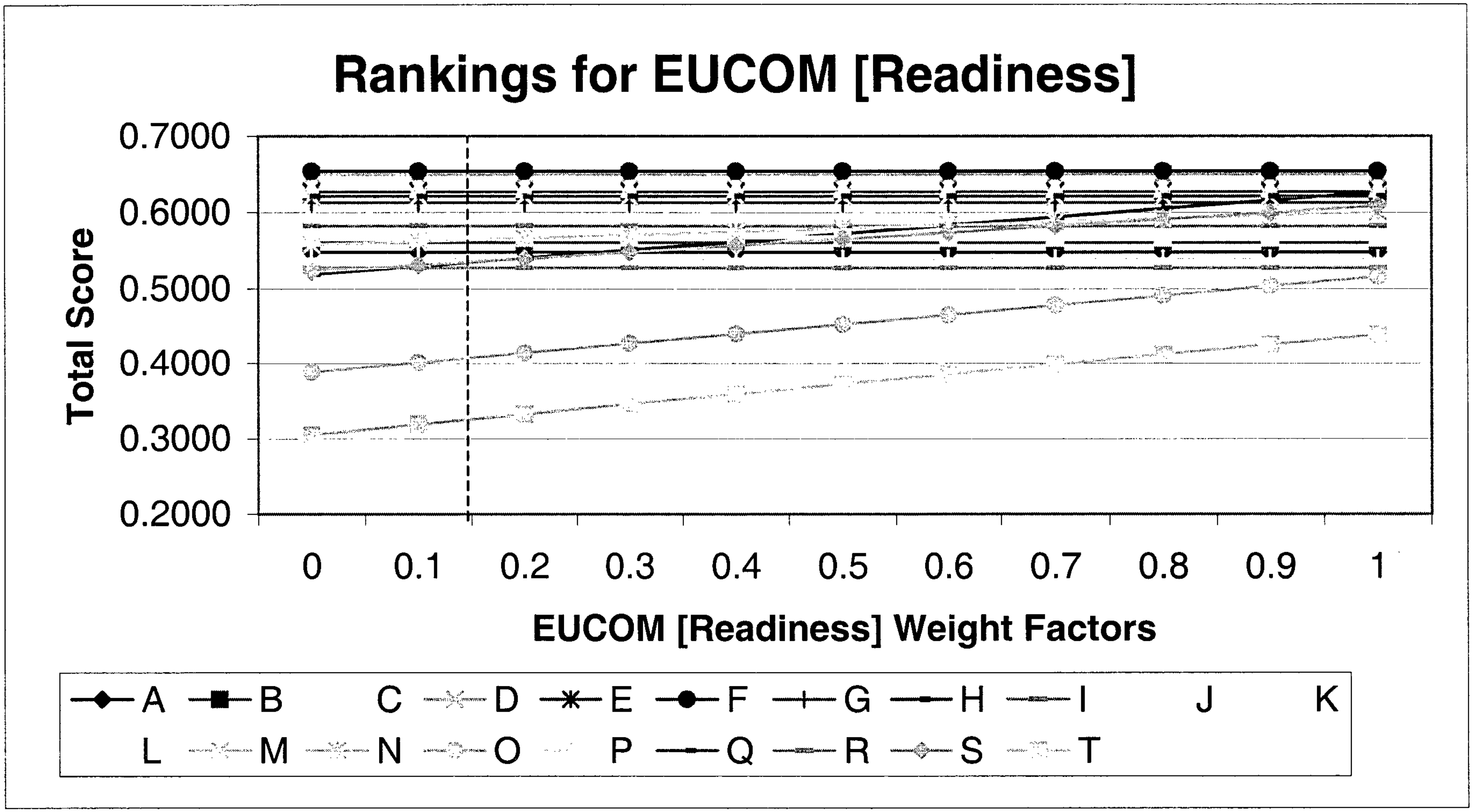
	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
CONUS	0.0000	0.0250	0.0500	0.0750	0.1000	0.1250	0.1500	0.1750	0.2000	0.2250	0.2500
CENTCOM	0.0625	0.0563	0.0500	0.0438	0.0375	0.0313	0.0250	0.0188	0.0125	0.0063	0.0000
EUCOM	0.0625	0.0563	0.0500	0.0438	0.0375	0.0313	0.0250	0.0188	0.0125	0.0063	0.0000
PACOM	0.0625	0.0563	0.0500	0.0438	0.0375	0.0313	0.0250	0.0188	0.0125	0.0063	0.0000
SOUTHCOM	0.0625	0.0563	0.0500	0.0438	0.0375	0.0313	0.0250	0.0188	0.0125	0.0063	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123
H	0.6265	0.6077	0.5890	0.5702	0.5515	0.5327	0.5140	0.4952	0.4765	0.4577	0.4390
I	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827
J	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685
K	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674
L	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305
M	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204
N	0.6010	0.5935	0.5860	0.5785	0.5710	0.5635	0.5560	0.5485	0.5410	0.5335	0.5260
O	0.5168	0.4943	0.4718	0.4493	0.4268	0.4043	0.3818	0.3593	0.3368	0.3143	0.2918
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.6084	0.5934	0.5784	0.5634	0.5484	0.5334	0.5184	0.5034	0.4884	0.4734	0.4584
T	0.4299	0.4083	0.3867	0.3651	0.3435	0.3219	0.3003	0.2787	0.2571	0.2355	0.2138
Maximum Score	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**



Rankings for CONUS [Readiness]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
CONUS [Readiness] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

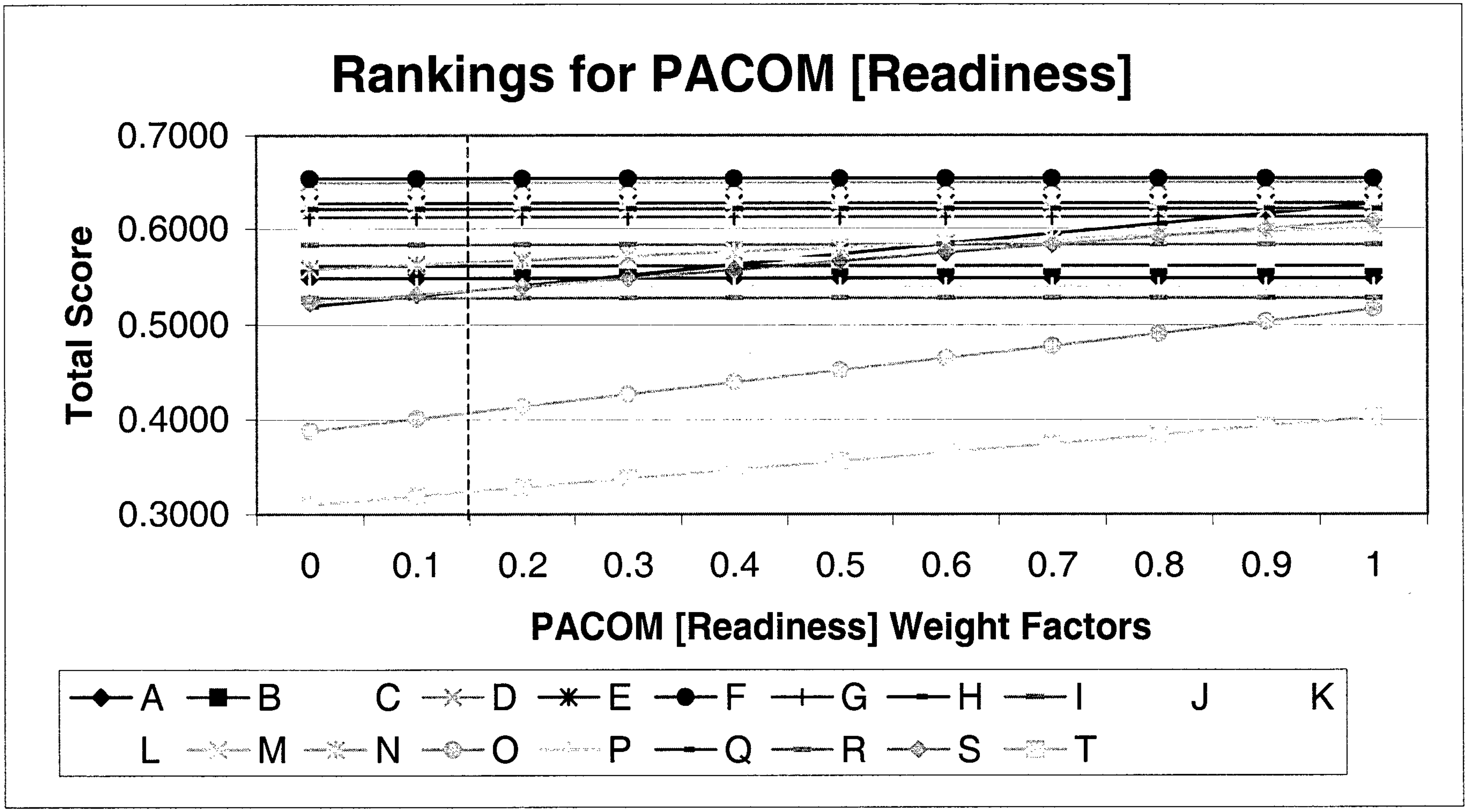
Tbl E.13 - Sensitivity Analysis for EUCOM [Readiness]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
EUCOM	0.0000	0.0250	0.0500	0.0750	0.1000	0.1250	0.1500	0.1750	0.2000	0.2250	0.2500
CENTCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
CONUS	0.1429	0.1286	0.1143	0.1000	0.0857	0.0714	0.0571	0.0429	0.0286	0.0143	0.0000
PACOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
SOUTHCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123
H	0.5193	0.5301	0.5408	0.5515	0.5622	0.5729	0.5836	0.5943	0.6051	0.6158	0.6265
I	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827
J	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685
K	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674
L	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305
M	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204
N	0.5581	0.5624	0.5667	0.5710	0.5753	0.5796	0.5838	0.5881	0.5924	0.5967	0.6010
O	0.3882	0.4011	0.4139	0.4268	0.4396	0.4525	0.4654	0.4782	0.4911	0.5039	0.5168
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.5227	0.5313	0.5399	0.5484	0.5570	0.5656	0.5741	0.5827	0.5913	0.5999	0.6084
T	0.3052	0.3185	0.3319	0.3453	0.3586	0.3720	0.3854	0.3987	0.4121	0.4255	0.4388
Maximum Score	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for EUCOM [Readiness]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
EUCOM [Readiness] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

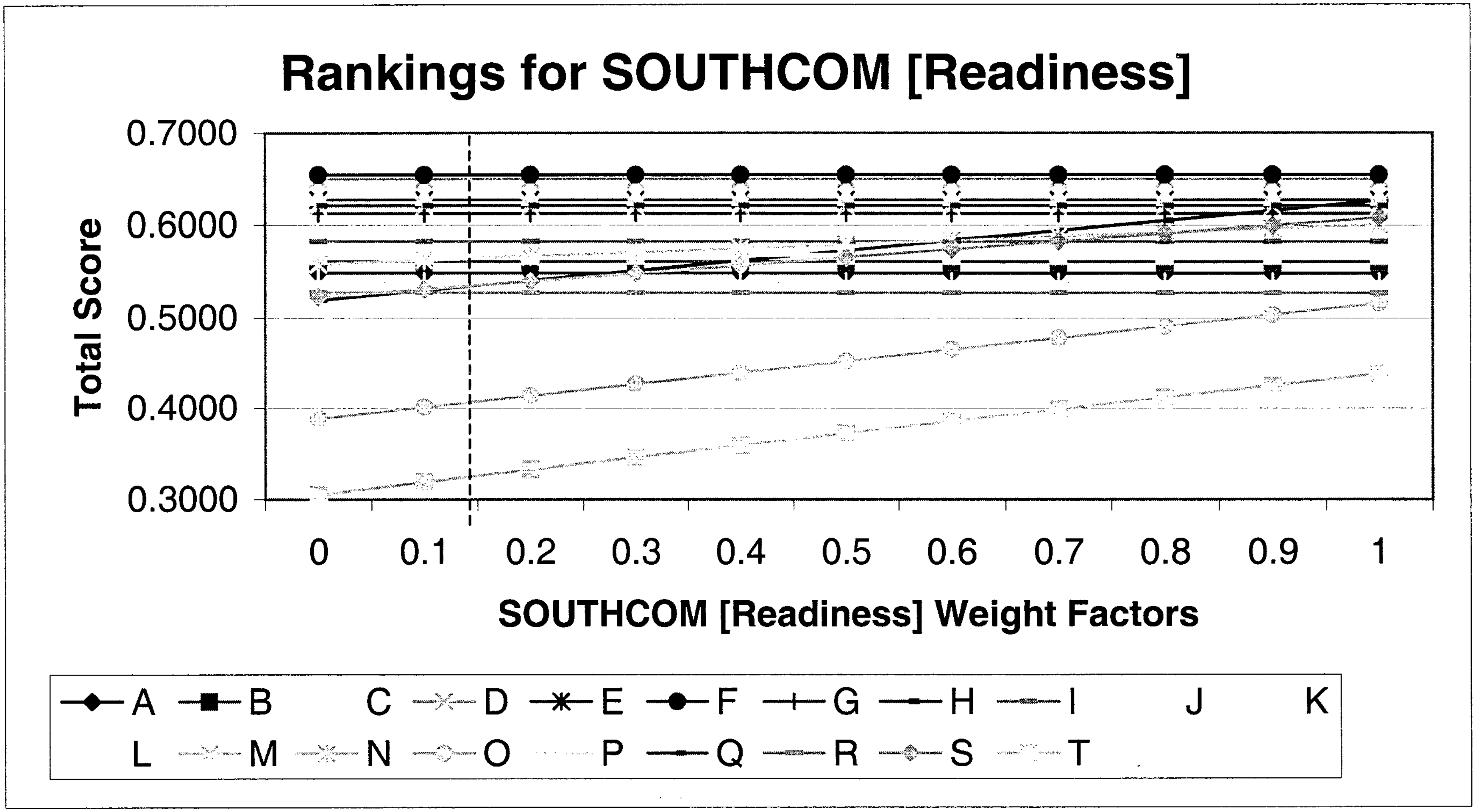
Tbl E.14 - Sensitivity Analysis for PACOM [Readiness]

	Applied Weights										
Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
PACOM	0.0000	0.0250	0.0500	0.0750	0.1000	0.1250	0.1500	0.1750	0.2000	0.2250	0.2500
CENTCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
CONUS	0.1429	0.1286	0.1143	0.1000	0.0857	0.0714	0.0571	0.0429	0.0286	0.0143	0.0000
EUCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
SOUTHCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123
H	0.5193	0.5301	0.5408	0.5515	0.5622	0.5729	0.5836	0.5943	0.6051	0.6158	0.6265
I	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827
J	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685
K	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674
L	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305
M	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204
N	0.5581	0.5624	0.5667	0.5710	0.5753	0.5796	0.5838	0.5881	0.5924	0.5967	0.6010
O	0.3882	0.4011	0.4139	0.4268	0.4396	0.4525	0.4654	0.4782	0.4911	0.5039	0.5168
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.5227	0.5313	0.5399	0.5484	0.5570	0.5656	0.5741	0.5827	0.5913	0.5999	0.6084
T	0.3103	0.3196	0.3288	0.3381	0.3474	0.3567	0.3660	0.3752	0.3845	0.3938	0.4031
Maximum Score	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for PACOM [Readiness]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
PACOM [Readiness] Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

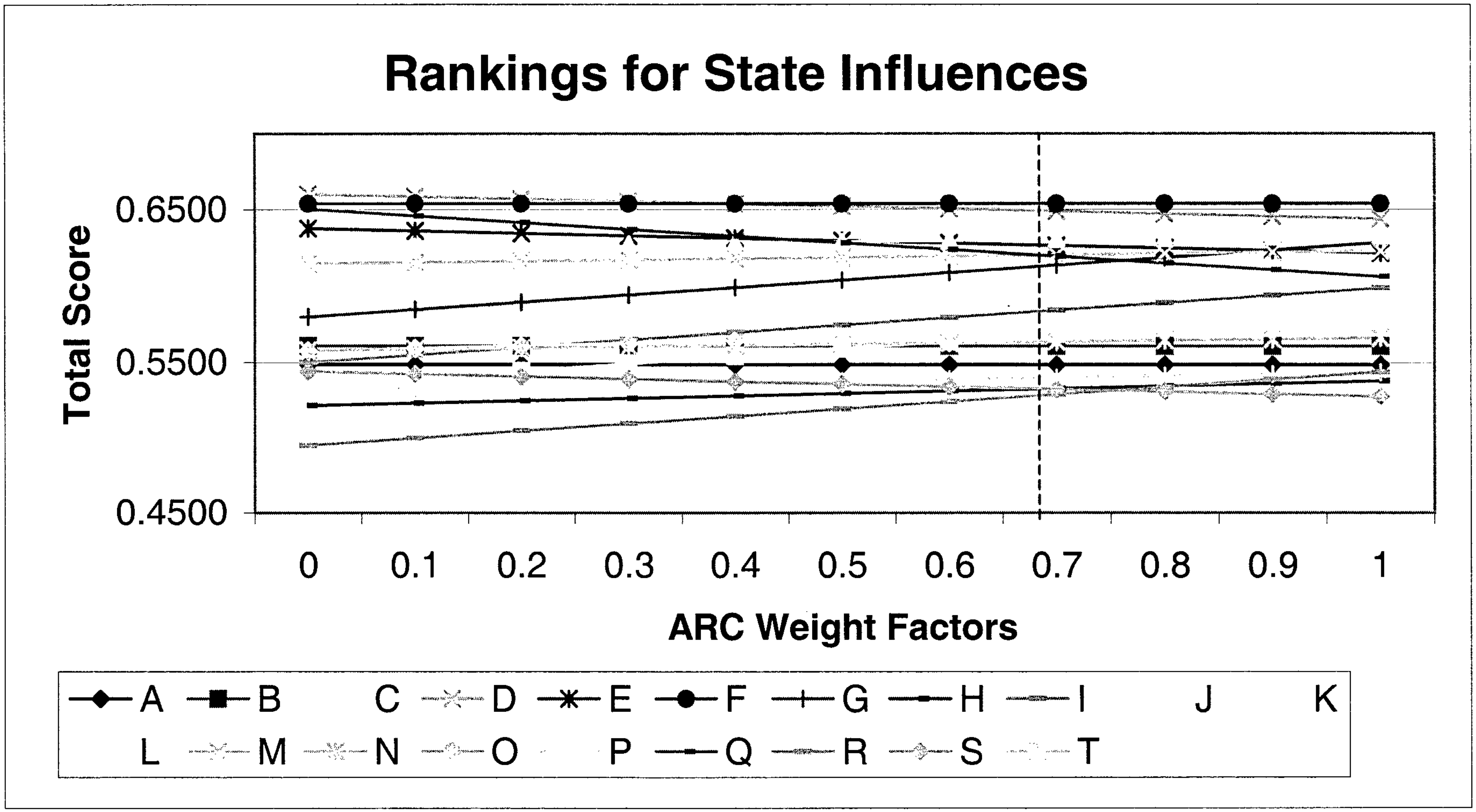
Tbl E.15 - Sensitivity Analysis for SOUTHCOM [Readiness]

	Applied Weights										
Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
SOUTHCOM	0.0000	0.0250	0.0500	0.0750	0.1000	0.1250	0.1500	0.1750	0.2000	0.2250	0.2500
CENTCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
CONUS	0.1429	0.1286	0.1143	0.1000	0.0857	0.0714	0.0571	0.0429	0.0286	0.0143	0.0000
EUCOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
PACOM	0.0357	0.0321	0.0286	0.0250	0.0214	0.0179	0.0143	0.0107	0.0071	0.0036	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271	0.6271
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123	0.6123
H	0.5193	0.5301	0.5408	0.5515	0.5622	0.5729	0.5836	0.5943	0.6051	0.6158	0.6265
I	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827	0.5827
J	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685	0.5685
K	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674	0.5674
L	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305	0.6305
M	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204	0.6204
N	0.5581	0.5624	0.5667	0.5710	0.5753	0.5796	0.5838	0.5881	0.5924	0.5967	0.6010
O	0.3882	0.4011	0.4139	0.4268	0.4396	0.4525	0.4654	0.4782	0.4911	0.5039	0.5168
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211	0.6211
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.5227	0.5313	0.5399	0.5484	0.5570	0.5656	0.5741	0.5827	0.5913	0.5999	0.6084
T	0.3052	0.3185	0.3319	0.3453	0.3586	0.3720	0.3854	0.3987	0.4121	0.4255	0.4388
Maximum Score	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for SOUTHCOM [Readiness]
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
SOUTHCOM [Readiness] Weight Factors
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

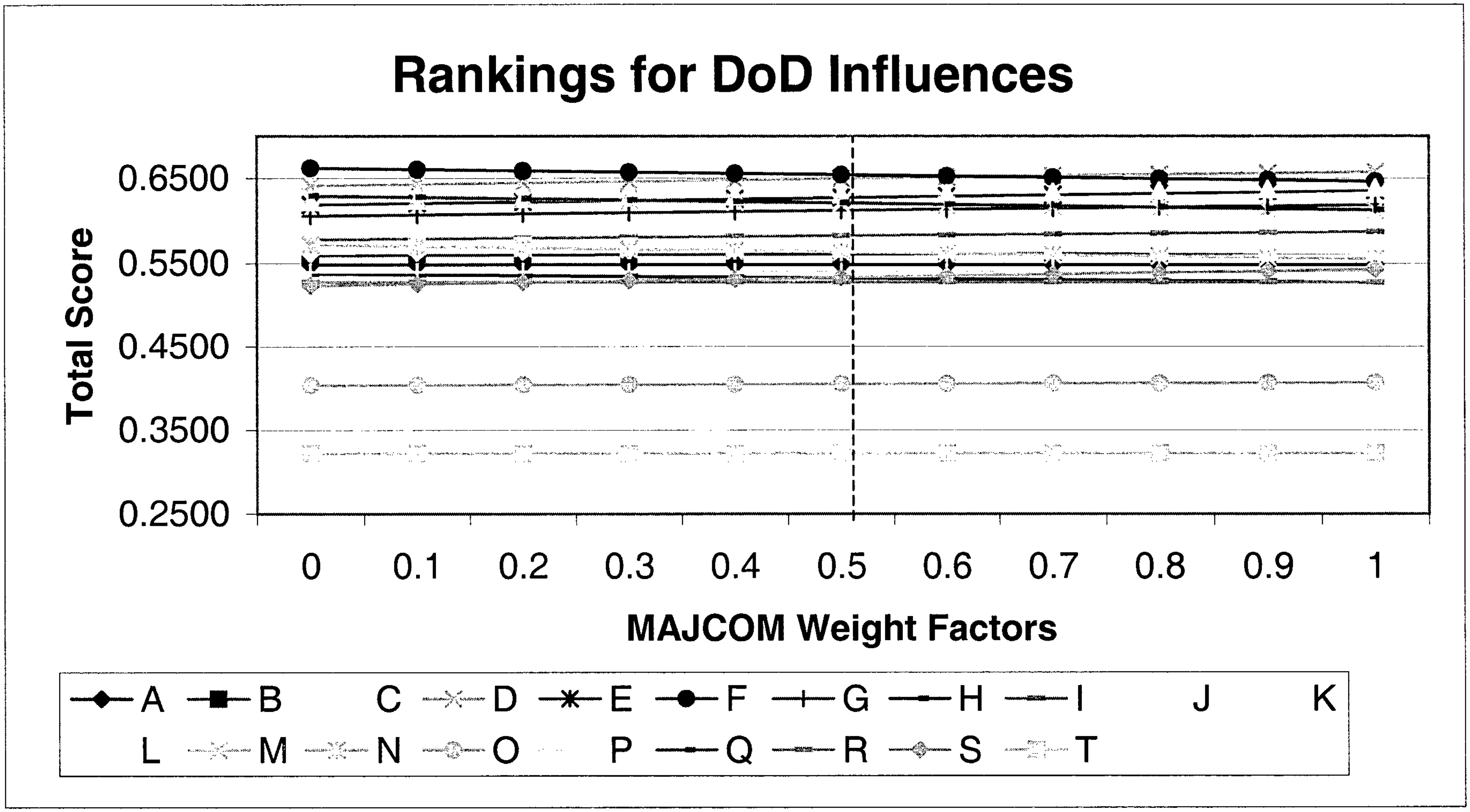
Tbl E.16 - Sensitivity Analysis for ARC and Active Duty Units

Weighting Factors	**0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1**
ARC Units	0.0000	0.0049	0.0097	0.0146	0.0195	0.0244	0.0292	0.0341	0.0390	0.0439	0.0487
Active Duty Units	0.0487	0.0439	0.0390	0.0341	0.0292	0.0244	0.0195	0.0146	0.0097	0.0049	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609	0.5609
C	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873	0.5873
D	0.6602	0.6586	0.6570	0.6553	0.6537	0.6521	0.6505	0.6488	0.6472	0.6456	0.6440
E	0.6379	0.6363	0.6347	0.6331	0.6315	0.6298	0.6282	0.6266	0.6250	0.6233	0.6217
F	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
G	0.5798	0.5847	0.5896	0.5944	0.5993	0.6042	0.6091	0.6139	0.6188	0.6237	0.6286
H	0.5219	0.5235	0.5252	0.5268	0.5284	0.5300	0.5317	0.5333	0.5349	0.5365	0.5381
I	0.5502	0.5550	0.5599	0.5648	0.5697	0.5745	0.5794	0.5843	0.5892	0.5940	0.5989
J	0.5577	0.5593	0.5609	0.5626	0.5642	0.5658	0.5674	0.5691	0.5707	0.5723	0.5739
K	0.5349	0.5398	0.5446	0.5495	0.5544	0.5593	0.5641	0.5690	0.5739	0.5788	0.5836
L	0.6251	0.6259	0.6267	0.6276	0.6284	0.6292	0.6300	0.6308	0.6316	0.6324	0.6333
M	0.6149	0.6157	0.6166	0.6174	0.6182	0.6190	0.6198	0.6206	0.6214	0.6223	0.6231
N	0.5580	0.5589	0.5597	0.5605	0.5613	0.5621	0.5629	0.5637	0.5646	0.5654	0.5662
O	0.4151	0.4135	0.4119	0.4102	0.4086	0.4070	0.4054	0.4037	0.4021	0.4005	0.3989
P	0.5325	0.5336	0.5347	0.5359	0.5370	0.5381	0.5393	0.5404	0.5416	0.5427	0.5438
Q	0.6504	0.6460	0.6416	0.6372	0.6328	0.6284	0.6240	0.6196	0.6153	0.6109	0.6065
R	0.4954	0.5003	0.5051	0.5100	0.5149	0.5197	0.5246	0.5295	0.5344	0.5392	0.5441
S	0.5443	0.5426	0.5410	0.5394	0.5378	0.5361	0.5345	0.5329	0.5313	0.5296	0.5280
T	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219
Maximum Score	0.6602	0.6586	0.6570	0.6553	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540	0.6540
Recommend	**D**	**D**	**D**	**D**	**F**	**F**	**F**	**F**	**F**	**F**	**F**


Rankings for State Influences
Total Score
0.6500
0.5500
0.4500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
ARC Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

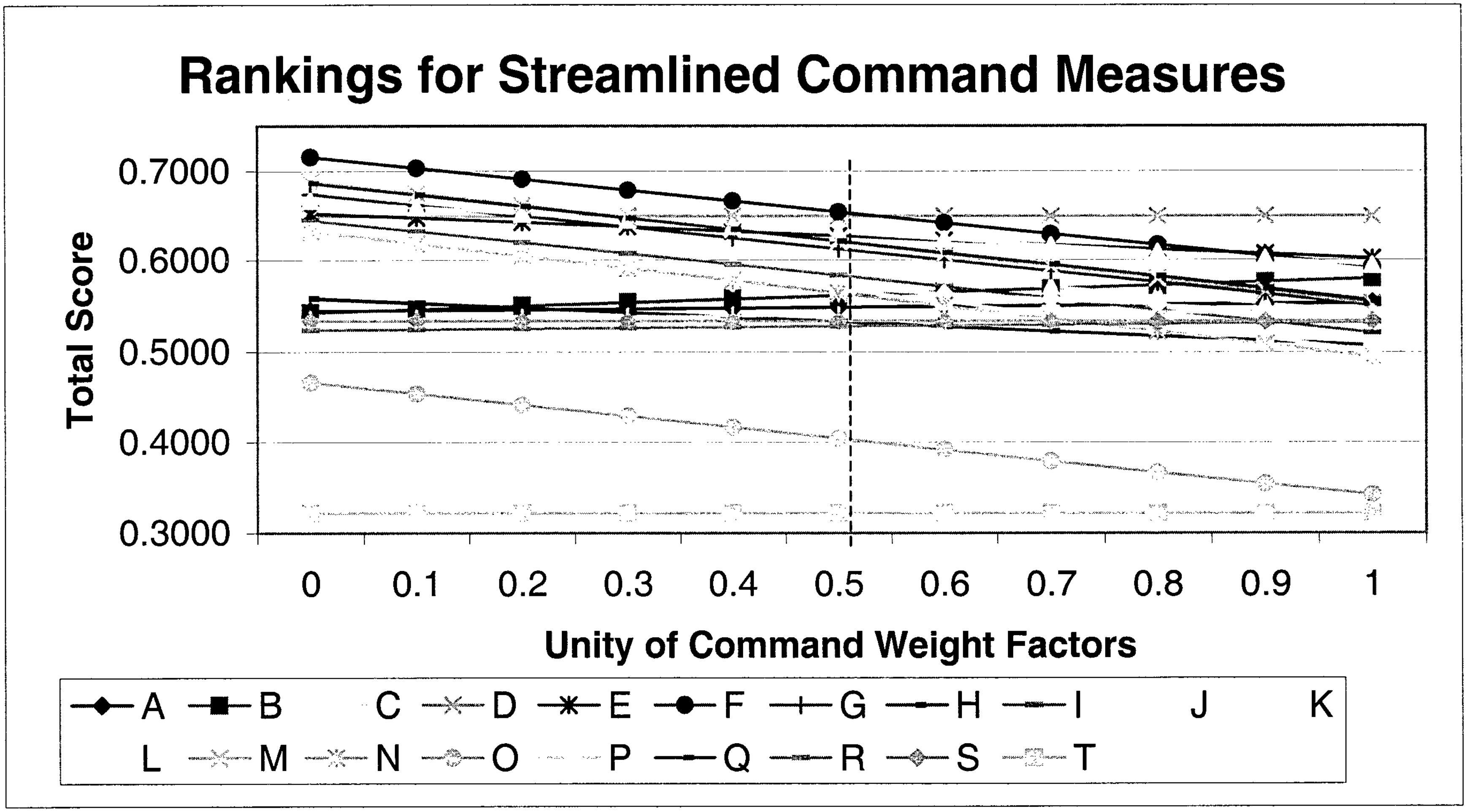
Tbl E.17 - Sensitivity Analysis for MAJCOMs & Higher HQs and NAFs and OCONUS Bases

Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
MAJCOMs & HQs	0.0000	0.0032	0.0065	0.0097	0.0130	0.0162	0.0195	0.0227	0.0260	0.0292	0.0325
NAFs & OCONUS	0.0325	0.0292	0.0260	0.0227	0.0195	0.0162	0.0130	0.0097	0.0065	0.0032	0.0000
Alternatives											
A	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487	0.5487
B	0.5593	0.5596	0.5599	0.5603	0.5606	0.5609	0.5612	0.5616	0.5619	0.5622	0.5625
C	0.5808	0.5821	0.5834	0.5847	0.5860	0.5873	0.5886	0.5899	0.5912	0.5925	0.5938
D	0.6413	0.6429	0.6445	0.6461	0.6478	0.6494	0.6510	0.6526	0.6543	0.6559	0.6575
E	0.6190	0.6206	0.6222	0.6239	0.6255	0.6271	0.6287	0.6304	0.6320	0.6336	0.6352
F	0.6621	0.6605	0.6589	0.6572	0.6556	0.6540	0.6524	0.6507	0.6491	0.6475	0.6459
G	0.6058	0.6071	0.6084	0.6097	0.6110	0.6123	0.6136	0.6149	0.6162	0.6175	0.6188
H	0.5376	0.5366	0.5357	0.5347	0.5337	0.5327	0.5318	0.5308	0.5298	0.5288	0.5279
I	0.5778	0.5788	0.5798	0.5807	0.5817	0.5827	0.5837	0.5846	0.5856	0.5866	0.5876
J	0.5620	0.5633	0.5646	0.5659	0.5672	0.5685	0.5698	0.5711	0.5724	0.5737	0.5750
K	0.5723	0.5713	0.5703	0.5694	0.5684	0.5674	0.5664	0.5655	0.5645	0.5635	0.5625
L	0.6224	0.6240	0.6257	0.6273	0.6289	0.6305	0.6322	0.6338	0.6354	0.6370	0.6387
M	0.6285	0.6269	0.6252	0.6236	0.6220	0.6204	0.6187	0.6171	0.6155	0.6139	0.6122
N	0.5716	0.5700	0.5684	0.5667	0.5651	0.5635	0.5619	0.5602	0.5586	0.5570	0.5554
O	0.4027	0.4030	0.4033	0.4036	0.4040	0.4043	0.4046	0.4049	0.4053	0.4056	0.4059
P	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Q	0.6292	0.6276	0.6260	0.6243	0.6227	0.6211	0.6195	0.6178	0.6162	0.6146	0.6130
R	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279	0.5279
S	0.5237	0.5256	0.5276	0.5295	0.5315	0.5334	0.5354	0.5373	0.5393	0.5412	0.5432
T	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219
Maximum Score	0.6621	0.6605	0.6589	0.6572	0.6556	0.6540	0.6524	0.6526	0.6543	0.6559	0.6575
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**D**	**D**	**D**	**D**


Rankings for DoD Influences
Total Score
0.6500
0.5500
0.4500
0.3500
0.2500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
MAJCOM Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

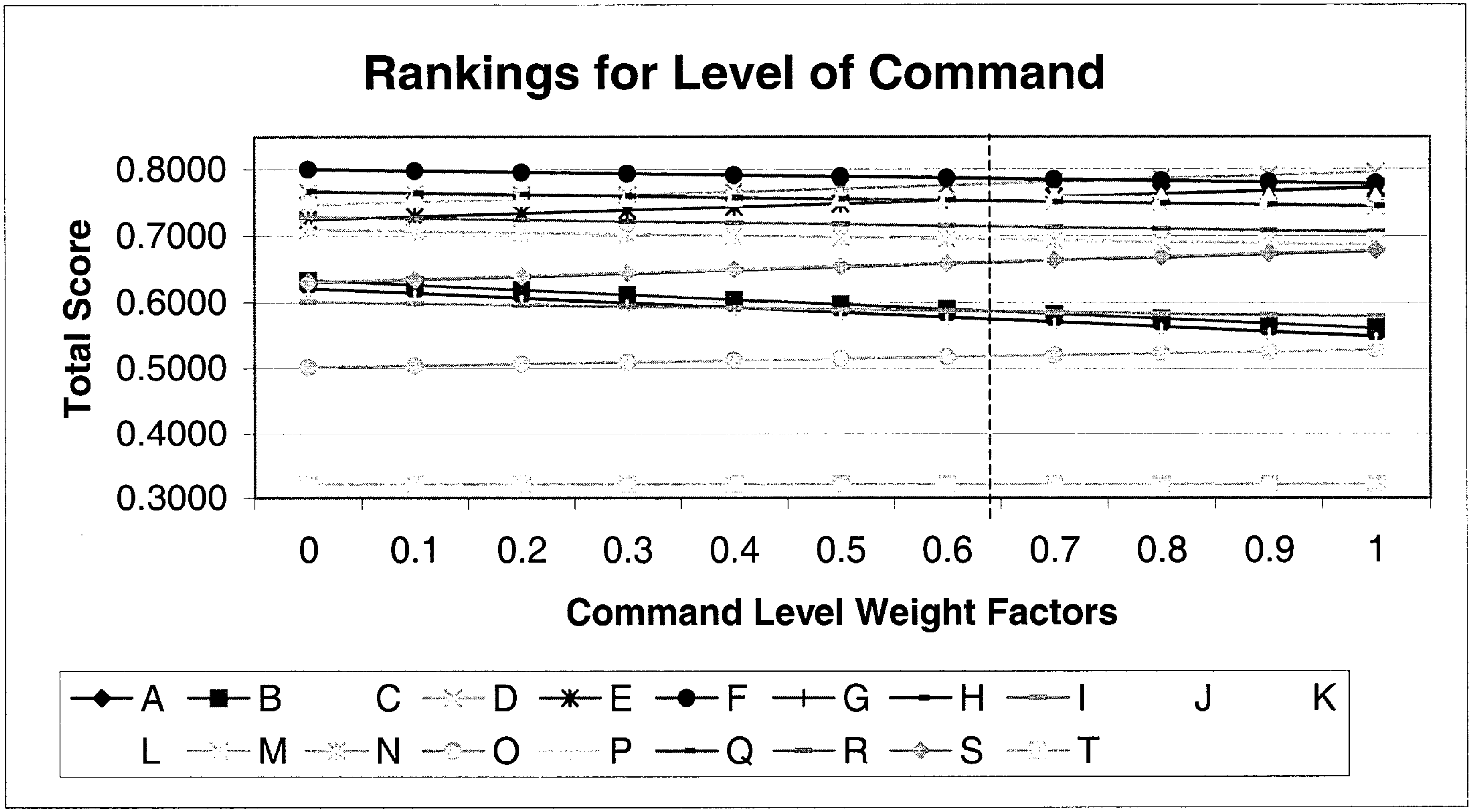
Tbl E.18 - Sensitivity Analysis for Unity of Command and Matching Structures

Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
Unity of Command	0.0000	0.0146	0.0292	0.0437	0.0583	0.0729	0.0875	0.1020	0.1166	0.1312	0.1458
Matching Structures	0.1458	0.1312	0.1166	0.1020	0.0875	0.0729	0.0583	0.0437	0.0292	0.0146	0.0000
Alternatives											
A	0.5443	0.5452	0.5461	0.5469	0.5478	0.5487	0.5496	0.5504	0.5513	0.5522	0.5531
B	0.5427	0.5463	0.5500	0.5536	0.5573	0.5609	0.5646	0.5682	0.5719	0.5755	0.5791
C	0.6310	0.6222	0.6135	0.6048	0.5960	0.5873	0.5785	0.5698	0.5610	0.5523	0.5435
D	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494	0.6494
E	0.6526	0.6475	0.6424	0.6373	0.6322	0.6271	0.6220	0.6169	0.6118	0.6067	0.6016
F	0.7160	0.7036	0.6912	0.6788	0.6664	0.6540	0.6416	0.6292	0.6168	0.6044	0.5920
G	0.6743	0.6619	0.6495	0.6371	0.6247	0.6123	0.5999	0.5875	0.5752	0.5628	0.5504
H	0.5583	0.5532	0.5480	0.5429	0.5378	0.5327	0.5276	0.5225	0.5174	0.5123	0.5072
I	0.6446	0.6322	0.6198	0.6075	0.5951	0.5827	0.5703	0.5579	0.5455	0.5331	0.5207
J	0.5977	0.5919	0.5860	0.5802	0.5744	0.5685	0.5627	0.5569	0.5510	0.5452	0.5394
K	0.6330	0.6199	0.6068	0.5936	0.5805	0.5674	0.5543	0.5412	0.5280	0.5149	0.5018
L	0.6670	0.6597	0.6524	0.6451	0.6378	0.6305	0.6233	0.6160	0.6087	0.6014	0.5941
M	0.6889	0.6752	0.6615	0.6478	0.6341	0.6204	0.6067	0.5930	0.5792	0.5655	0.5518
N	0.6320	0.6183	0.6046	0.5909	0.5772	0.5635	0.5498	0.5361	0.5224	0.5087	0.4950
O	0.4662	0.4538	0.4415	0.4291	0.4167	0.4043	0.3919	0.3795	0.3671	0.3547	0.3423
P	0.5357	0.5365	0.5374	0.5383	0.5392	0.5400	0.5409	0.5418	0.5427	0.5435	0.5444
Q	0.6867	0.6736	0.6605	0.6473	0.6342	0.6211	0.6080	0.5949	0.5817	0.5686	0.5555
R	0.5235	0.5244	0.5253	0.5261	0.5270	0.5279	0.5288	0.5296	0.5305	0.5314	0.5323
S	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334	0.5334
T	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219
Maximum Score	0.7160	0.7036	0.6912	0.6788	0.6664	0.6540	0.6494	0.6494	0.6494	0.6494	0.6494
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**D**	**D**	**D**	**D**	**D**


Rankings for Streamlined Command Measures
Total Score
0.7000
0.6000
0.5000
0.4000
0.3000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Unity of Command Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

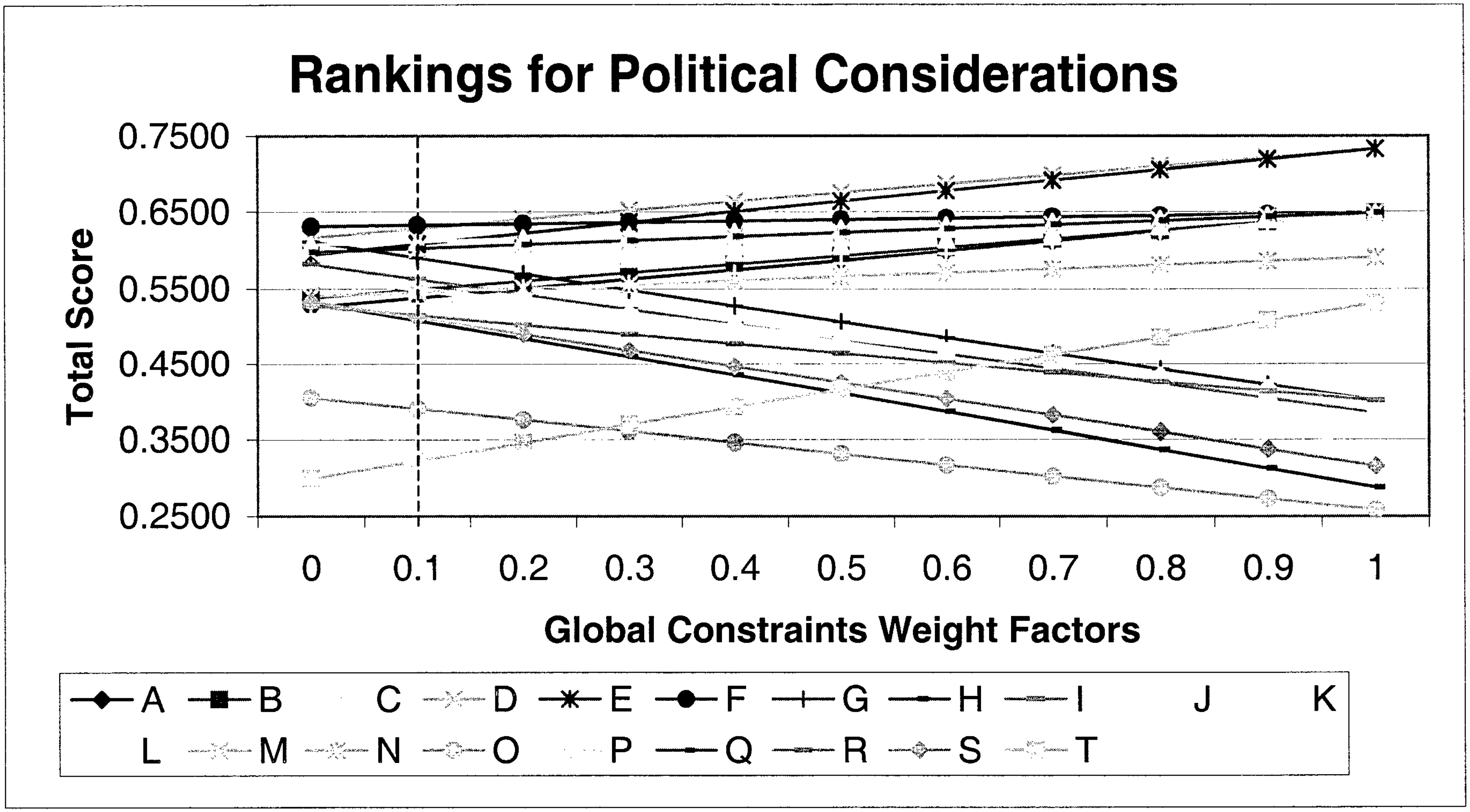
Tbl E.19 - Sensitivity Analysis for Command Level and Rank of Command

Weighting Factors	*0*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*1*
Command Level	0.0000	0.0073	0.0146	0.0218	0.0291	0.0364	0.0437	0.0509	0.0582	0.0655	0.0728
Rank of Command	0.0728	0.0655	0.0582	0.0509	0.0437	0.0364	0.0291	0.0218	0.0146	0.0073	0.0000
Alternatives											
A	0.6215	0.6142	0.6069	0.5996	0.5924	0.5851	0.5778	0.5705	0.5633	0.5560	0.5487
B	0.6337	0.6264	0.6191	0.6119	0.6046	0.5973	0.5900	0.5828	0.5755	0.5682	0.5609
C	0.6662	0.6637	0.6613	0.6589	0.6565	0.6540	0.6516	0.6492	0.6468	0.6443	0.6419
D	0.7465	0.7514	0.7562	0.7611	0.7659	0.7708	0.7756	0.7805	0.7853	0.7902	0.7950
E	0.7242	0.7291	0.7339	0.7388	0.7437	0.7485	0.7534	0.7582	0.7631	0.7679	0.7728
F	0.7997	0.7975	0.7953	0.7931	0.7909	0.7887	0.7866	0.7844	0.7822	0.7800	0.7778
G	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580
H	0.6299	0.6347	0.6396	0.6444	0.6493	0.6541	0.6590	0.6638	0.6687	0.6736	0.6784
I	0.7283	0.7262	0.7240	0.7218	0.7196	0.7174	0.7152	0.7131	0.7109	0.7087	0.7065
J	0.6778	0.6756	0.6734	0.6712	0.6690	0.6668	0.6647	0.6625	0.6603	0.6581	0.6559
K	0.6888	0.6891	0.6893	0.6896	0.6898	0.6900	0.6903	0.6905	0.6908	0.6910	0.6912
L	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580	0.7580
M	0.7660	0.7638	0.7617	0.7595	0.7573	0.7551	0.7529	0.7507	0.7486	0.7464	0.7442
N	0.7091	0.7070	0.7048	0.7026	0.7004	0.6982	0.6960	0.6939	0.6917	0.6895	0.6873
O	0.5014	0.5041	0.5067	0.5094	0.5121	0.5148	0.5174	0.5201	0.5228	0.5254	0.5281
P	0.6128	0.6055	0.5983	0.5910	0.5837	0.5764	0.5692	0.5619	0.5546	0.5473	0.5400
Q	0.7668	0.7646	0.7624	0.7602	0.7580	0.7558	0.7537	0.7515	0.7493	0.7471	0.7449
R	0.6007	0.5985	0.5963	0.5941	0.5919	0.5898	0.5876	0.5854	0.5832	0.5810	0.5788
S	0.6305	0.6354	0.6403	0.6451	0.6500	0.6548	0.6597	0.6645	0.6694	0.6742	0.6791
T	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219	0.3219
Maximum Score	0.7997	0.7975	0.7953	0.7931	0.7909	0.7887	0.7866	0.7844	0.7853	0.7902	0.7950
Recommend	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**D**	**D**	**D**


Rankings for Level of Command
Total Score
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Command Level Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

Tbl E.20 - Sensitivity Analysis for Global Constraints

Weighting Factors	***0***	***0.1***	***0.2***	***0.3***	***0.4***	***0.5***	***0.6***	***0.7***	***0.8***	***0.9***	***1***
Global Constraints	0.0000	0.0332	0.0664	0.0996	0.1328	0.1660	0.1992	0.2324	0.2656	0.2988	0.3320
Air Force	*0.3320*	*0.2988*	*0.2656*	*0.2324*	*0.1992*	*0.1660*	*0.1328*	*0.0996*	*0.0664*	*0.0332*	*0.0000*
ARC Units	0.03251	0.02926	0.02601	0.02276	0.01951	0.01626	0.01301	0.00975	0.00650	0.00325	0.00000
Active Duty Units	0.01623	0.01461	0.01299	0.01136	0.00974	0.00812	0.00649	0.00487	0.00325	0.00162	0.00000
MAJCOMs & Higher	0.01625	0.01462	0.01300	0.01137	0.00975	0.00812	0.00650	0.00487	0.00325	0.00162	0.00000
NAFs & OCONUS	0.01625	0.01462	0.01300	0.01137	0.00975	0.00812	0.00650	0.00487	0.00325	0.00162	0.00000
Unity of Command	0.07289	0.06560	0.05831	0.05102	0.04373	0.03644	0.02915	0.02187	0.01458	0.00729	0.00000
Matching Structures	0.07289	0.06560	0.05831	0.05102	0.04373	0.03644	0.02915	0.02187	0.01458	0.00729	0.00000
Command Level	0.04854	0.04369	0.03883	0.03398	0.02913	0.02427	0.01942	0.01456	0.00971	0.00485	0.00000
Rank of Command	0.02423	0.02181	0.01939	0.01696	0.01454	0.01212	0.00969	0.00727	0.00485	0.00242	0.00000
Alternatives											
A	0.5262	0.5384	0.5507	0.5629	0.5752	0.5874	0.5997	0.6119	0.6242	0.6364	0.6487
B	0.5384	0.5494	0.5604	0.5715	0.5825	0.5935	0.6046	0.6156	0.6266	0.6377	0.6487
C	0.5647	0.5731	0.5815	0.5899	0.5983	0.6067	0.6151	0.6235	0.6319	0.6403	0.6487
D	0.6172	0.6288	0.6404	0.6520	0.6636	0.6752	0.6868	0.6984	0.7100	0.7216	0.7333
E	0.5949	0.6087	0.6226	0.6364	0.6503	0.6641	0.6779	0.6918	0.7056	0.7194	0.7333
F	0.6315	0.6332	0.6349	0.6366	0.6384	0.6401	0.6418	0.6435	0.6453	0.6470	0.6487
G	0.6123	0.5911	0.5700	0.5488	0.5276	0.5064	0.4852	0.4640	0.4428	0.4217	0.4005
H	0.5327	0.5083	0.4838	0.4594	0.4349	0.4104	0.3860	0.3615	0.3371	0.3126	0.2882
I	0.5827	0.5628	0.5429	0.5230	0.5031	0.4832	0.4633	0.4434	0.4235	0.4036	0.3838
J	0.5685	0.5517	0.5349	0.5181	0.5013	0.4845	0.4677	0.4509	0.4341	0.4173	0.4005
K	0.5674	0.5487	0.5300	0.5112	0.4925	0.4738	0.4551	0.4364	0.4176	0.3989	0.3802
L	0.6080	0.6121	0.6161	0.6202	0.6243	0.6284	0.6324	0.6365	0.6406	0.6446	0.6487
M	0.5978	0.6029	0.6080	0.6131	0.6182	0.6233	0.6283	0.6334	0.6385	0.6436	0.6487
N	0.5409	0.5460	0.5511	0.5562	0.5613	0.5664	0.5715	0.5766	0.5816	0.5867	0.5918
O	0.4043	0.3897	0.3751	0.3605	0.3459	0.3313	0.3167	0.3022	0.2876	0.2730	0.2584
P	0.5175	0.5306	0.5437	0.5569	0.5700	0.5831	0.5962	0.6093	0.6225	0.6356	0.6487
Q	0.5985	0.6036	0.6086	0.6136	0.6186	0.6236	0.6286	0.6337	0.6387	0.6437	0.6487
R	0.5279	0.5151	0.5024	0.4896	0.4769	0.4641	0.4513	0.4386	0.4258	0.4131	0.4003
S	0.5334	0.5117	0.4899	0.4682	0.4464	0.4247	0.4029	0.3811	0.3594	0.3376	0.3159
T	0.2993	0.3226	0.3458	0.3691	0.3923	0.4155	0.4388	0.4620	0.4853	0.5085	0.5317
Maximum Score	0.6315	0.6332	0.6404	0.6520	0.6636	0.6752	0.6868	0.6984	0.7100	0.7216	0.7333
Recommend	**F**	**F**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**


Rankings for Political Considerations
Total Score
0.7500
0.6500
0.5500
0.4500
0.3500
0.2500
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Global Constraints Weight Factors
A B C D E F G H I J K
L M N O P Q R S T

APPENDIX F: DECISION MAKER'S REPRESENTATIVE'S BIOGRAPHY

This section presents the decision maker's representative's biography, as released by public affairs. The diverse experiences he has had in civil engineering, in RED HORSE as well as Prime BEEF, are evidenced in this biography. These experiences made the decision maker's representative thoroughly qualified for his role in this research effort.

BIOGRAPHY

UNITED STATES AIR FORCE

Air Combat Command
Office of Public Affairs
Langley Air Force Base, Va. 23665-1987

COLONEL JAMES T. RYBURN

Colonel James T. (Tom) Ryburn is the Chief, Readiness Division, Directorate of The Civil Engineer, Headquarters Air Combat Command, Langley Air Force Base, Virginia. He is responsible for the Prime BEEF, RED HORSE, Fire Protection, Explosive Ordnance Disposal, Disaster Preparedness, and Individual Mobilization Augmentee programs. He provides oversight of CE's Research, Development, and Acquisition programs for the Combat Air Forces (ACC, USAFE, PACAF) and represents ACC/CE on the Battle Staff directing all CE support during contingencies or exercises. He is also responsible for planning and training of the Response Task Force in event of incidents involving any Air Force nuclear weapons in the CONUS.

Colonel Ryburn was commissioned from Officers Training School in 1975 after graduating from the University of Arkansas with a Bachelor of Architecture Degree. He has commanded three civil engineer squadrons and a support group. He was the 1994 USAFE Outstanding Civil Engineer Senior Military Manager and was runner-up for the Air Force Award. He is married to the former Rebecca Willard of Dublin, Virginia. They have one son, Matthew.

EDUCATION:
1975 Bachelor of Architecture, University of Arkansas
1978 Squadron Officer School, Maxwell Air Force Base, Ala.
1980 Education with Industry, Daniel, Mann, Johnson, and Mendenhall, Los Angeles, Calif.
1984 Masters of science in Engineering Management, Air Force Institute of Technology, Wright-Patterson AFB, Ohio
1988 Air Command and Staff College,
1998 Air War College, Maxwell Air Force Base, Ala.

ASSIGNMENTS:
1. October 1975 - July 1978: Civil Engineering Officer, 363rd Civil Engineer Squadron, Shaw AFB, South Carolina.
2. July 1978 - August 1979: Civil Engineering Officer, 554th RED HORSE Squadron, Taegu AB, Korea.
3. August 1979 - June 1980: Student, Education with Industry, Daniel, Mann, Johnson, and Mendenhall, Los Angeles, California.
4. July 1980 - July 1981: Architect, 36th Civil Engineer Squadron, Bitburg AB, Germany.
5. July 1981 - June 1983: Civil Engineering Inspector, Inspector General, United States Air Forces in Europe, Ramstein AB, Germany.
6. June 1983 – August 1984: Student, Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

7. August 1984 – August 1987: Chief, Operations, 823rd RED HORSE Squadron, Hurlburt Field, Ft. Walton Beach, Florida.
8. August 1987 – June 1988: Student, Air Command and Staff College, Maxwell AFB, Montgomery, Alabama.
9. July 1988 – July 1991: Chief, Civil Engineering and Services Officer Assignment Section, Air Force Military Personnel Center, Randolph AFB, San Antonio, Texas.
10. July 1991 – July 1993: Chief, Operations, 18th Civil Engineer Squadron, Kadena AB, Japan.
11. July 1993 – July 1994: Commander, 36th Civil Engineer Squadron, Bitburg AB, Germany.
12 July 1994 – January 1997: Commander, 786th Civil Engineer Squadron, Ramstein AB, Germany.
13. January 1997 – August 1997: Commander, 89th Civil Engineer Squadron, Andrews AFB, Maryland.
14. August 1997 – June 1998: Student, Air War College, Maxwell AFB, Alabama.
15. July 1998 – August 2000: Commander, 305th Support Group, McGuire AFB, New Jersey.
16. August 2000 -- Present: Chief Readiness Division, Directorate of the Civil Engineer, Headquarters Air Combat Command, Langley AFB, Virginia.

PROFESSIONAL CERTIFICATIONS:
Registered architect, Minnesota

MAJOR AWARDS AND DECORATIONS:
Legion of Merit
Meritorious Service Medal with seven Oak Leaf Clusters
Air Force Commendation Medal
Air Force Achievement Medal

EFFECTIVE DATES OF PROMOTION:
Second Lieutenant Oct. 16, 1975
First Lieutenant Oct. 16, 1977
Captain Oct. 16, 1979
Major Jan. 1, 1987
Lieutenant Colonel Jan. 1, 1992
Colonel May 1, 1998

(Current as of 16 August 2000)

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18. Kloeber, Lt Col Jack. Class Handout, OPER 745, Advanced Decision Analysis: Multiple Objective Decision Analysis (MODA). Graduate School of Engineering and Management, Air Force Institute of Technology, Wright Patterson AFB OH, 5 July 2000.

19. Kloeber, Lt Col Jack. Class Handout, OPER 745, Advanced Decision Analysis: Multiple Objective Decision Analysis (MODA). Graduate School of Engineering and Management, Air Force Institute of Technology, Wright Patterson AFB OH, 7 July 2000.

20. Kloeber, Lt Col Jack. Class Handout, OPER 745, Advanced Decision Analysis: Multiple Objective Decision Analysis (MODA). Graduate School of Engineering and Management, Air Force Institute of Technology, Wright Patterson AFB OH, 12 July 2000.

21. Kloeber, Lt Col Jack. Class Handout, OPER 745, Advanced Decision Analysis: Multiple Objective Decision Analysis (MODA). Graduate School of Engineering and Management, Air Force Institute of Technology, Wright Patterson AFB OH, 14 July 2000.

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Vita

Captain Lance D. Clark was born on [redacted] at Wright-Patterson AFB, Ohio. He graduated from Armwood High School in Brandon, Florida in June 1990. He entered undergraduate studies at Texas A&M University in College Station, Texas where he graduated with a Bachelor of Science degree in Civil Engineering in May 1995. He was commissioned through the Detachment 285 AFROTC at Texas A&M University where he was recognized as a Distinguished Graduate.

His first assignment was at Randolph AFB as the Pollution Prevention Program Manager. In April 1996, he was assigned to the 823rd RED HORSE Squadron, Hurlburt Field AFB, Florida where he served as a project engineer. In July 1999, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned the 36th Civil Engineering Squadron at Andersen AFB, Guam.

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5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Clark, Lance D., Captain, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

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Graduate School of Engineering and Management (AFIT/EN)
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WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER

AFIT/GEE/ENV/01M-01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

ACC/CEX
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Langley AFB, VA 23665-2769 DSN: 574-3044

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

The primary contingency engineering capability within the United States Air Force is provided by Rapid Engineer Deployable, Heavy Operations Readiness Squadron, Engineer (RED HORSE). This thesis examines the macroscopic organizational structure of RED HORSE; that is, the manner in which RED HORSE resources (personnel and equipment) are organized collectively, above the unit (squadron or flight) level. It builds on the findings of the Air Combat Command – sponsored RED HORSE 2010 Strategic Study, and focuses on issues of geographic location and chain of command above the unit level, as the study found these two topics were found to be vital to the accomplishment of the RED HORSE mission. Working in direct cooperation with ACC, this research uses value focused thinking and multi-attribute preference theory to create a hierarchical structure depicting the goals and objectives of a qualified decision maker (ACC/CEX). The research effort generated and evaluated 20 alternatives. The decision analysis model recommends an optimal macroscopic organizational structure whereby RED HORSE units are assigned to different theater commands as the most preferred alternative. Extensive sensitivity analysis showed that the model is very reactive to changes in objective and evaluation measure weights, indicating that further research is required.

15. SUBJECT TERMS

Decision Making, Decision Theory, Military Organizations, Organizational Realignment

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