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STANDARDIZED U.S.-LED COALITION FORCES UNIFORM

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Monterey, CA; Naval Postgraduate School

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JOINT APPLIED PROJECT REPORT

STANDARDIZED U.S.-LED COALITION FORCES UNIFORM

June 2018

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13. ABSTRACT (maximum 200 words)

The purpose of this research is to conduct a feasibility study to determine if U.S.-led coalition forces could effectively wear a standardized camouflage uniform. If not feasible, the secondary purpose is to research the aspects of partial standardization of camouflage uniforms. This research examines advantages and disadvantages of uniform standardization through a political, economic, social, technological, legal and environmental (PESTLE) and strengths, weaknesses, opportunities and threats (SWOT) analysis. It analyzes the psychological and sociological cohesiveness, as well as potential competitive advantages, of the use of more technologically superior personnel equipment.

This research examines coalition nation types of uniforms, camouflage patterns, performance specifications, uniform regulations, and procurement. The literature review consists of a research study conducted by the Government Accountability Office addressing the failure of the U.S. Department of Defense to develop a future joint combat camouflage uniform. This research addresses sociological perspectives of uniforms and their impact on team building, organizational authority, legitimacy, and social interaction control.

The findings of this research show that implementing a U.S.-led coalition camouflage uniform could result in increased personnel morale, improved unit cohesion, improved personal safety and performance, and lower procurement and outfitting costs.

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STANDARDIZED U.S.-LED COALITION FORCES UNIFORM

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

ADA	Anti-Deficiency Act
AF	Armed Forces
BAA	Buy American Act
BiH	Bosnia Herzegovina
C&T	Clothing and Textile Directorate
CADPAT	Canadian Disruptive Pattern
CBG	Coalition Building Guide
CRS	Congressional Research Service
DCAS	Defense Casualty Analysis System
DCU	Desert Camouflage Uniform
DLA	Defense Logistics Agency
DoD	Department of Defense
DODI	DoD Instruction
DPCU	Disruptive Pattern Camouflage Uniform
DPM	Disruptive Pattern Material
ERDL	Engineer Research and Development Lab
EU	European Union
FMS	Foreign Military Sales
FR	Flame Resistant
GPA	Government Procurement Agreement
ISAF	International Security and Assistance Force
JP	Joint Publication
JSF	Joint Strike Fighter
MARPAT	Marine Pattern
MCU	Multi-Terrain Camouflage Uniform
MIC	Multinational Interoperability Coalition
MLSA	Mutual Logistic Support Arrangement
MOD	Ministry of Defense
MOU	Memorandum of understanding
MTP	Multi-Terrain Pattern

NATO	North Atlantic Treaty Organization
NDAA	National Defense Authorization Act
NFP	Netherlands Fractal Pattern
NGO	Non-Governmental Organization
NPR	National Public Radio
NSO	NATO Standardization Office
NZ	New Zealand
OCP	Operational Camouflage Pattern
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OPCON	Operational Control
PESTLE	Political, Economic, Social, Technological, Legal and Environmental
RSM	Resolute Support Mission
SAT	Simplified Acquisition Threshold
SG	Steering Group
STANAG	Standardization Agreement
SWOT	Strengths, Weaknesses, Opportunities and Threats
TFEU	Treaty on the Functioning of the European Union
UCP	Universal Camouflage Pattern
UK	United Kingdom
UN	United Nations
U.S.	United States of America
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
WIA	Wounded in Action
WTO	World Trade Organization Agreement

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I. INTRODUCTION

A. BACKGROUND

The United States (U.S.) and North Atlantic Treaty Organization (NATO) forces have engaged in the Global War on Terror in Iraq and Afghanistan in response to the September 11, 2001, attacks. The U.S. along with its coalition partners have participated in these operations with their own country and service specific uniforms. The uniform is the most visible peripheral sign of military service. It identifies a service member as part of a nation and unit, and it serves as an outfit in the line of duty. Military uniforms are heavily symbolic and change the psychology of the soldier from an individual to a group. The Revolution in Military Affairs with its new technologies, digitalized command, control, communications, and surveillance capabilities has been the subject of intense academic research since the mid-1990s (Gray, 2004). The introduction of these new technologies has changed the nature of warfare. However, Prussian military leaders argued that, "war's nature does not change—only its character" (Mewett, 2014). Therefore, the nature of war fundamentally remains unchanged. Researchers are undoubtedly correct to focus on the research and development of new equipment to provide advantages on the battlefield.

Another challenge 21st century military planners are confronting is the "Coalitions" and "wartime alliances." In the post-Cold War era, U.S. coalition size has significantly grown (Weitsman, 2009). Coalitions and multinational operations have become deeply entrenched in today's military operations. "These norms became institutionalized with the evolution of U.S. military doctrine to deal with the complexities of multinational operations" (Weitsman, 2009). Former U.S. president Barack Obama once said, "In such circumstances, we should not go in alone. Instead, we must mobilize allies and partners to take collective action. We have to broaden our tools to include diplomacy and development, sanctions and isolation, appeals to international law, and, if just, necessary, and effective, multilateral military action" (Obama, 2016). As multinational operations have increased, cooperation among nations and allies has gained much more importance.

Another quieter and unnoticed transformation is the dramatic change in the uniforms worn by combat soldiers, especially the U.S. and its coalition partners. Going back approximately 400 years, we are only in the fourth uniform revolution that began in 2001 (King, 2014). The U.S. and its allies have increasingly replaced disruptive patterns with digital and pixelated camouflage designs. Even though coalition forces' military objectives may be the same, service uniforms worn are different and every nation follows its own uniform standards. Therefore, our focus will be to analyze how a singular coalition force uniform may be useful in the attainment of the singular military objective.

B. PURPOSE

Following the September 11, 2001, attacks, the U.S. Armed Services became militarily involved in Afghanistan and Iraq. Regional stabilization, insurgency defeat, reconstruction facilitation, and combatting extremism were a few U.S., NATO, and coalition force objectives. However, U.S., NATO, and the coalition forces maintained their own service uniforms while serving together during the Iraq and Afghan wars. The United Nations (UN) and NATO coalitions have devised ways to differentiate their forces while in their operational control (OPCON). However, there has been no consideration of operating with a single coalition camouflage uniform to increase cohesion and effectiveness among the forces. The U.S. has considered a single, universal camouflage pattern for all its service branches in the past but has not received positive responses from each branch leadership. The primary goal of this research is to identify advantages and disadvantages of full uniform standardization for U.S.-led coalition forces.

C. RESEARCH QUESTION

The primary research question for this thesis is: what is the feasibility for U.S.-led coalition forces to wear the same camouflage uniform in combat operations?

D. SECONDARY RESEARCH QUESTIONS

Some of the subsidiary research questions that may assist in our endeavors:

- Under what conditions would a coalition uniform make sense and how it might be implemented?
- What are the affordability impacts? Who will fund the effort?
- What are the logistical considerations?
- Are there legal constraints for different countries?
- Are there any sociological impacts within coalition forces cohesiveness and camaraderie?
- Are there any correlations in the number of casualties with more superior forces vs. secondary (lesser equipped/fewer numbers/not well trained) forces within the coalition?

E. METHODOLOGY

To address our primary research question, we must analyze the academic framework that governs the process of initiating or implementing any organizational changes. We will utilize two qualitative strategic management tools—Political, Economic, Social, Technological, Legal and Environmental (PESTLE) analysis (Shapiro, 2013) and Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis—to study the feasibility, management, and effectiveness of a standardized uniform for future conflicts (Renault, 2017). A PESTLE analysis is an analytical tool used to assess an operational environment from multiple angles. It provides an organization a framework for strategic advantage considerations and decisions. A SWOT analysis is an analytical tool used to assess organizational internal and external limitations. It assists in developing goals, overcoming obstacles, and strategically assessing current and future possibilities. These tools will also be used to study whether a joint uniform can be a source of sustained competitive advantage or become a core competency for coalition forces. The research and data for this analysis will be based on recent conflicts in Iraq and Afghanistan where coalition forces have used different camouflage uniforms.

F. ASSUMPTIONS

We have made the following general assumptions as a starting point during our research:

- Future military operations are likely to be multinational or coalition-led in character.
- The U.S. will facilitate coalition operations as the lead nation.
- Each nation of the coalition/future multinational force recognizes the importance of a joint singular military uniform.
- The most current Iraq and Afghanistan troop strength data used for our analysis.
- Initial focus for the consideration of a singular uniform pertains only to coalition partners/allies ground forces.
- The casualty percentages in Iraq and Afghanistan calculated assuming other factors of training, personnel equipment, and force capabilities as constant.

II. BACKGROUND

A. PAST U.S.-LED COALITIONS

Over the past century, use of coalitions has positively influenced world peace (Erickson, Neilson, & Prete, 1983). In today's globalized world, nations prefer to use alliances or coalitions when dealing with international crises, rather than engaging in operations on their own. Forming coalitions is a key component of U.S. defense strategy that states

> Alliances are force multipliers: through multinational cooperation and coordination, the sum of our actions is always greater than if we act alone. We will continue to maintain the capacity to defend our allies against old and new threats. We will also continue to closely consult with our allies as well as newly emerging partners and organizations so that we revitalize and expand our cooperation to achieve common objectives. And we will continue to mutually benefit from the collective security provided by strong alliances. (Joint Chiefs of Staff, 2013)

The U.S. National Security Strategy issued in 2010 emphasizes the importance of partnerships with our allies, other state partners, non-state and private actors, and international institutions, principally the UN (Obama, 2015). Allied partnerships often facilitate achievement of political and military objectives. Coalition operational advantages include burden-sharing of responsibilities among nations, military action acceptance and justification, addressing possible capability gaps, shared resources, shared expertise, and niche capabilities ("Multinational," 2015).

Today, most nations acknowledge that the preferred method of bringing worldwide peace is through coalition partnerships. The idea of multinational military operations or coalitions is not new. Most current major military operations have been joint multinational or coalition. A few examples include World War I, World War II, the Vietnam War, the Korean War, and other UN-sponsored peacekeeping operations, peace enforcement, and regional conflict devolvement. Coalition operations have increasingly become the primary focus of military activity. As a result, support for coalition peacekeeping operations, humanitarian assistance, and military conflict continues to grow. The U.S. and its allies' global interests have naturally led them to the future of warfare: joint coalition operations.

OEF and OIF are two examples where nations have joined large military coalitions and used military force to deliver policy objectives as well as establish peace.

1. Coalition Forces Operations after 9/11

The U.S. launched international military campaigns in response to the September 11, 2001 attacks with the goal of eliminating Al-Qaeda and preventing the emergence of other terrorist networks. Military operations in Afghanistan began when the U.S. initiated aerial bombing on October 7, 2001, targeting Taliban and Al-Qaeda camps (McCaeleb, 2001). This was followed by an invasion of ground troops and Special Forces. After Afghanistan, the U.S. invaded Iraq in March 2003 ("War in Iraq," 2009). The war on terrorism was a multinational campaign involving different nations. The number of countries and boots on the ground involved in both operations is explained in the following paragraphs.

a. Coalition Forces in Afghanistan

The U.S., NATO, Coalition forces, and the Afghan National Army (ANA) attempted to stabilize Afghanistan. As a result, U.S. military presence in Afghanistan continued for a number of years. The U.S. troop level in Afghanistan has changed constantly due to in-country operational requirements (see Figure 1). As of August 2017, there were roughly 11,000 U.S. troops in Afghanistan (Livingston & O'Hanlon, 2017).

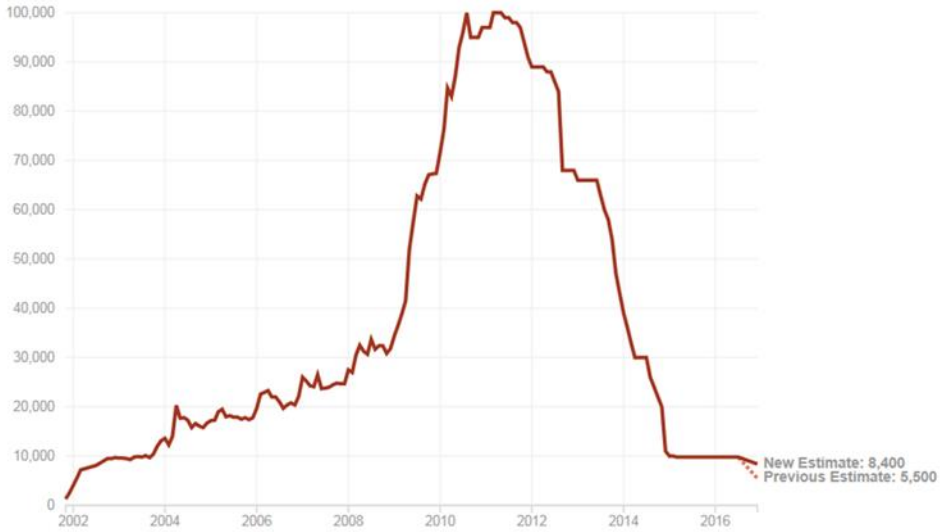

Figure 1. U.S. troop levels in Afghanistan.
Adapted from Kurtzleben (2016).

Coalition forces in Afghanistan are conducting two operational missions: the U.S.-led Operation Enduring Freedom (OEF) conducting counterinsurgency and anti-terror operations and the NATO-led International Security and Assistance Force (ISAF) providing national security for Afghanistan (Fieckert, 2007). Various countries deployed troops to both OEF and ISAF, while various countries deployed forces exclusively to ISAF (Fieckert, 2007). In 2007, 21 nations deployed troops to OEF while 37 NATO and non-NATO nations deployed troops to ISAF (Fieckert, 2007). After the stand-down of ISAF, a different NATO-led mission launched to, "Train, advise and assist the Afghan security forces and institutions" (Fieckert, 2007). The new mission named Resolute Support Mission (RSM) included 39 nations (see Figure 2) that deployed approximately 13,576 troops to RSM ("North Atlantic," RSM 2017).

	Albania	83		Germany	980		Portugal	10
	Armenia	121		Greece	4		Romania	587
	Australia	270		Hungary	90		Slovakia	38
	Austria	10		Iceland	2		Slovenia	7
	Azerbaijan	94		Italy	1,037		Spain	8
	Belgium	62		Latvia	22		Sweden	25
	Bosnia-Herzegovina	55		Lithuania	21		the former Yugoslav Republic of Macedonia[1]	39
	Bulgaria	92		Luxembourg	1		Turkey	659
	Croatia	95		Mongolia	120		Ukraine	10
	Czech Republic	223		Montenegro	18		United Kingdom	500
	Denmark	97		Netherlands	100		United States	6,941
	Estonia	4		New Zealand	10			
	Finland	29		Norway	42			
	Georgia	872		Poland	198		Total	13,576

Figure 2. Nations contributing troops to RSM as of 9 June 2017. Adapted from "North Atlantic RSM" (2017).

b. Coalition Forces in Iraq

Operation Iraqi Freedom (OIF) began in March 2003 and involved 37 participating nations. These nations deployed approximately 150,000 ground troops (see Figures 3 and 4) from the start of the operation through 2009 (Carney, 2011). U.S. soldiers together with their coalition partners were a significant contributor to Iraq's stabilization. Although coalition forces provided further resources and different capabilities, U.S. Army planners were challenged in the integration of various military partners into U.S. operational plans (Carney, 2011).

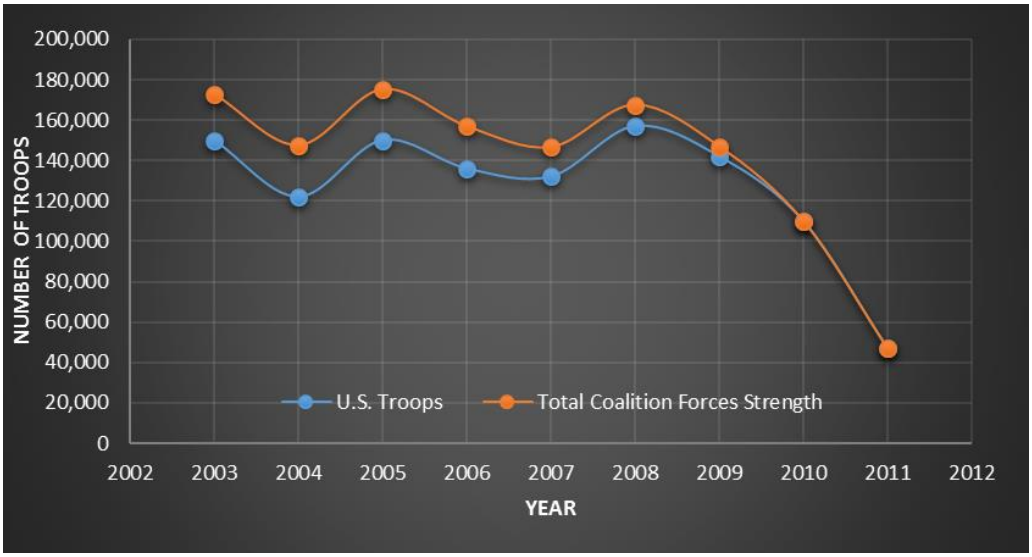

Figure 3. Troop numbers in Iraq. Adapted from "Troop Numbers" (2011).

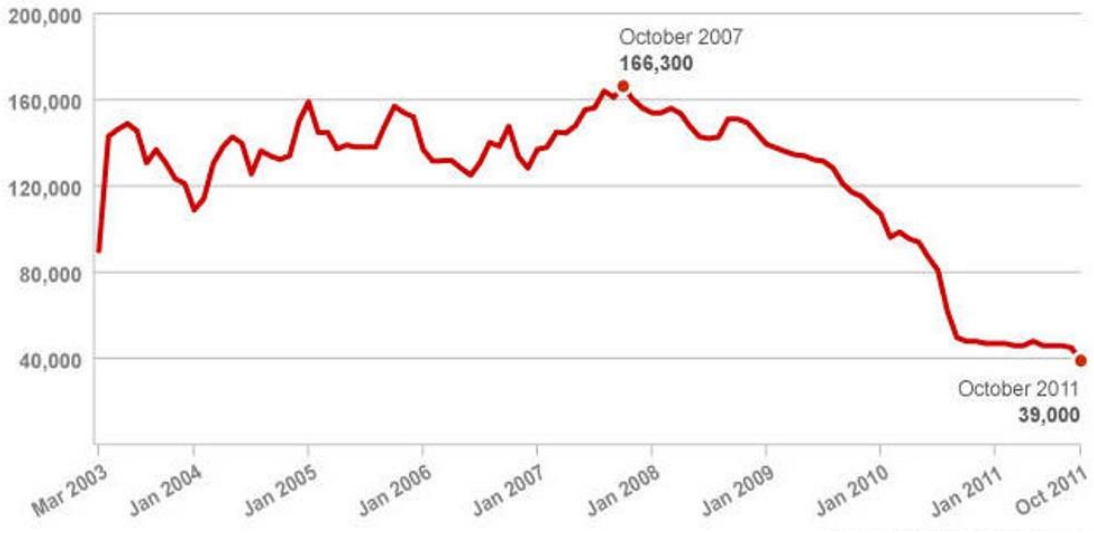

Figure 4. Number of U.S. troops in Iraq. Adapted from "Chart" (2011).

Allied forces conducted security operations and provided reconstruction assistance in OIF. Coalition forces' capabilities varied considerably, which affected mission availability. However, this study will only focus on the gaps in uniform standardization

and analyze its effects on overall mission. Allied nations' OIF troop deployment numbers are provided in Figure 5.

	Albania	240	1,320		Itay	2600	7,800		Portugal	128	256
	Armenia	50	372		Japan	600	6100		Reblic of Korea	3,600	20,000
	Australia	515	2,400		Kazakhstan	29	320		Romania	730	6,600
	Azerbaijan	175	1,100		Latvia	126	1,150		Slovakia	85	425
	Bosnia Herzegovina	85	295		Lithuania	750	850		Spain	1,300	4,100
	Bulgaria	496	1,110		Macedonia	80	420		Thailand	433	866
	Czech Republic	357	2,000		Moldova	20	110		Tonga	55	200
	Denmark	545	5,500		Mongolia	180	1,128		Ukraine	1,630	7,000
	Domincan Republic	302	600		Netherlands	1345	7,564		United Kingdom	46,000	102,000
	El Savador	380	5,800		New Zealand	161	250		United States	165,000	
	Estonia	40	240		Nicaragua	115	115				
	Georgia	1,850	10,000		Norway	150	300				
	Hondorus	368	736		Philippines	51	100		Peak deployment		
	Hungary	300	600		Poland	2400	13,900		Total deployment (cumulative)		

Figure 5. Allied nation OIF troop deployment numbers as of 30 September 2011. Source Carney (2011).

2. Types of Camouflage Uniforms

The term camouflage came into widespread use during World War I, and the major focus of concealment was on tanks, artillery pieces, vehicles, bunkers, and observation posts. The U.S. Army history of camouflage adoption dates back to World War I when special camouflage units formed. "The U.S. Army formed a camouflage unit made up of camofleurs—people who were artists and designers in their civilian lives" (Durando, 2014). Camouflage in uniforms has seen continuous development throughout military history starting with plain green and brown overall to the modern computer-generated pixelated uniform patterns. However, this study will focus on coalition forces' uniforms used in the Iraq and Afghanistan wars after 2001. Most coalition nations participated in both operations, so our primary focus will be on the current or existing camouflage uniforms of those partners consistent with U.S.-led coalitions.

a. Albania

Albanian forces deployed in Afghanistan have worn a copy of MultiCam®, a pattern that focuses on the way the brain perceives shape, volume, and color to blend the wearer ("Albania," n.d.). The current camouflage pattern (see Figure 6) first appeared in 2012 on the 100th anniversary of the Albanian State (Albanian Armed Forces, n.d.). The pattern is pixelated drawing-based.

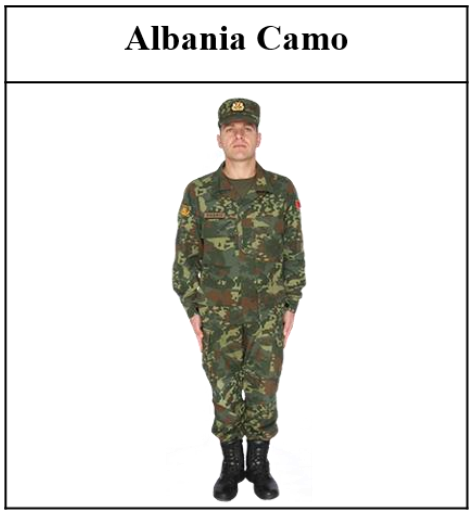

Figure 6. Albanian uniform camouflage pattern.
Adapted from Albanian Armed Forces (n.d.).

b. Armenia

Following the footsteps of Canada and the U.S., a pixelated camouflage pattern was adopted by Armenia for general issue to its AFs (“Armenia,” n.d.) (See Figure 7). “The camouflage pattern incorporates medium brown, olive green and black shapes on a khaki background, which have applicability only in sparsely vegetated or arid regions” (“Armenia,” n.d.).

Figure 7. Armenian uniform camouflage pattern. Adapted from “Armenia” (n.d.).

c. Australia

Australia issued the Disruptive Pattern Camouflage Uniform (DPCU) to its troops deployed to Afghanistan (Figure 8). Three patterns of the Australian camouflage uniform were developed. The first pattern was a three-color camouflage, while the second and third patterns were almost identical with only slight color variations (Brayley, 2009). Australia launched a new hybrid pattern, however, Australian Multi-Camouflage Uniform (AMCU) at the Chief of Army's Exercise in Brisbane on September 22, 2014 (Australian Army, 2016). The improved design will enhance soldier's survivability and mobility and will be functional for employment in a variety of terrains and operational environments.

Figure 8. AMCU.
Adapted from "Australian MultiCam®" (2014).

d. Austria

By mid-2018, the Bundesheer forces are expected to be outfitted in new uniforms featuring “a unique, Austrian camouflage pattern” (see Figure 9) (“Austria,” n.d.). Its characteristics include the combination of a six-color pattern “in a variegated pattern that is intended to replicate the type of native vegetation found in Austria” (“Austria,” n.d.).

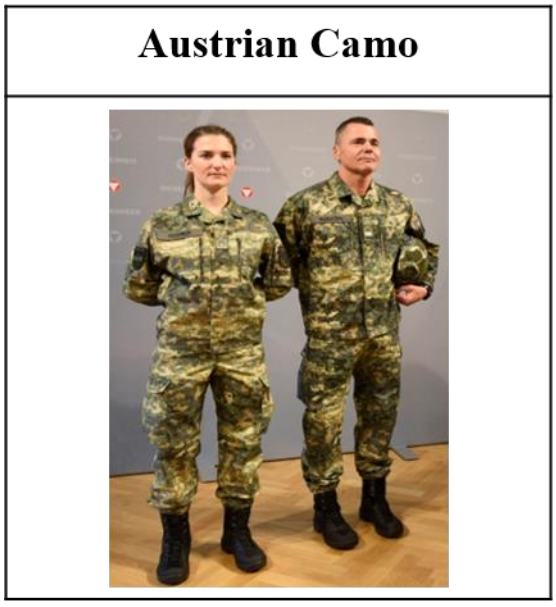

Figure 9. Austrian new battle dress.
Adapted from Cramer (2017).

e. Azerbaijan

The Azerbaijani AFs wear Turkish-pattern arid digital camouflage uniforms. This new camouflage pattern was adopted in 2013. Azerbaijani peacekeepers seen in Figure 10 are wearing the Turkish camouflage pattern while being sent off to Afghanistan to serve with the NATO-led Resolute Support Mission (Azerbaijan Ministry of Defense [MOD], 2018).

Figure 10. Azerbaijan uniform camouflage pattern. Adapted from "Azerbaijan" (2018).

f. Belgium

The Belgian Army wears its own indigenous camouflage pattern nicknamed "jigsaw" (see Figure 11) for its resemblance to multicolored jigsaw puzzle pieces (Borsarello, 1999, p. 15). The design, introduced in 1956, includes four different variants. Belgium's third variation of the jigsaw pattern, introduced in 2004, has a distinctive desert camouflage pattern and was used during the ISAF operations in Afghanistan ("Belgium," n.d.).

Figure 11. Belgian jigsaw pattern, desert variation.
Adapted from "Belgium" (n.d.).

g. Bosnia Herzegovina

The Bosnia Herzegovinian (BiH) AFs wear a Twill Woodland digitized camouflage pattern (see Figure 12) similar to the U.S. Marine Corps (USMC) MARPAT ("Bosnia," n.d.). The Bosnian contingent deployed to Afghanistan and Iraq wore tri-color desert camouflage uniforms.

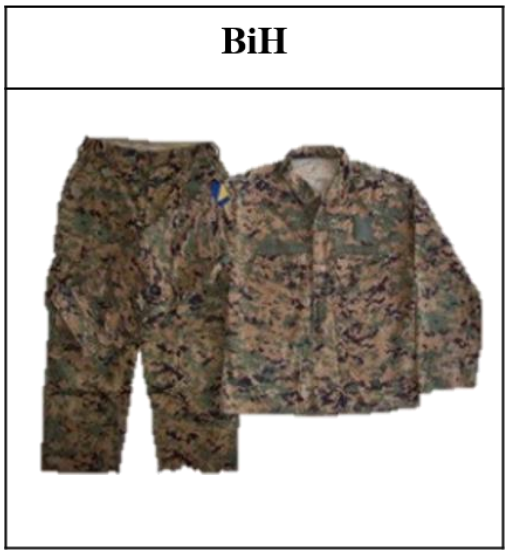

Figure 12. Bosnian camouflage pattern.
Adapted from "Bosnia" (n.d.).

h. Bulgaria

Bulgarian troops deployed to Afghanistan used a desert camouflage uniform with stone base color overprinted with irregular patches of very light green and medium brown (Brayley, 2009, p. 24). This camouflage pattern as seen in Figure 13 is similar to U.S. desert camouflage uniforms.

Figure 13. Bulgarian desert camouflage pattern Adapted from Brayley (2009).

i. Canada

In 1997, Canada officially adopted the first distinctive new uniforms, a digitalized pattern called Canadian Disruptive Pattern (CADPAT™), with two separate design patterns for woodland and arid environments (Cramer, n.d.; Figure 14). This uniform was introduced as a major part of the Department of National Defense "Clothe the Soldier Program" (Canadian Military Police, n.d.). CADPAT™ incorporates near-infrared protection designed to conceal soldiers from night vision devices (Canadian Armed Forces, 2002). In 2002, based on CADPAT, the U.S. Marine Corps developed their own digitalized Marine Pattern (MARPAT) (Alvarez & Daugherty, 2016, Chapter 11, An All Weather Training Facility, para. 3).

Figure 14. CADPAT™ patterns.
Adapted from Canadian Military Police (n.d.).

j. Croatia

Croatian AFs use a pixelated camouflage pattern with embedded digitized map of Croatia (see Figure 15). The pixelated designs are intended for deployment to temperate/ woodland, desert, and urban landscapes. The design closely resembles USMC MARPAT.

Figure 15. Croatian pixelated pattern.
Adapted from Seven (2009).

k. Czech Republic

Czech AFs wear the camouflage pattern designated as Vz. 95 leaf pattern. The camouflage pattern is similar to the U.S. Engineer Research and Development Lab (ERDL) camouflage pattern. Two variations of the Vz. 95 pattern are currently in use (Czech Ministry of Defense, 2012; Figure 16).

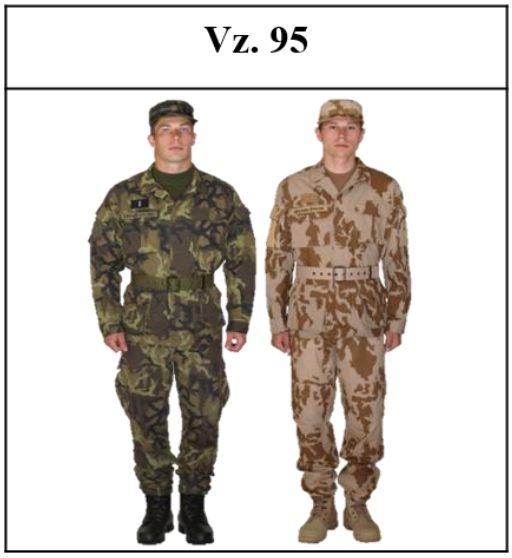

Figure 16. Czech Vz. 95 pattern.
Adapted from Czech Ministry of Defense (2012).

l. Denmark

Initially Denmark used the M/84 pattern similar to the German “Flecktarn” camouflage pattern (Brayley, 2009, p. 35). In 2011, the Danish Defense Acquisition and Logistics Organization introduced the new M/11 combat uniform similar to the MultiCam® pattern used by U.S., Australian, and British forces in Afghanistan (Figure 17).

Figure 17. Denmark combat uniform M/11. Adapted from “Denmark” (n.d.).

m. Estonia

Estonia has adopted a pixelated pattern similar to the Canadian camouflage pattern (CADPAT). The pattern has sparse brown and grey color over sandy background for deployments to desert regions (see Figure 18).

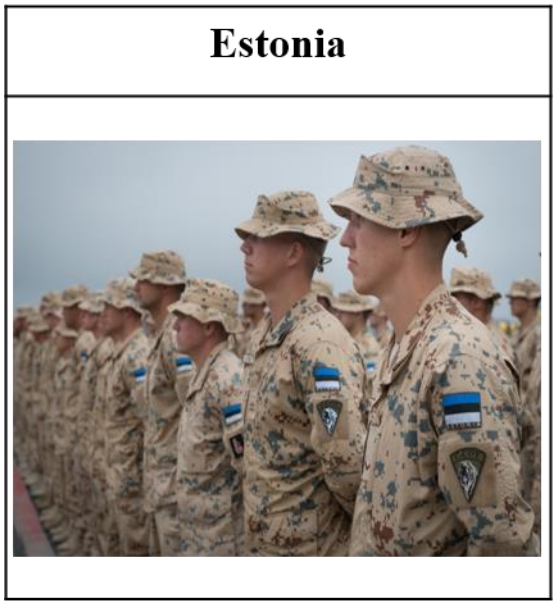

Figure 18. Estonian pixelated pattern.
Adapted from "Republic of Estonian Government" (2014).

n. Germany

German AFs have used two patterns since 1990: the Flecktarn and Wusterntarn patterns (Figure 19). Flecktarn comes from the German word Fleck meaning spot and Tarnung meaning camouflage (Sathivel, 2017). German AFs use two variations of the Flecktarn pattern, the woodland and Wusterntarn. The woodland type incorporates "dark green, light green, red, black and tan" (Sharp, 2016). The desert-type Wusterntarn incorporates "tan, brown and green" shades (Sharp, 2016). Wusterntarn is regarded as highly effective and has been influential in other countries like Japan, Poland, and China (Dougherty, 2017).

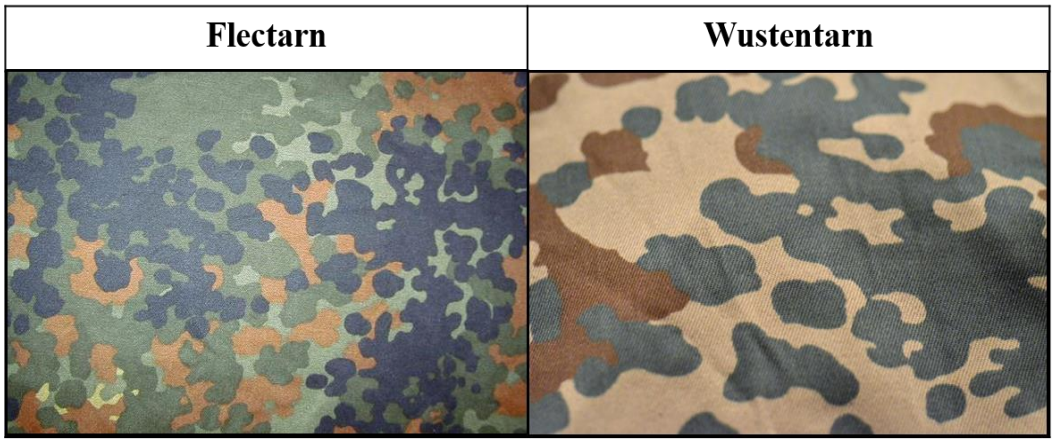

Figure 19. German woodland and arid camouflage patterns. Adapted from Sharp (2016).

o. Italy

The Italian Army uses the “Vegetata” camouflage pattern introduced in 2004 (Figure 20). It appears to be a digital camouflage, but the camouflage scheme is not pixelated. It is made from rip-stop fabric (Brayley, 2009, p. 55).

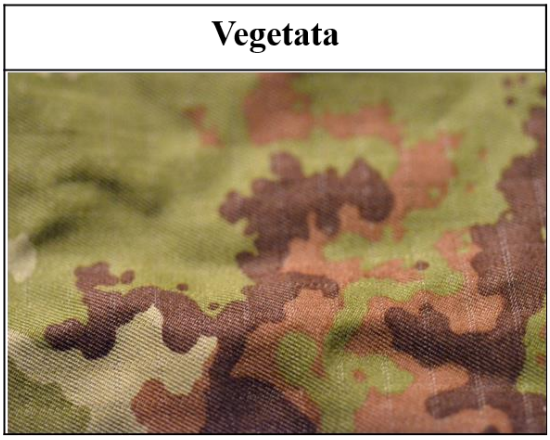

Figure 20. Italian camouflage pattern. Adapted from Sharp (2016).

p. Latvia

Latvian AFs adopted their own design pattern called the LATPAT comprising "large dark grey, nearly black, medium brown and khaki squares on a sandy background" ("Latvia," n.d.; Figure 21).

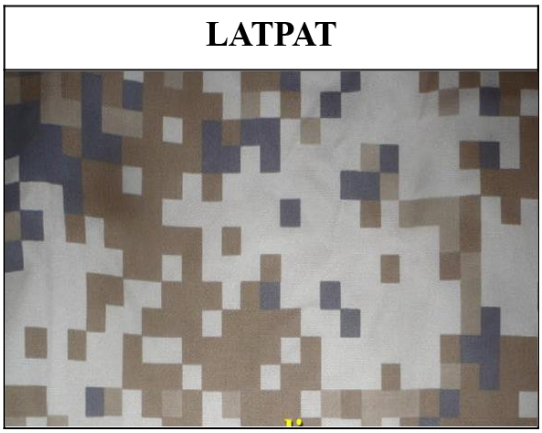

Figure 21. Latvian camouflage pattern. Adapted from "Latvia" (n.d.).

q. Lithuania

The Lithuanian M05 four-color pattern is the standard operational uniform for its ground forces. Different variations of the camouflage pattern are utilized to suit prescribed operational environments (Figure 22).

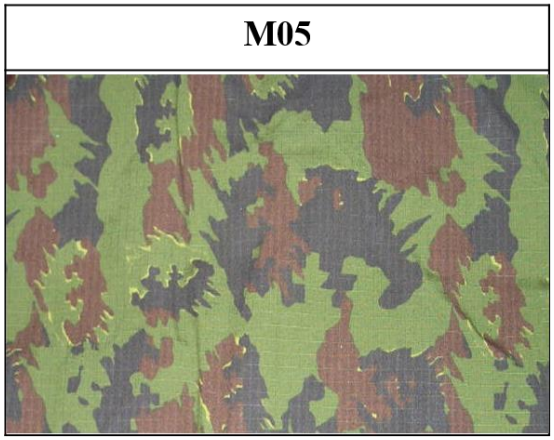

Figure 22. Lithuanian camouflage pattern. Adapted from “Lithuania” (n.d.).

r. Luxembourg

The Luxembourg Army's approximately fewer than 1,000 troops have worn the U.S. M81 woodland pattern since 1968 (Borsarello, 1999). Luxembourg troops deployed to Afghanistan have also worn the Belgian Army desert camouflage pattern uniform (Figure 23).

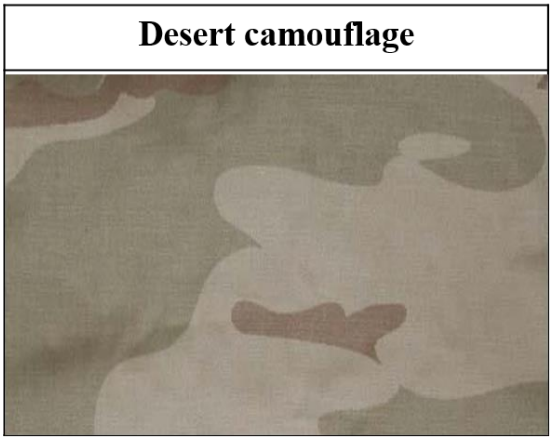

Figure 23. Luxembourg desert camouflage pattern. Adapted from "Luxembourg" (n.d.).

s. Netherlands

The Dutch Army adopted the Netherlands Fractural Pattern (NFP) as their official new camouflage uniform in 2014 (“Dutch Army,” 2014). NFP is used in two variants: Green Woodland and Tan Arid (Figure 24).

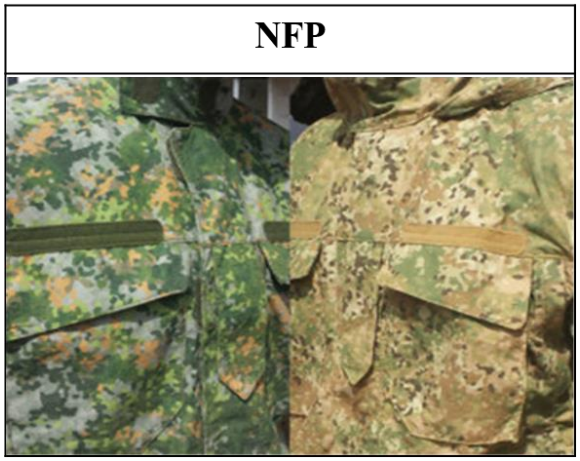

Figure 24. NFP camouflage pattern.
Adapted from “Dutch Camo” (2013).

t. New Zealand

The New Zealand (NZ) Army has introduced the Multi-Terrain Camouflage Uniform (MCU), worn by deployed troops in support of combat operations. “The new MCU has a camouflage pattern that works in multiple environments including jungle, scrub, arid, desert and urban.” (“Multi Terrain,” 2015; Figure 25). This single camouflage pattern is effective across a wide range of operating environments.

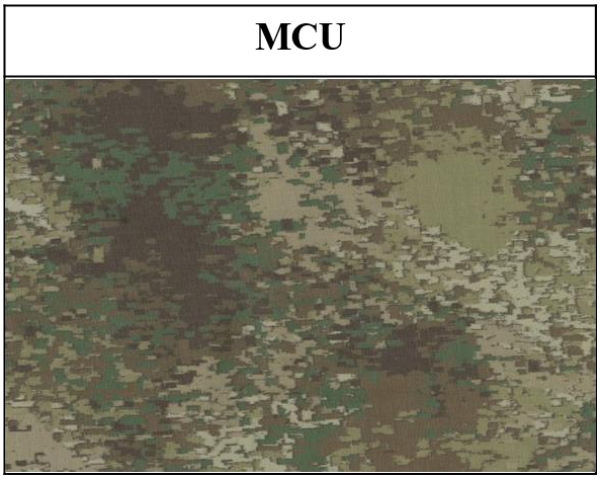

Figure 25. NZ Army multi-terrain camouflage. Adapted from “Multi Terrain” (2015).

u. Norway

Norwegian Army fielded the M/98 camouflage pattern in 1998 with a rip-stop fabric and different color variations for the green and arid environments (Figure 26).

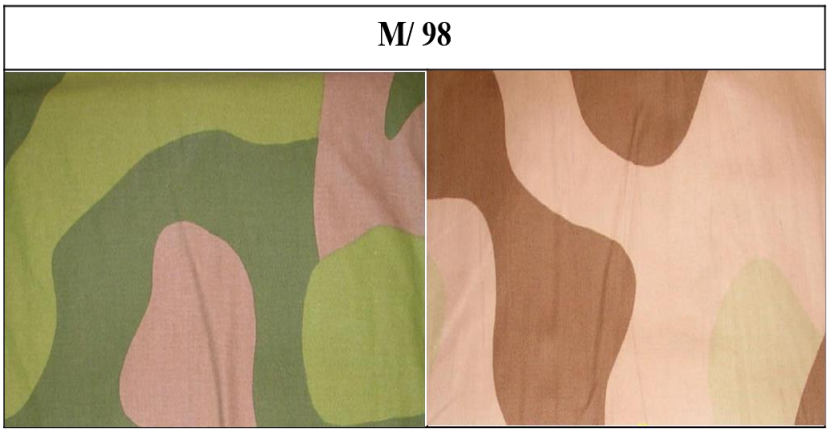

Figure 26. Norwegian camouflage pattern. Adapted from "Norway" (n.d.).

v. Poland

Polish AFs wear a four-color Wz93 “Pantera” design pattern (Brayley, 2009, p. 70; Figure 27). It is a woodland pattern composed of “light green, dark green, brown and black colors” (Brayley, 2009). Introduced in 2003, the desert version of the Wz93 was used in the Iraq and Afghanistan wars by Polish military personnel.

Figure 27. Polish Wz93 patterns.
Adapted from “Ministry of National Defence” (n.d.).

w. Portugal

Portuguese AFs wear a camouflage pattern similar to the British Disruptive Pattern Material (DPM). Introduced in the mid-1990s, DPM replaced the older "Lizard" pattern camouflage (Brayley, 2009, p. 71). Two variants of the DPM are being used (Figure 28).

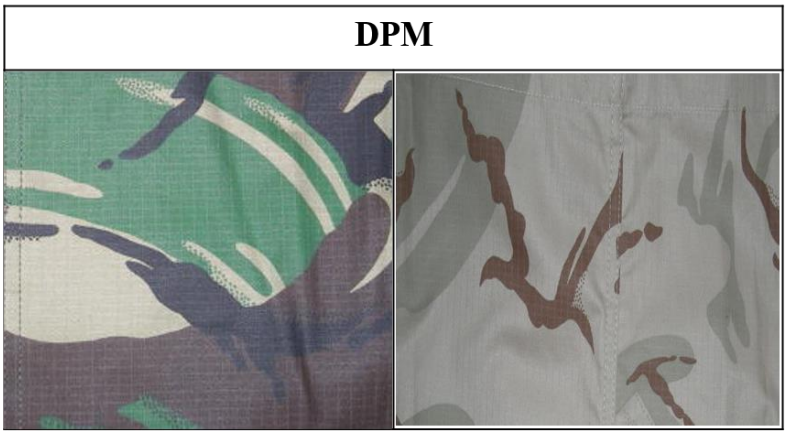

Figure 28. Portuguese camouflage pattern. Adapted from "Portugal" (n.d.).

x. Romania

Romanian troops used DPM camouflage uniforms in Iraq and Afghanistan. The Romanian Army introduced new patterns with different color variants in 2017 (Perez, 2018). The new camouflage pattern utilizes fractal shapes (Figure 29). The Army version is similar to the color scheme of MultiCam®.

Figure 29. Romanian camouflage pattern. Adapted from Perez (2018).

y. Slovenia

Slovenian troops deployed to Afghanistan utilized the U.S.-supplied tricolor desert camouflage uniform ("Slovenia," n.d.). However, in 2013, Slovenian ground forces decided to change their woodland pattern to SloCam that has five color shades and is effective in vegetated, barren, and urban areas ("SloCam," 2013; Figure 30). This camouflage pattern resembles the MultiCam®.

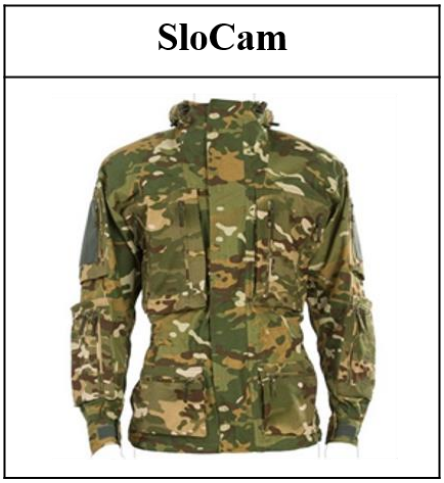

Figure 30. Slovenia camouflage pattern.
Adapted from "Slovenian Land" (2014).

z. Spain

The Spanish Army adopted the camouflage pattern known as M09 Ejercito Pixelado, with two variations; woodland and desert ("M09 Spanish," n.d.; Figure 31). Spanish forces used the desert version while deployed to Afghanistan. The pattern is similar to MultiCam®, with a slight difference in color and shapes of the pixels. Both variations have proven to be very effective in their respective terrains.

Figure 31. Spanish M09 pattern.
Adapted from "New Spanish" (2010).

aa. Turkey

Turkish AFs adopted their own new camouflage pattern in 2008. The pattern is effective in both arid and desert environments (Figure 32).

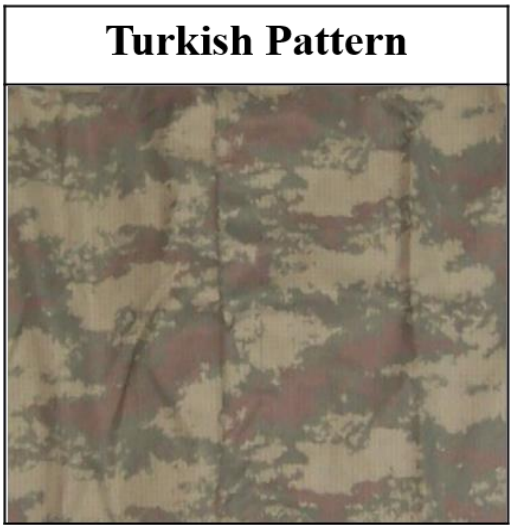

Figure 32. Turkish camouflage pattern.
Adapted from Sergiy (2010).

bb. Ukraine

In 2016, Ukraine adopted western-style uniforms for their AFs (Figure 33). Ukrainian troops wore British-style outfits during a parade in Kiev, to celebrate 25 years of independence (Lukatsky, 2016). Ukrainian special forces have been observed wearing uniforms with a camouflage pattern similar to the U.S. Operational Camouflage Pattern (OCP) (Threvithick, 2017).

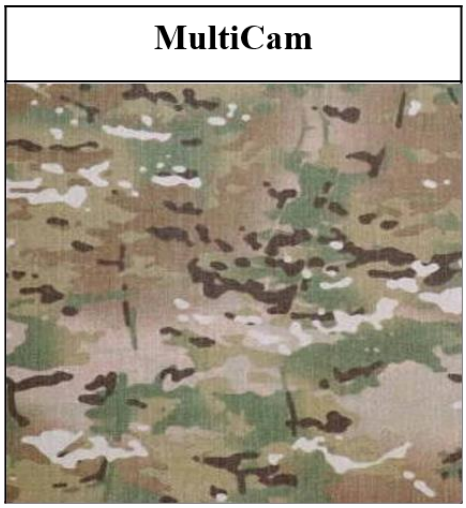

Figure 33. Ukrainian MultiCam® Pattern. Adapted from “Ukraine” (n.d.).

cc. United Kingdom

First issued in 1969, British forces used the Disruptive Pattern Material (DPM) developed by Army Personnel Research Establishment in Farnborough (Blechman, 2011). In 1995, a new improved version of the DPM was introduced named the "Soldier 95" uniform, which was capable of functioning in any environment. Much of the original DPM was retained, but major improvements were made in the fabric, modern design, and layered pattern system (Tanner, 2014). In 2011, the next major camouflage pattern change was introduced and called the Multi Terrain Pattern (MTP). This pattern derived from the MultiCam® camouflage pattern developed by a U.S. company, Crye Precision, in partnership with the U.S. Army (Copping, 2009). The MTP is "designed to blend with a range of environments such as woodland, jungle, compounds, crops, grassland and arid stone" ("Personal Clothing," n.d.; Figure 34).

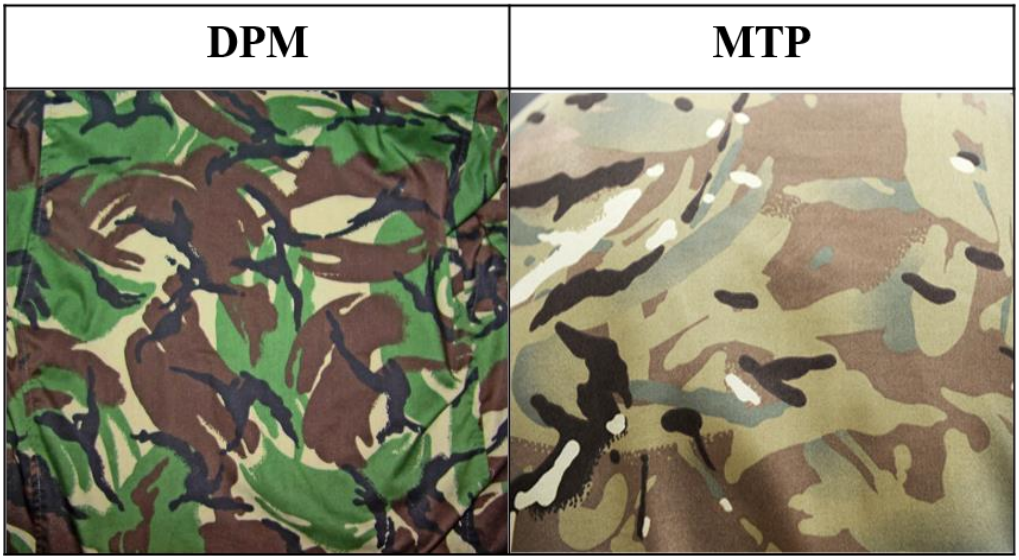

Figure 34. British camouflage patterns.
Adapted from Dougherty (2017).

dd. United States

The U.S. military has used multiple patterns among its service branches but we will primarily focus on ground forces for this study. In 2002, the Marine Corps adopted a Marine Corps Combat Utility Uniform (MCCUU) called the Marine Pattern (MARPAT) derived from the CADPAT. The MARPAT has two variations: woodland and desert (Figure 35). The MARPAT is the first digital pattern uniform adopted by the U.S. military. The MARPAT desert uniform has been used in OEF and OIF.

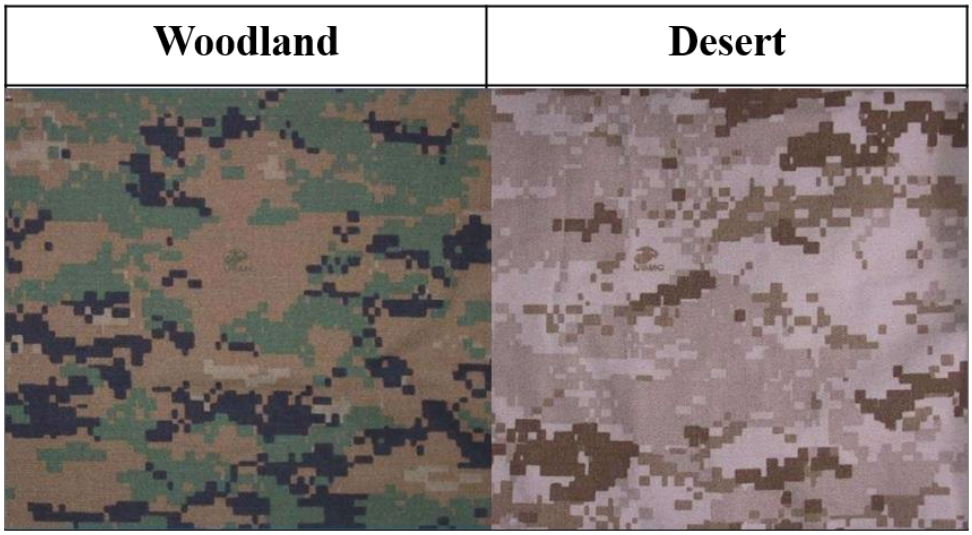

Figure 35. MARPAT.
Adapted from Cramer (2013).

In 2004, the Army followed suit and adopted a digital three-color Universal Camouflage Pattern (UCP) (Durando, 2014). The UCP is, "a computer generated pixelated uniform with a mix of green, tan, and grey that helps soldiers blend into desert, woodland and urban environments" (Durando, 2014). In April 2015, the Army revealed Operational Camouflage Pattern (OCP) uniforms, a MultiCam® commercial pattern developed by Crye Precision LLC, now referred to as Operation Enduring Freedom Camouflage Pattern (OEF-CP), which would be issued to troops deployed to Afghanistan, Iraq, and Europe (Tan, 2015). "Col. Bob Mortlock, former head of the Army's Project Manager Soldier Protection and Individual Equipment, said the OCP has been optimized for performance across all the

military operating environments that the Army may face. It has also been optimized for night-time operations" (Cox, n.d.). OCP is similar to the MultiCam® pattern also known as Scorpion W2 developed in 2002 by Crye Precision LLC for the Army's Objective Force Warrior Program (Cox, 2015).

U.S. camouflage uniform design also incorporated higher performance specification standards. U.S. forces camouflage uniforms are treated with permethrin insect repellent, made with a combination of rayon fabrics for flame resistance, and specially coated for night operations with a classified treatment. The UCP and OCP patterns are shown in Figure 36.

Figure 36. U.S. Army UCP and OCP patterns.
Adapted from Army, (n.d.).

3. Summary of Coalition Forces Uniforms

Upon review of the various uniforms used by nations involved in OEF and OIF, we can summarize that:

- U.S., Canada, UK, and Germany lead military uniform research, development, and adoption of various uniform patterns.

- Coalition nations used different derivatives of DPM, pixelated MultiCam®, and OEF-CP patterns. Current camouflage patterns adopted by the U.K., Australia, Romania, and Denmark are similar to the U.S. OEF-CP pattern.

- Camouflage patterns used by smaller nations are influenced by the camouflage patterns adopted by the U.S., UK, and Germany.

B. UNIFORM REGULATIONS

1. NATO Standardization Agreements

After the fall of the Axis Powers at the end of World War II, a new threat emerged: the rise of the Soviet Union. To address the Soviet threat, the Treaty of Brussels was signed as a mutual defense agreement between UK, France, Belgium, Luxembourg, and the Netherlands. The world quickly realized that the communist threat had significant political influence and military might threatened to sweep all the way to the Atlantic Ocean nations and North America, a move that the Treaty of Brussels would not be able to contain. Taking this threat, several European political and military leaders met with Pentagon officials led by Secretary of State George C. Marshall to discuss a new military alliance.

After only a few short months and greater emphasis on trans-Atlantic security cooperation, NATO was created. The new treaty was signed on 4 April 1949 in Washington, DC, by 12 nations including the U.S., Canada, Italy, Portugal, Denmark, Norway, Iceland, and the original five signatories of the Treaty of Brussels. This treaty committed each member nation to a collective defense against the Soviet Union or other aggressors. This collective defense involved allocating resources, sharing risks and responsibilities, and upholding common values of "individual liberty, democracy, human rights and the rule of law" (NATO, 2018).

This multinational alliance created the need for standardization and interoperability, leading to the establishment of the Military Standardization Agency on 15 January 1951, which later evolved in July 2014 into the NATO Standardization Office (NSO). The NSO is the "lead agent for the development, coordination, and assessment of operational standardization" for the Military Committee who "directs and guides

standardization activities." One of the core principles of the Military Committee revolves around the understanding that there is an "evolving nature of operations, increased partner participation in Allied operations, interoperability between NATO forces and non-NATO entities, to include military contributions, necessitate a high level of interoperability amongst all actors. The required level of interoperability can be best achieved through standardization" ("North Atlantic," 2017).

Participating nations must use agreed-upon administrative processes, operational and tactical procedures, battlefield technology and performance, and military terminology. The Standardization Agreement (STANAG) defines the conditions that the member nations, NATO structures, non-governmental organizations, and other non-defense government departments will adhere to in order to seamlessly operate. Several STANAGs dictate the standardization of technology, performance, and visual markings of personal protective equipment, uniforms, and other battlefield gear as well as standardization for supply chain procedures. The following lists significant STANAGs that relate to uniforms, equipment, and procedures ("North Atlantic," n.d.):

- NATO – STANAG 3150 edition 8. Codification – Uniform System of Supply Classification (30 March 2004) where Participating nations agree that NATO will adopt the U.S. "Federal Supply Classification System."
- The NATO Uniform System of Supply Classification with the NATO Uniform System of Item Identification (STANAG 3151) forms the basis for the NATO Codification System
- STANAG 2019. NATO Joint Military Symbology
- STANAG 2116. NATO Codes for Grades of Military Personnel
- STANAG 2138. Troop Trial Principles and Procedures – Combat Clothing and Personal Equipment
- STANAG 2311. Principles Governing the Design of the Individual Load Carrying Equipment of the Combat Soldier

- STANAG 2333. Performance and Protective Properties of Combat Clothing
- STANAG 2335. Interchangeability Combat Clothing Sizes
- STANAG 2352. Chemical, Biological, Radiological, and Nuclear Defense Equipment Operational Guidelines
- STANAG 2835. NATO Ultraviolet Reflecting White Color for the Camouflage of Military Equipment in Snow Environments
- STANAG 2836. Removable Paints for Camouflage
- STANAG 2931. Orders for the Camouflage of Protective Medical Emblems on Land in Tactical Operations
- STANAG 4364. Waterproof Clothing
- STANAG 4563. Tropical Field Clothing System (Climate Zones B1, B2, and B3)
- STANAG 4573. Design Criteria for Arctic Clothing (Climate Zones C0, C1, C2, and C3)
- STANAG 3150. Uniform System of Supply Classification
- STANAG 3151. Uniform System of Item Supply Identification

2. UN Uniform Regulations

UN peacekeeping force comprising personnel from various member countries have served in 56 UN peacekeeping operations to date. “Military personnel in peacekeeping operations remain members of their own national establishments but serve under the operational control of the UN and are expected to conduct themselves exclusively in accordance with the international character of their mission. They wear their national uniforms, but also wear blue berets or helmets and the UN insignia.” (“United Nations,” 2003, p. 4).

3. U.S. Uniform Rules and Regulations

a. U.S. Uniform Procurement

U.S. military uniforms are procured under the following DoD guidance and provisions:

- The Berry Amendment, established in 1941 to protect U.S. industry during periods of conflict and requiring the DoD to purchase identified American products exclusively. Products include clothing (military uniforms), tools, fabrics, food, and stainless steel.
- Federal Acquisition Regulation (FAR) "established for the codification and publication of uniform policies and procedures for acquisition by all executive agencies" (Federal Acquisition Regulation, 2018).
- "DoD Instruction 4160.1-R, DoD Supply Chain: Material Management Regulation, which describes the process of materiel management within the DoD supply chain system" (Grasso, 2015).
- "DoD Instruction 4140.63, Management of DoD Clothing and Textiles (Class II), which outlines the authority, policy, and responsibilities for the management of DoD clothing and textiles…" (Grasso, 2015).
- Fiscal Year 1998, National Defense Authorization Act, Section 850 mandates that requirements notice and contract solicitation be accomplished "through a single, government-wide point of entry. The Federal Business Opportunities (FedBizOpps) site is the electronic, government-wide entry point for information on all federal contracts over $25,000" (Grasso, 2015).
- Defense Logistics Agency (DLA) internal regulations.

DLA, a DoD agency headquartered in Ft. Belvoir, VA, "is DoD's largest combat support agency, providing worldwide logistics support for the U.S. military services, civilian agencies, and foreign countries" (Grasso, 2015). DLA Troop Support, a supply center headquartered in Philadelphia, PA, is responsible for U.S. military uniform procurement. The Clothing and Textile (C&T) Directorate, a section within DLA Troop

Support, is a uniform, textile, and equipment supplier. C&T procures U.S. military uniforms usually via competitive contracts. C&T may procure and provide uniform material to contractors vice purchasing finished products in order to gain higher quality and cost savings. Legislative initiatives pertaining to military uniform procurement are regularly proposed and passed as the government seeks to maintain a competitive advantage and provide its armed services with the highest quality uniforms.

b. Funding Policy

The U.S. Constitution Article I, Section 8 states, *"The Congress shall have power to lay and collect Taxes, Duties, Imposts, and Excises, to pay the Debts and provide for the common Defense and general Welfare of the United States…"* ("Article I," n.d.). This provision covers a portion of congressional allocation of power regarding national defense and is where military funding authorization begins. Congress receives the annual defense budget from the President and once approved, funding is allocated to the Department of Defense.

c. Berry Amendment

It is important to note that laws exist that regulate the procurement of equipment and uniforms for the military. The Berry Amendment, 41 U.S.C. § 2533a was enacted in 1941 to ensure the DoD provided U.S. military personnel with only American-made uniforms, only American-produced food, and to protect U.S. industry during periods of conflict. The Berry Amendment governs only DoD procurement and pertains specifically to federal government contracts (Grasso 2014). Therefore, any activities expending funds on behalf of federal agencies must comply with specified Berry Amendment restrictions. A Berry Amendment violation would likely result in violation of the Anti-Deficiency Act (ADA) (31 U.S.C. § 1341). "The Berry Amendment contains a number of domestic source restrictions that prohibit DoD from acquiring food, clothing, fabrics (including ballistic fibers), specialty metals, stainless steel, and hand or measuring tools that are not grown or produced in the U.S." (Grasso 2014).

4. Summary of Uniform Regulations

NATO member states are already following specific STANAGs to operate seamlessly in a multinational operational environment. These STANAGs dictate standardized guidelines for adopting performance and properties of combat clothing, its supply chain, and interchangeable clothing sizes. Thus, NATO member states are following the same guidelines for their country-specific uniforms. NATO member countries are likely to transition smoothly towards a joint coalition uniform in case the member states decide to do so. UN member countries in peacekeeping operations wear their national uniforms with the exception of blue helmets and UN insignia. This policy can be adopted as well in case the resistance towards a joint uniform is high. We think that the Berry Amendment that restricts the DoD to only American uniforms might be a hurdle towards the implementation of a joint coalition uniform.

C. FOREIGN NATIONS UNIFORM PROCUREMENT POLICY

1. European Union Nations Procurement Policies

European Union (EU) member nations adhere to the EU Commission (The Commission) defense procurement Directive 2009/81/EC. The directive provides overarching regulations and procedures for contracts in the security and defense sectors that EU nations incorporate within their own procurement rules. Through this EU directive, commonalities in procurement rules become apparent throughout. In a Law Business Research publication in 2017 titled "Getting the Deal Through: Defense and Security Procurement," six EU countries that have been part of the major coalition forces were highlighted (Nackman, 2017, p. 2). Germany, Norway, Poland, Sweden, Italy, and the UK all have to include provisions in their procurement policies that do not discriminate against companies based on their nationality. Contracting procedures must ensure transparent and open competition. This precludes these nations from having preferential treatment for local vendors during source selection. These stipulations lead to two criteria of having the "lowest price "while providing the "most economically advantageous tender" ("The European Parliament," 2016). While the Commission requires open market competition and full transparency, sovereign nation security is still a priority. Article 346 of the Treaty

on the Functioning of the European Union as contained in the Official Journal of the July 2016 allow nations to take measures to protect "essential interests of its security which are connected with the production of or trade in arms, munitions and war materiel" ("The European Parliament," 2016).

a. Germany

The Commission's 2009 directive bound Germany's procurement regulations contained in the Public Procurement Regulation for Contracts in the Fields of Defense and Security as well as in Part IV of the German Act Against Restraints for Competition (Nackman, 2017, p. 14). Germany does not have any provisions regarding providing preference over local vendors. There are no restrictions on bidding and awards by foreign contractors and no rule exists that provides preferential treatment for any treaty partner nations (Nackman, 2017, p. 14).

b. Norway

Norway's legal framework is largely based on The Commission's procurement directive in terms of providing open and fair competition without regard to a contractor's national origin. Their defense rules can be found in the Public Procurement Act No. 73 and the Regulation No. 974 on Public Procurement (Nackman, 2017, p. 41). Contracts that contain national security classifications and sensitivities can be exempted from foreign contractors and only allow local companies to bid. In addition, for existing bilateral security agreements, Norway can elect to give preference to those specific partners for classified contracts (Nackman, 2017, p. 44).

c. Poland

Poland's procurement regulations can be found in the Polish Public Procurement Law and the Ministry of National Defense Decision No. 367/MON (Nackman, 2017, p. 50). EU regulations under the defense directive still apply. Poland does not have any set rules of preference with domestic vendors. Foreign contractors may bid and win regardless of their nationality or country of origin. Certain items that have security classifications can be restricted to local vendors (Nackman, 2017, p. 50).

d. Sweden

Swedish defense procurement rules are also heavily based on The Commission's procurement directive. The Defense and Security Procurement Act and the Government Procurement Act dictate Sweden's legal framework (Nackman, 2017, p. 59). As with all other EU member nations, classified contracts, especially those dealing with undersea warfare and aviation warfare, are exempted (Nackman, 2017, p. 59). For unclassified items and general war materiel, however, there are no restrictions on bidding and being awarded contracts by foreign contractors (Nackman, 2017, p. 61). Sweden has been regarded as a free-trade nation and treaty partnerships generally do not give influence when awarding contracts.

e. Italy

Italy's legal framework for defense and security contracts can be found in the Italian Public Contract Code: Legislative Decree No. 50/2016 and the Italian Public Contract Code of 2006 (Nackman, 2017, p. 22). As part of the EU, Italy can also invoke TFEU Article 346 in order to protect certain classified contracts (Nackman, 2017, p. 22). There are no restrictions against foreign contractor bids and no preference exist for domestic vendors. Italy's policy falls in line with The Commission's policy of transparency, open competition, and neutrality with contract awards (Nackman, 2017, p. 25).

f. The United Kingdom

The UK is currently a part of the EU, although a referendum vote to leave the union was held on 23 June 2016. Article 50 was invoked in order to start the process with the EU and the UK can detach as early as 29 March 2019 (Hunt & Wheeler, 2018). Until the official detachment, the UK is still subject to The Commission's rules and regulations for defense procurement directive. The UK's legal framework detailed in the Defence and Security Public Contracts Regulation 2011 incorporates EU directive principles that include equal treatment, open competition, and transparency for all its contract negotiations (Nackman, 2017, p. 69). There is no explicit preference for domestic vendors; under Article 346 in the TFEU, however, the UK is allowed to give domestic companies preference due to the classified and sensitive nature of certain contracts (Nackman, 2017, p. 69).

2. Non-European Union Nations Procurement Policies

a. Turkey

Turkey's defense and procurement regulations are dictated in the Turkish Public Procurement Law Article 3(b) and 3(n), in Law No. 5201: The Law on Control of Private Industrial Enterprises Producing War Weapons, Equipment, Vehicles and Ammunitions and Explosives, and in Law No. 5202: The Defense Industry Security Law (Nackman, 2017, p. 64). Turkey has no regulations barring foreign contractors from bidding and winning awards. The Turkish government, however, does provide preference to local contractors (Nackman, 2017, p. 66). If foreign contractors wish to collaborate and become partners with local vendors, transfers of knowledge and capabilities to local contractors could be required (Nackman, 2017, p. 66)

b. Australia

In September 2010, the Australian Government Defense Materiel Organization (DMO) released the "Review of the Policy Framework for Clothing Procurement" report that looked into the effectiveness of procedures and processes used for procuring military clothing. The report highlighted the Australian government's procurement policies that include open and competitive practices. There currently are no policies that discriminate against overseas or foreign suppliers. Currently, certain Australian Defence Uniforms are being manufactured in China. The Department of Defence awarded a contract worth over $9 million AUS to a Chinese firm called Australian Defence Apparel through an open bidding process (Gillman, 2016). The policy does provide for reasonable opportunity for local vendors to compete for contracts. Australia's Department of Defense cites the following principles as well (Australian Defense Materiel Organization, 2010):

- Best value for money over the life cycle of the contract.
- Open and effective competition.
- Recognition of Australia's international trade agreements.

- Showing support for innovative research for product and process improvements.
- Within their procurement policy framework, Australia highlights several considerations for procurement:
- The need for a secure and reliable source of supply.
- The decision to support strategically significant domestic industry by paying for higher premiums over foreign outsourced vendors will be conducted on a case-by-case basis.
- The government's intent is not to subsidize domestic vendors that prove uncompetitive
- There is currently no government-endorsed "buy-Australian" policy similar to the U.S. Berry Amendment, although the Australian DoD would execute such a policy only if mandated by the government.

3. Canada

Canada's procurement is regulated by the Financial Administration Act and Regulations, Department of Public Works and Government Services Act, and the Defense Production Act (Taylor & Bolton, 2006). Government contracts require open competition, transparency, and non-discrimination (The Law Library of Congress [LOC], 2010). Canada is part of the World Trade Organization Agreement on Government Procurement (WTO-GPA) (LOC, 2010). Foreign vendors are allowed to bid on government contracts, but exclusions apply to procurements dealing with the Royal Canadian Mounted Police as well as dealing with sensitive and classified Department of Defense contracts (LOC, 2010). Procurements for national defense and security items and services can be given solely to local vendors through open competition (Taylor & Bolton, 2006). Foreign vendors who wish to bid in certain defense-related contracts may create partnerships with local companies that can then act as the prime vendor (Taylor & Bolton, 2006).

4. Summary of Foreign Nation Uniform Procurement Policy

Procurement policies differ for each country, even those nations subject to an overarching directive such as those in the EU. Camouflage combat uniforms provide the opportunity to offer personnel protection beyond visual concealment. Special fabrics and design can provide a tactical advantage for coalition troops and can be considered as an essential national security item. Thus, special provisions within each coalition nation's procurement policies must be taken into consideration. Fortunately, even though certain provisions do not restrict foreign defense contractors from bidding, each country studied within this research includes a bit of flexibility such as those outlined in Article 346 under the TFEU or Canada's Defense Production Act that allows protection of potentially classified war materiel.

III. LITERATURE REVIEW

A. GAO STUDY ON JOINT UNIFORMS

In fiscal year 2010, the National Defense Authorization Act (NDAA) released a requirement for all military service branches to develop performance characteristics for future joint combat camouflage uniforms as a response to each branch releasing at least one ground combat uniform that was uniquely tailored for themselves since 2002. The NDAA also required that any innovation may be shared across the service branches and that any "service specific proprietary arrangements" will not prevent any service from implementing it on their own uniforms (Russell, 2012). The 2010 NDAA remains an unfulfilled task and since then, the Government Accountability Office (GAO) released a report in 2012 highlighting the failures in the process for the Department of Defense to develop joint uniforms and outlined recommendations to a fix (Russell, 2012).

Historically, each service branch has worked independently to develop their own sets of uniform. The United States Marine Corps (USMC) took two years and $319K to develop the Marine Corps Combat Utility Uniform (MCCUU) (Russell, 2012). Its requirement included improved durability and utility combat. The MCCUU also needed to provide its leaders a wider range of versatility in use for different missions. Finally, it had to be "uniquely marine" (Russell, 2012).

The United States Army (Army) between 2003 and 2005 developed the Army Combat Uniform (ACU) with an overall cost of $3.2 million. The ACU required better operational utility, improved near-infrared capabilities, and improved visual capabilities with acceptable patterns and performance for woodland, urban, and desert environments (Russell, 2012). In addition, the Army required that the uniform be more appealing to improve soldier morale. The Army's uniform development continued and between 2009 and 2012, the Operation Enduring Freedom Camouflage (OCP) was developed in response to the inputs from the Afghanistan operations, which cost over $3.4 million (Russell, 2012). This led to a camouflage pattern development that studied the feasibility of a singular pattern that blends well with desert, woodland, and transitional operational environments.

The overall cost of the third project was over $7 million (Russell, 2012). If the Army were to choose a brand-new uniform, the cost would be over $4 billion over a five-year period to replace all uniforms, related peripherals, and gear (Russell, 2012).

The United States Air Force (USAF) has a five-year development of the Airman Battle Uniform (ABU) that started in 2002. With the cost of $3.2 million, the USAF created a camouflage uniform that was distinct from the Army combat BDUs, but provided better fit, easier maintenance, as well being more cost effective over its lifetime (Russell, 2012).

The Navy's ground components were provided its own set of uniforms. From 2006 to 2011, the Navy developed the Type II Desert and Type III Woodland uniforms (Russell, 2012). The overall cost was merely $435K, which included the addition of requirements that were approved by the special operations commanders (Russell, 2012).

The GAO identified two elements to any successful acquisition programs. The first is consistent implementation of detailed policies and procedures. The second is the effective gathering and interpretation of relevant and reliable data to allow leaders to make the best-informed decisions (Russell, 2012). Out of the four branches, only the USMC successfully applied these two concepts in addition to properly utilizing "acquisition strategy, acquisition program baseline, risk assessment, cost estimate for program's life cycle, and finally, test and evaluation master plan" (Russell, 2012). Ultimately, the GAO study by Russell cites the following failures consistent across the other service branches (Russell, 2012):

- There were no consistencies in the decision-making process.
- The DoD did not provide alternatives and supplemental guidance to give clarity for overall development.
- The service branches did not provide specific equivalent levels of protection, nor was any collaboration conducted to address risks.
- There was no collaboration regarding possible cost savings through shared developmental costs, shared warehousing fees, as well as shared overall life cycle costs of the combat uniforms. (Russell, 2012)

The GAO's recommendations focus on thorough collaboration across all the services. There are many mechanisms in place within the acquisition program that allows for successful development and rollout of any projects. Adhering to these concepts and strategies will allow the service to fully realize the potential for joint uniforms. Potential benefits that the GAO has cited include equal personnel protection on the battlefield and potential savings of over $82 million for the Army alone if partnered with another branch through reduced development, inventory, and procurement costs (Russell, 2012).

B. NATO STANAG 2333

NATO has long realized the importance of standardization. Communication, terminology, equipment, and strategy all require collaboration and standardization in order to effectively execute command and control. NATO commanders also realize the significance of providing combat clothing with superior "performance and protective properties" ("North Atlantic," 1992). STANAG 2333 establishes NATO land forces combat clothing properties and requirements. Combat clothing includes under garments, outer garments, footwear, and any protective clothing. The wearer's combat clothing should not impede in their ability "to perform combat and training activities," optimize physical mobility, and provide protection ("North Atlantic," 1992). This STANAG provides guidance to aid in uniform camouflage. It directs nations to ensure garments intended for certain regions and climates meet some or all of the following depending on operational requirements ("North Atlantic," 1992):

- Blend in with intended background
- Fluorescence characteristics
- Utilize a disruptive camouflage pattern to ensure body outline is disguised
- Outer garments for use in temperate or cold environments shall be water repellant during its life. Protective over garments worn for short periods should be impermeable
- Flame resistance

- Protection against “chemical and biological warfare agents, prevent penetration of radio-active dust, have a minimum of 6 hours protection, and each layer should be capable of decontamination or disposable (“North Atlantic,” 1992).

- Garments must provide protection against nuclear explosion thermal radiation burns or thermal energies as defined in NATO Triptych AC/225 (Panel VII)D/101

- Reasonable durability during normal laundering

- Ballistic protection when not available by other means without restricting movement

While the exact pattern of camouflage uniform is not explicitly laid out in STANAG 2333, baseline parameters for performance, visual disruptive ranges, and color characteristics are given. This provides the flexibility to shift patterns as based on operational environments. U.S.-led coalitions could benefit from this format, while adding other characteristics such as insect repellent and buoyancy requirements, to be identified during planning stages. These base performance parameters could be in place while collaborating for the final product design for use in specific operational theaters.

C. NORDIC COMBAT UNIFORM

Nordic Defense Cooperation (NORDEFCO) was established on 4 November 2009 (“Nordic,” n.d.). Denmark, Norway, Sweden, Finland, and Iceland are part of the organization. The main purpose of this organization is, “to strengthen the participants’ national defense, explore common synergies and facilitate efficient common solutions” (“Nordic,” 2009). In 2016, four Nordic countries united behind a joint procurement project to acquire a common Nordic Combat Uniform (NCU) (O’Dwyer, 2017). The Nordic countries plan to buy a joint combat uniform. This uniform will be used by the Nordic nations in operations worldwide. The four countries would still maintain their identity by wearing the flag on their shoulders. Brigadier General Peter Kølby Pedersen from the

Danish Defense Acquisition and Logistics Organization has explained the following benefits of the joint uniform:

- Better quality for the same price or even better quality at cheaper price.
- Enhancement in the operational effect, which is the main goal of the project.
- Attract larger players in the uniform market that can offer better solutions to future requirements.

D. SOCIOLOGICAL PERSPECTIVE

1. Uniforms as a Team Building and Legitimacy Tool

The Harvard Business School's Professor James L. Heskett wrote a business case regarding how then-Commissioner William Bratton dealt with New York City's rising crime rates, low police morale, lack of cohesion, and sub-par performance. Bratton set about to reengineer the organization and its teams. Heskett's research cites John Linder's seven strategies based on a holistic approach to solving issues (Heskett, 1999):

- Getting guns off the streets of New York.
- Curbing youth violence in the schools and on the streets.
- Driving drug dealers out of New York.
- Breaking the cycle of domestic violence.
- Reclaiming the public spaces of New York.
- Reducing auto-related crime in New York.
- Police Strategy of rooting out corruption, building organizational integrity in the New York Police department. (Heskett, 1999)

There was a massive issue in the self-perception within the police force. This led to Linder's "Cultural Diagnostic" detailed questionnaire designed to anonymously disclose concerns and grievances of the members of the police force regarding their job, their peers,

their superiors, and their roles in the community. Based on the responses from the questionnaire, Linder created the following 12 topics for each team to focus on (Heskett, 1999):

- Building community partnerships
- Geographical versus functional organizational structure
- Precinct organization
- Supervisory training
- In-service training
- Productivity
- Paperwork
- Integrity
- Rewards and career paths
- Discipline
- Equipment and uniforms
- Technology. (Heskett, 1999)

Effective service requires improvement from all 12 topics in Linder's list. It is important to highlight that as part of this re-engineering strategy addressed equipment and uniforms. Bratton realized that in order to ensure that his police force performed, he must provide them with the proper equipment such as better bulletproof vests and better weapons with higher capacity magazines. He also recognized the importance of cohesion and legitimacy. A simple, yet powerful, tool is his implementation of better uniforms that were darker and had a more authoritative design. This allowed his police force to identify more closely with each other and to the overall mission of the organization. Improved equipment and better uniforms also provided a visual signal to the community in which these police

officers served. The uniforms allowed a path to improve perceptions of the community, leading to better relations and lower crime rates (Heskett, 1999).

Bratton not only used uniforms and symbols as a positive reinforcement to improve morale. He was able to leverage the uniform and the badge as a symbol of honor, commitment, and discipline. As part of his efforts to address the issue of corruption within the police force, Bratton would personally be a part of the arresting party for those officers accused of such acts. In addition, he made his commitment very clear to the organization by publicly retiring the badges of those officers convicted of corruption charges so that "no other police officer would ever have to wear them." By doing so, he was able to elevate the importance and prestige of membership within the organization by using uniforms and insignias (Heskett, 1999).

Bratton's efforts to improve the New York City Police Department have their applications in military coalitions. A near exact necessity exists between the two organizations to standardize, collaborate, and be cohesive. Bratton took the lead in order to ensure his policies were implemented while making all stakeholders accountable for their actions. The results created a competitive advantage for the organization because of buy-in and ownership from each member. Similarly, top commanders from all representative nations must show their complete support while making their service members accountable to every improvement efforts of standardization, collaboration, and cohesion within the coalition.

2. Effective Organizational Authority and Change

One of the biggest challenges in large organizations is the ability to create and maintain their identity while dealing with internal and external forces. Morris Janowitz wrote about the patterns of organizational authority in the *Administrative Science Quarterly* and highlights the demands brought upon by social norms, organizational cultures, as well as forces of change regularly required to ensure the top organizational health and stability. Janowitz uses the military establishment as the platform for this analysis because it is "often regarded as the prototype of bureaucracy" (Janowitz, 1959, p. 473). Larger organizations tend to have more complex and bureaucratic structures that eventually

encounter transformation. With that, the sources of authority also have seen transformation to maintain their effectiveness. The military structure of authority has traditionally been centered around domination, but as society has shown to shift, methods in the military have also shown trends that point toward manipulation concept or one that is more indirect form of authoritarian structure.

Technological change has influenced the shift of authoritarian trends from domination to manipulation. Technology has allowed better access and communication within the military establishment. More importantly, it has created a more complex network of interdependence among its members as well as with other non-military organizations. Janowitz highlights three trends within his research that stem from the influence of technology (Janowitz, 1959, p. 477):

- Military technology both extraordinarily increases the destructiveness of warfare and widens the scope of automation in the use of new weapons.
- The revolution in military technology shifts the military mission from that of preparation for the use of violence to that of deterrence of violence.
- Military institutions, as compared with civilian institutions, which are resistant to change have been eliminated as the process of innovation in the military establishment has become routinized. (Janowitz, 1959, p. 477).

In order to maintain competitive advantage, the military establishment must continuously improve upon itself as outlined by Janowitz' third assumption. Janowitz writes in his article about the shift of military authority from the rigid dominant type to one that is a subtler, but still "unstable," manipulative type. Janowitz has defined domination as "influencing an individual's behavior by giving explicit instruction as to desired behavior without reference to the goals sought" (Janowitz, 1959, p. 482). Domination relies less on positive reinforcement than on drawing on coercive power base emphasizing negative consequences if orders are not carried out. Janowitz defines manipulation as "influencing an individual's behavior by indirect techniques of group persuasion and by an emphasis on group goals" (Janowitz, 1959, p. 482).

While the shift from domination to manipulative authority has gained traction, Janowitz explains that manipulation does not provide the most stable method in terms of maintaining organizational balance. Because there is an inherent need for rigid organizational coordination, it contradicts certain practices within the manipulation method that calls for group initiative and improvisation. Janowitz outlines three sources of contradictions that prevent the optimization of manipulation to achieve organizational balance (Janowitz, 1959, p. 482):

- Organizational rigidity, which is the "handling of new problems through the mechanical application of traditional practices rather than by innovation."
- Ceremonialism, which points to "organizational processes that are conventional gestures and formal observances."
- Exaggerated professionalism is the concern that "professional status outweigh concerns with functional performance." (Janowitz, 1959, p. 482).

In order to move towards a more balanced organizational bureaucracy, a different approach is needed to effect change in military establishments dealing with standardization, conformity, and cohesion. Successful organizational transformation could be achieved with fraternal-type authority where the "equality of unequals" among its members within the organization is recognized (Janowitz, 1959, p. 449). Janowitz describes fraternal-type authority as a system that "reflects the authority of the older brother over the younger, circumscribed and functional [and] although the older brother's superior authority cannot be denied because of the biological facts of age and the forms of family structure, the younger brother has his forms of equality because of the very same considerations" (Janowitz, 1959, p. 489). Fraternal-type authority detracts from the "senseless and arbitrary exercise of authority" where the emphasis of motivation of any task is always the ultimate goal of the mission. Organizations based on fraternal authority gravitates towards equality of their members (Janowitz, 1959, p. 490).

3. Legitimacy and Prestige

Nathan Joseph and Nicholas Alex published "The Uniform: A Sociological Perspective" in the American Journal of Sociology, in which they broke down the components, importance, and implications of uniforms in organizations. In the article, Joseph and Alex write that a uniform "acts as a totem, reveals and conceals statuses, certifies legitimacy, and suppresses individuality" (Joseph & Alex, 1972, p. 719).

a. Uniform as a Group Emblem

One of the primary intents for uniforms is to be able to identify with a group or an organization. Uniforms may enhance or denigrate the individual identified with the organization and vice versa, the individual may enhance or disgrace the organization based on his or her actions. Thus, the uniform is a very overt way to distinguish the person among the population. In the article, prestige is usually granted for military personnel in the southern region of the U.S. while police officers are afforded lower esteem in urban areas among minorities (Joseph & Alex, 1972, p. 721). The uniform offers a certain certificate of legitimacy not only to the outside observer, but also within those members in the organization. As an example, donning the uniform for the first time symbolizes initiation to the group while those members who have shown competence have earned the privilege to wear specific insignias or extra bars for promotions. The use of physically removing components of the uniform or its entirety provides an impactful method for those individuals in the group who have underperformed or are being expelled.

b. Concealment of Status

Donning the uniform conceals and reveals the wearer's status. On one hand, military personnel conceal their status in civilian life once they are in uniform. The military personnel are usually prohibited from revealing political allegiances. Concurrently, service members reveal to the community and to the organization that they are a part of the military and what status they have attained in terms of rank, certifications, and achievements (Joseph & Alex, 1972, p. 722).

c. Certificate of Legitimacy

Uniforms require that there is an organization, the military for example, with structure, rules, regulations, codes, behaviors, and standards (Joseph & Alex, 1972, p. 722). Wearing a uniform implies conformity to the rules of the organization and that there is a higher authority to govern the actions of its members. An implied accountability within the ranks is clearly translated through the uniform, which is visible to other organizations and the civilian world. Legitimacy is more or less readily recognized without doubt by the public (Joseph & Alex, 1972, p. 722)

d. Suppresses Individuality

Joseph and Alex express that the "uniform suppresses individual idiosyncrasies in behavior and appearance" and that, "standardization of apparel is another source of group-imposed conformity." Uniforms certify legitimacy and any effort to deviate from its proper use diminishes the status of the individual. (Joseph & Alex, 1972, p. 723). Consequently, the uniform also influences the actions, mannerisms, and behavior of the member. The authors indicate that there are two sources of ego-gratification for individuals in uniform: self-esteem through conformity and self-prestige by conflict (Joseph & Alex, 1972, p. 723).

e. Control of Social Interaction

The authors of the article examine the role of uniforms in social settings and interactions. Humans often conduct social placement for those they meet. Initial encounters with strangers produce characterization from cues: mannerisms, diction, apparel, and posture. All of this information so we can answer the question, who this person is, and if the person is actually telling the truth based on cues. A uniformed individual answers those questions and removes much of the ambiguity set forth by the person without going in depth into their background. The uniform displays the wearers' affiliation, rank, and achievements. While the cues indicate the person's background, the second part of the social placement process is to determine the trustworthiness of the information derived from the individual. The uniform serves to answer that question because it provides some level of legitimacy (Joseph & Alex, 1972, p. 724–725). The observer can easily ascertain

the uniformed individual's identity and individuals from the same organization can easily distinguish members.

The authors also consider the interactions with the individuals wearing the uniform. The observer has a level of expectation that the uniformed members will fulfill their duties set forth by their organization.

f. Rejection of the Uniform

The authors offer insights to possible sources of rejection to wearing uniforms. It is, however, important to distinguish the root cause of the rejection: is it the refusal of the physical uniform or is it the negative response to the status or group represented by the uniform? Some of the objections highlighted by the authors Joseph and Alex (1972) include the following (Joseph & Alex, 1972, p. 727–729):

- Uniforms create obstacles to performance.
- Denial of individuality.
- Expression of discontent with the status behind the uniform.
- Opposition to the group.
- Social class. (Joseph & Alex, 1972, p. 727–729)

Sources of rejection to the uniform manifest when clear differences arise between those members and the organization. This rejection will inevitably garner reactions from the organizations and their fellow members. Although rejection of the uniform may seem unfavorable, the authors cite that it is a "safety valve" to identify and remove those individuals rather than having to deal with insubordination, desertion, or mutiny (Joseph & Alex, 1972, p. 729).

E. THE MULTINATIONAL INTEROPERABILITY COUNCIL

1. MIC Overview

The Multinational Interoperability Council (MIC) was established in 1996 to give coalition forces a platform to address and analyze strategic challenges and make recommendations to develop operational practices that maximizes the effectiveness of coalition operations. Currently, the MIC membership includes the U.S., the UK, Australia, France, Canada, Germany, and Italy. The MIC makes several assumptions (MIC VOL III.1, 2015):

- The majority of future operations and conflicts will likely involve multinational coalitions.
- Multinational operations may have to be executed under an established coalition framework.
- One of the major powers will most likely lead coalition operations.
- Each MIC nation participant must be prepared to lead coalition operations and commit resources if called upon.
- A recognized international organization such as NATO or the UN could provide the mandate for the level of operations necessary. (MIC VOL III.1, 2015)

The MIC regularly releases updates to the Coalition Building Guide (CBG), but it is not in any way an official mandate or policy to creating, planning, and executing multinational coalition operations. Multinational coalition operations will use NATO doctrine as a default policy for planning and execution unless otherwise specified by the lead nation. The CBG reflects the analysis, recommendations, and lessons identified from past coalition operations, joint exercises, and experiments, thus creating a very fluid and ever-changing document. MIC principals comprising general and flag officer representatives and their staff from the seven nations meet semi-annually to discuss the

ever-changing challenges and possible solutions to mitigate risks in a contemporary operating environment.

The MIC has identified critical interoperability challenges (MIC VOL III.1, 2015):

- Compatibility
- Capabilities Integration
- Information Sharing
- Interagency Coordination

In addition, the MIC identified nine lines of development to focus on enhancing awareness of the differing capabilities and weaknesses of participating nations to improve their operability (MIC VOL III.1, 2015):

1. Leadership Development
2. Command and Control
3. Education and Training
4. Doctrine
5. Logistics
6. Knowledge Advantage
7. Shared Situational Awareness
8. Organizational Constructs
9. Planning (MIC VOL III.1, 2015)

The MIC also identifies seven key capability gaps (MIC VOL III.1, 2015):

1. Standardization
2. Common lexicon for military concepts, doctrine, and operations

3. Common rules of engagement appropriate to an operation

4. Secure computing/voice/video capabilities among coalition members

5. Utilization of existing services and support doctrine in training and exercises

6. Common training

7. Common tools for command and control (MIC VOL III.1, 2015)

The CBG addresses the top key capability gap of standardization by highlighting the differences between commonality of equipment and supplies versus the compatibility of process of execution. The MIC realizes that in order to have a higher degree of success, a higher level of capabilities integration must exist. While coalition nations are able to use each other's equipment, it is another issue to be coordinated and cohesive during coalition operations. The MIC's guidelines ensure the following capabilities integration challenges are addressed (MIC VOL III.1, 2015):

- That nations share the fair burden of responsibilities.
- That nations are given the proper tools to attain operational objectives while minimizing risks.
- That the coalition will optimize the use of scarce resources of the theater.
- That the coalition will be able to address any capability gaps through the Comprehensive Approach method.
- That the coalition's force generation and preparation processes will be efficient (MIC VOL III.1, 2015).

2. MIC Logistic Planning Considerations

The MIC published in their third edition CBG the potential benefits and challenges of a multinational logistics operation. The article acknowledges the inefficiencies with historical efforts to sustain forward deployed forces. These inefficiencies include slow and

chaotic in-theater initial set up, redundant and sometimes unnecessary efforts that create potential issues of competing for space and scarce in-theater resources as well as wasted funding. “Ad hoc planning,” as the authors have called it, has fallen short of the necessary cohesive characteristics required to properly manage and perform logistics with multiple nations.

A properly run multinational logistics operations that is centralized, coordinated in its user arrangements, and with standardized processes has the potential to enhance the performance of nations within the coalition. A few of the benefits that the authors have cited in the planning guide (MIC VOL III.1, 2015):

- Efficient logistic planning.
- Improve the speed of deployment and better flexibility.
- Better utilization of scarce theater resources via coordination with the host nation and contractors.
- Provides coalition nation to provide support based on their capabilities.
- Reduce overall logistic footprint.
- Optimized force protection (MIC VOL III.1, 2015).

There are constraints multinational logistics operations could encounter. The guide outlines the following (MIC VOL III.1, 2015):

- Reluctance of participating nations to commit logistic resources and forces.
- Some nations may not have the available logistic resources to provide support for the multinational coalition as well as for their own forces.
- No pre-existing coalition logistic planning could lead to disorganized initial stages of implementation of logistic operations.
- Multinational and cultural sensitivities to certain processes such as blood transfusions, mortuary affairs, and ammunition sustainment.

- Difficulty of achieving consensus regarding financing and reimbursements.
- Challenges in knowledge and information management.
- Challenges in including all the coalition nations during planning and execution due to the varying speeds between Phase 0 and Phase II of operations.
- Lack of familiarity regarding multinational logistic procedures, concepts, and knowledge among participation nations (MIC VOL III.1, 2015).

F. LITERATURE REVIEW SUMMARY

The use of uniforms is a proven method for individuals to adapt. For organizations that rely heavily on conformity and standardization, such as the military, wearing the uniform is the very first step to building an effective competitive advantage against its adversaries. While this potential benefit is known, it has proven itself a challenge for many military organizations to implement. As Russell points out in his GAO study, there are massive potential cost savings that could be realized if the two or more of the U.S. military branches partnered on even just sharing the cost of initial inventory fees. Each branch embarked on its own design, development, testing, and distribution of camouflage uniforms. Although Congress directed each service chief to collaborate, there was still massive resistance due to a number of factors, leading to a task that is incomplete, with uniform patterns and performance parameters still inconsistent.

Multinational coalitions such as NATO and the Nordic Defense nations have made efforts to capitalize on standardization. The NATO STANAG 2333 provides a baseline performance and characteristic requirement for its uniform, though it does not specify the actual final pattern, while the NCU all have made successful advances through collaboration. The NCU specifically asserts potential cost savings and better performance through partnership throughout the development and acquisition process.

Aside from the potential tangible benefits in performance and finance, there are also potential improvements that could be attained within psychological and sociological

aspects. Studies conducted show that Bratton's efforts to improve the New York City Police Department through strict collaboration, ownership, top-down leadership, and the effective use of uniforms have proved successful. Uniforms have been proved to be tools to legitimize organization, give prestige to those who wear them, and provide potential positive control with social interaction. Although there will always be pockets of resistance, the benefits seem to always outweigh those costs.

Finally, as the current trend of evolution of operating theaters led to the need for coalition forces, the MIC has been formed to analyze and provide counsel to enhance collaboration and ensure success of interoperability among nations. Standardization is a key capability gap that the MIC has identified that could be implemented from terminology, tactics, logistics, and strategy. Coalition partnerships through close cooperation allows for maximizing the potential of success of the mission.

IV. ANALYSIS

A. POLITICAL, ECONOMIC, SOCIAL, TECHNOLOGICAL, LEGAL, AND ENVIRONMENTAL ANALYSIS

The PEST or PESTLE framework was introduced by Francis J. Aguilar to analyze the external environment of a business (Frue, 2017). Earlier, it was used as a tool for strategic analysis and decision making in business environment (Ruziwa, 2015). Now its use is equitable in non-business organizations as well, including military and government organizations. Through PESTLE analysis, we will focus on the possibility of a joint U.S.-led coalition forces uniform. We will evaluate this through the six interlinked categories of the PESTLE framework that can create the opportunity of joint uniform or some sort of standardization in coalition forces uniforms.

1. Political Factors

Future military and security operations are likely to be increasingly multinational or an alliance within the framework of a coalition force (MIC Vol III.4, 2015). These multinational operations will be led by one of the major nations and will be legitimized by international organizations like the UN and NATO. This was very much evident in the case of the Iraq and Afghanistan wars. The number of troop-contributing nations were 38 in OIF and 49 in OEF, respectively. In both the operations, the U.S. was the lead nation and the troop-contributing nations were also the same apart from some exceptions. Coalition partners politically accepted the U.S. as the lead nation in both the instances and there was a strategic-level political consensus. The MIC, which formed in October 1996, has provided insights into resolving core issues in the effective execution of multinational operations. While the MIC, NATO, and the UN each lack extensive policies for a common combat camouflage uniform, standardization is still considered as one of the key capability requirements. As Bratton did for NYPD, the implementation of a common uniform has the potential to legitimize the alliances formed within coalition organizations. The general population in the countries in which the operations are conducted provide the much-needed support and approval to help win the mission. External legitimization and endorsement potentially makes winning the hearts and minds of the community less problematic.

a. Current Strengths

- MIC, which is a unique forum to understand, analyze and address issues associated with the strategic and operational challenges.
- NATO, which has already a set of standard agreements in place to facilitate interoperability between the allies and enhance the cooperation within a coalition.

b. Current Challenges

- Challenges in commonality of a uniform span a wide spectrum of national pride, camouflage pattern, performance parameters, and trust between the coalition partners.
- Political will to pursue and share the niche performance characteristics of a standard uniform.

2. Economic Factors

Economics factor will play a significant role in pursuing a single joint coalition uniform. The economic structure of any future coalition force is likely to be well supported. $1.6 trillion was approved by Congress from 2001 to 2014 for "military operations, base support, weapons maintenance, training of Afghan and Iraqi security forces, reconstruction, foreign aid, embassy costs, and veterans' health care for the war operations" after the 9/11 attacks (Belasco, 2014). In 2016, the U.S. contributed 22.14%, of the NATO budget, with Germany in second place at 14.65%, followed by France and Britain (Goodenough, 2017). Overall, the U.S. "spends more on its military than the rest of the NATO combined" (McCarthy, 2017). NATO members' current target for military spending is 2% of GDP (Kottasova, 2017). Only five member countries have achieved the target so far. This automatically puts the U.S. as the lead nation for any coalition operation. The expenditures of NATO countries in 2016 can be seen in Figure 37.

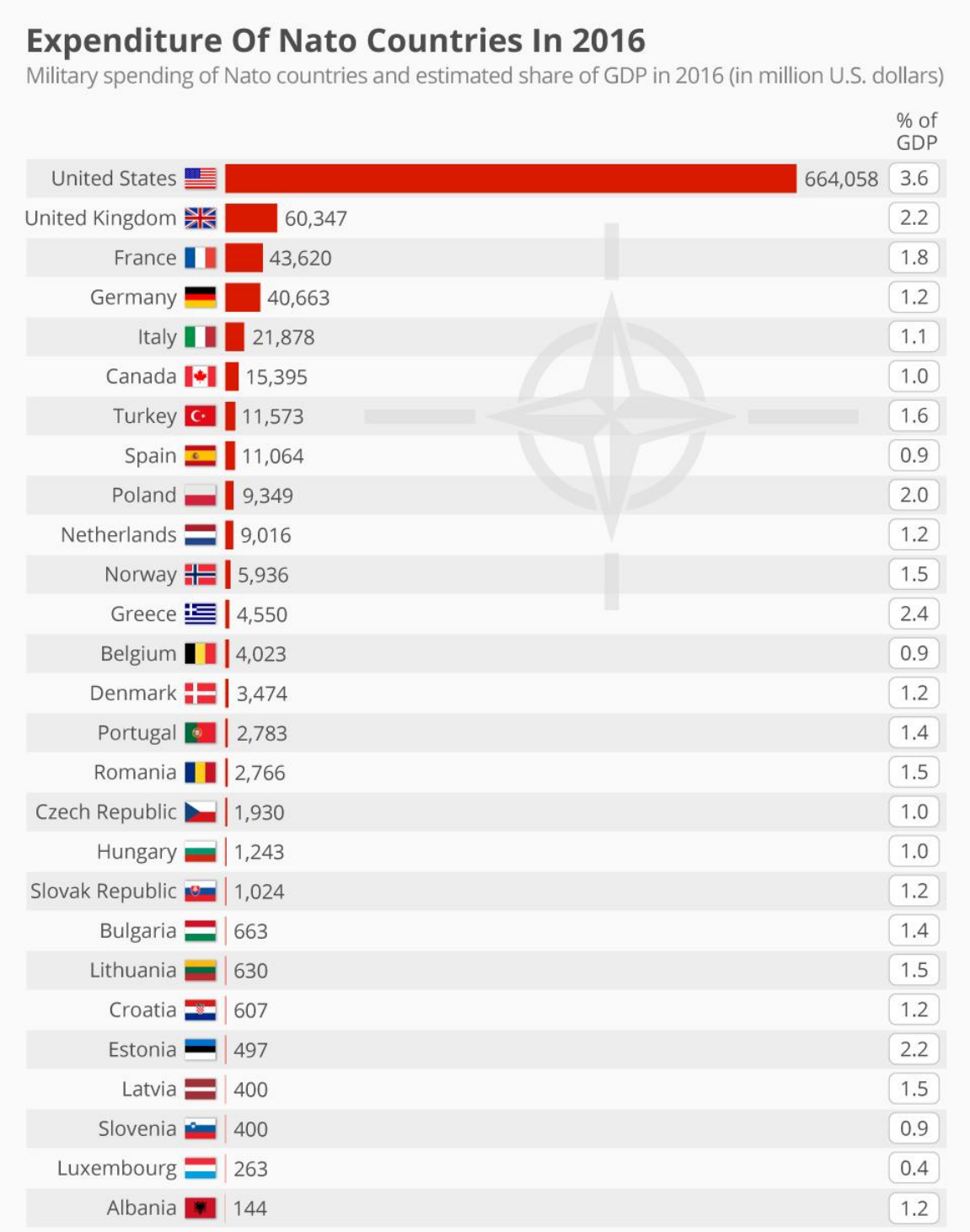

Figure 37. Defense expenditures of NATO countries.
Source: McCarthy (2017).

Collaboration for a single camouflage uniform will provide opportunity for cost savings both in production and future development. Case in point is the Nordic camouflage uniform. Denmark, Norway, Sweden, and Finland have adapted a joint uniform purchasing policy to reduce costs and achieve economies of scale. Professor K. Hartley from the University of York suggests in his study "A Single European Market for Defense Equipment" that a single market for defense procurement can save 10% in unit costs of the equipment, if there is perfect collaboration among the partner nations (Hartley, 1997). He explains this through a table (Table 1) that shows the development and productions costs of an aircraft program pursued by two nations independently or in collaboration. The net savings is 50% in developmental costs and 10% in unit production costs.

Table 1. Savings in perfect collaboration. Adapted from Hartley (1997).

Independent Venture	Number purchased	Development cost (£ billions)		Production cost	
		Total	Each Nation	Total (£ billion)	Unit production cost (£ million)
Nation A	200	10	10	2	10
Nation B	200	10	10	2	10
Collaboration (A&B)	400	10	5	3.6	9
Collaborative savings		10	5	0.4	1

Collaboration for a joint uniform would lower the costs in the long run since it will abolish duplication of effort in R&D. This can significantly enhance the savings of the participating nations and use the resources towards enhanced interoperability. A joint coalition forces uniform will reduce the logistic burden of the participating nations, maximize logistic cooperation, and reduce the shipment and storage costs.

a. Current Strengths

- STANAG 3150 in which NATO countries agree to adopt the U.S. "Federal Supply Classification System."

- EU procurement policies tend to follow the criteria of lowest cost with economically advantageous tenders and no explicit restriction on the foreign suppliers.

b. Current Challenges

- Consensus on the financing and funding of a joint coalition uniform.
- Issues related to the size of the future coalition force and the number of participating troops and nations.
- Lack of capabilities of the coalition partners in sharing and processing of logistic information for sustaining the coalition force.
- Interoperability of the logistics systems.

3. Social Factors

Society's culture, norms, and values change over time. Most of the time, these changes evolve gradually with some degree of resistance but, on other occasions, the changes can be sudden and disruptive. Military uniforms being certificates of legitimacy serves as a unique emblem and signify the distinctive look of each service or a country. Changing the thinking of each individual soldier in general and the top military hierarchy in particular for a singular uniform will be the biggest challenge. Another challenge with the military organizations is to maintain its identity while dealing with internal and external forces. They tend to have bureaucratic structure and might encounter the transformation as well. At the same time, considering the future battlefield to be more coalition oriented, militaries are looking for ways to increase interoperability and cooperation. The question that needs a plausible solution is whether a coalition force with a singular identity will produce a more effective force of the future or a coalition force with distinct uniform pattern will remain relevant. Similarly, a singular uniform will provide a positive reinforcement to morale (Heskett, 1999) of the smaller nations. They can feel being part of the force instead of being overwhelmed by a major lead nation. If the mission of a coalition force is to achieve a higher degree of success through integration, the potential benefits

from social equality provides adequate justification for the adoption of a joint uniform (MIC Vol III.6, 2015).

Coalition troops from different nations wearing unique uniforms in the same combat theater will be exposed to varied levels of risks (Russell, 2012). For example, major allies in the coalition forces in Iraq and Afghanistan changed their camouflage patterns to enhance the performance of individual soldiers, whereas most of the smaller nations used their traditional camouflage patterns.

a. Current Strengths

- Unique and united outlook of the coalition force.
- Increase the morale of coalition troops and aid in cross-cultural integration.

b. Current Challenges

- Changing the individualistic approach of particular camouflage pattern to a singular one.
- Country and organizational biases towards the policy of a singular uniform pattern.

4. Technological Factors

Rapid developments in defense-related technologies could have a dramatic impact on the mission of the coalition operations and the manner in which they are conducted. The recent developments in the camouflage patterns and the technological improvements in the uniform performance create issues for most of the military organizations. As we have observed in Chapter I, coalition partners tend to follow the lead nations in adopting these new technologies. Improvements, which are continuously being incorporated, include improved concealment and visual properties, near-infrared capabilities, flame resistance, insect repellency and improved fabric technology. Tens of millions are spent by each coalition partner to remain current with the advances in uniforms. Every time a new camouflage is adopted by a country, it has to pass extensive testing under controlled environments. These tests and trials add another layer of expenditure that the coalition

partners have to bear. Allies and partners in a coalition can expand their options by working together in the field of technological advancement.

The 2018 National Defense Strategy Summary necessitates DoD to organize itself for innovation and deepen the interoperability with its allies and partners to achieve military objectives (Mattis, 2018). The same document also illustrates that:

> Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates it and adapts its way of fighting. (National Defense Strategy, 2018)

The 2018 National Defense Strategy Summary also explicitly explains that (Mattis, 2018):

> The Department's management structure and processes are not written in stone, they are a means to an end—empowering the warfighter with the knowledge, equipment and support systems to fight and win. Department leaders will adapt their organizational structures to best support the Joint Force. If current structures hinder substantial increases in lethality or performance, it is expected that Service Secretaries and Agency heads will consolidate, eliminate, or restructure as needed. The Department's leadership is committed to changes in authorities, granting of waivers, and securing external support for streamlining processes and organizations. (Mattis, 2018)

a. Current Strengths

- Increasing collaboration for a standardized uniform can expand options in the field of new technologies. Case in point is of flame resistant (FR) rayon fiber to manufacture FR uniforms. According to GAO "Currently, there is only one source of FR rayon fiber to support the manufacturing of FR uniforms for the DoD—an Austrian-headquartered company, Lenzing" (Solis, 2011). DoD has identified alternative FR for uniforms and has tested various fabric blends to bring the required improvements in the FR fabric. So, there could be room for improvement in certain areas due to increased cooperation.

- Reduce the costs on the technological innovations of new camouflage patterns.

b. Current Challenges

- Risk involved in sharing the classified niche capabilities with the coalition partners.
- Patents and certain proprietary measures may impede sharing of new technology, camouflage patterns, advanced uniform designs, and FR properties.

5. Legal Factors

As we started our literature review, we thought that each particular nation's laws, rules, and regulations would be the biggest impediment in implementing a singular camouflage pattern. Detailed review of the rules and regulations of the major coalition partners showed similarity in the procurement and implementation of new changes. Apart from the U.S., which is sensitive to antitrust regulations, the rest of the NATO nations are fairly open to foreign purchase of the security equipment. Australia has recently outsourced some of their uniform production to a Chinese firm called Australian Defence Apparel through an open bidding process (Gillman, 2016).

a. Current Strengths

- EU defense procurement Directive 2009/81/EC, which establishes commonalities in the procurement policies and does not discriminate companies based on their nationality.
- Turkey has no regulations barring foreign contractors from bidding and winning awards (Nackman, 2017).
- Australian policy for clothing procurement includes open and competitive practices with no discrimination against overseas or foreign suppliers.
- Canadian procurement regulation demands open and transparent competition with some restrictions on sensitive and classified department of defense contracts (LOC, 2010). Foreign vendors who wish to bid in

certain defense-related contracts have to create partnerships with local companies to become eligible for the award of the contract.

b. Current Challenges

The Berry Amendment, which mandates that U.S. uniforms be 100% domestically manufactured items.

6. Environmental Factors

The environment in which coalition forces have to operate will change, which will directly affect the type of camouflage pattern being adopted. Measures against this change have already been taken by various countries to adopt a singular uniform for both arid and woodland/tropic regions.

a. Current Strengths

- The new OEF-CP uniform adopted by U.S. troops in Afghanistan was suitable for diverse terrains and backgrounds.
- Similar developments in camouflage pattern by UK and Australia and other nations that adopted camouflage patterns similar to MultiCam®.

b. Current Challenges

We do not foresee any impact of the future operating environment on the pattern and design of the combat uniforms since major nations are already moving towards a singular uniform pattern for all types of terrain and climatic conditions.

B. STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS ANALYSIS

The Strengths, Weaknesses, Opportunities, and Threats Analysis (SWOT) is a framework to evaluate a firm's internal and external environments in order to assess its competitive strategy (Thota & Munir, 2011). Through this method, the firm will take inventory of its competitive advantages and leverage them while formulating strategies to guard against its limitations (Thota & Muir, 2011). Concurrently, the firm would also

assess external factors that will create opportunities it could leverage while mitigating threats from technological innovations, government intervention, and trends in the market (Thota & Munir, 2011). SWOT's development came out in the 1960s and 1970s by Albert Humphrey at the Stanford Research Institute as a way for corporations to assess mistakes and manage change without having to depend on paid consultants (Humphrey, 2005). Through the use of the SWOT framework, the following analysis is made to focus on the feasibility of having a joint camouflage uniform worn by U.S.-led coalition forces.

1. Strengths

- Existing multinational coalitions such as NATO already have effective standardization efforts in place.
- STANAG 3150 "Federal Supply Classification System."
- STANAG 2333 "Performance and Protective Properties of Combat Clothing."
- Existing defense procurement policies for most coalition forces allow for flexibility in sources of manufacturers: EU procurement open competition, non-discrimination, and lowest cost.
- Top MIC coalition commanders see the benefits of standardization.
- Coalition nations gravitate towards major coalition nation camouflage patterns.
- Existing logistics supply chain in place by major coalition nation leaders.
- Existing design, development, and testing process of camouflage uniforms.

The nations mentioned in this paper have been a part of a coalition such as NATO or a political organization such as the EU. They have all been subjected to rules and regulations that reflect compromises and some level of standardization. NATO, with the STANAG agreements, facilitate operations through standardization. STANAG 3150 for

example adopts the U.S. “Federal Supply Classification System” to dictate a “uniform system of supply classification for use by the Armed Forces of the NATO countries” (“North Atlantic,” 2004). Another notable example is NATO’s STANAG 2333 that standardizes the “performance and protective properties of combat clothing” for ground forces (“North Atlantic,” 1992). In terms of defense procurement, while the U.S. is somewhat restricted by the Berry Amendment, other coalition forces have fewer restrictions regarding required sources. EU member nations are bound by directive to ensure open competition and non-discrimination for non-local defense contractors. The Multinational Interoperability Council (MIC) has been established to address challenges and proposed solutions to future coalition operations. The MIC considers every aspect of streamlining resources and standardization in order to maximize cohesion and interoperability in complex operating environments. Top officials in each representative country in the MIC constantly provide their recommendations to ensure the data is current and up to date.

With military and political organizations already addressing policies that highlight the importance of standardization, there are mechanism in place to facilitate a successful implementation of a joint standardized uniform. The U.S. as well as other major coalition nation leaders have established research and development systems as well as robust supply chains to effectively support the joint coalition uniform efforts form initial design to outfitting.

2. Weaknesses

Weaknesses are inherent due to the uniqueness of each nation and the complexity of the standardization process. Interoperability requires close collaboration among all nation partners that they will need to overcome the following established elements:

- Each coalition nation has a unique set of defense procurement policies.
- Each coalition nation has its own distinct supply chain.
- Nations view the uniqueness of their uniform, whether in performance or appearance, in high regard.

- Coalition achievements and failures are not readily attributed to specific nations.

As presented in the prior section, certain aspects of strengths are its weaknesses. While procurement policies and supply chains within organizations such as the EU and NATO offer similarities that allow an avenue to standardize, the nuances and distinctions in government policies and its supply chains could hinder or even derail the process. As mentioned before, the purpose of SWOT is to identify the weaknesses and set up guards to protect the organization from adversaries (or challenges) from breaking down the system. Coalition nation partners could mitigate issues regarding the differences in policies and supply chains by adding or amending the regulations to be tailored for coalition requirements.

The challenges due to the uniqueness of policies and supply chains are also apparent among each nation's military personnel. Individuality and pride through the uniqueness of their uniforms have often been sources of resistance to change. Standardization removes a certain degree of national identity that attributes achievements and failures directly to the coalition and not individual nations' forces.

3. Opportunities

Opportunities are an inventory of factors that provide the potential for improvement in core competencies and competitive advantage. These external factors provide the possibility to exploit capabilities not organic to the organization. Opportunities identified throughout this study include the following:

- Potential source of competitive advantage
- Potential improvement in operational cohesion
- Potential for more effective command and control
- Potential to enhance performance, confidence, and morale

- Normalize rank structure with the potential to decrease negative cultural stereotypes
- Potential deterrent for enemy combatants
- Potential to increase/improve performance parameters during development of the new uniforms
- Design, development, production, staging, distribution, and outfitting by utilizing existing supply chains and contracts and decreasing costs
- Potential for other nations to contribute through funding even though they lack the technological or supply chain capabilities

Due to the complex nature of operational theaters, military organizations always strive to maintain a competitive advantage over the enemy with a similar mission to create and maintain competitive advantages. A potential source of this critical competitive advantage in a multinational coalition highlighted by the MIC is the importance of effective collaboration among coalition partners along with non-governmental organizations (NGOs), and private groups (MIC Volume III.4, 2015). Capability gaps within standardization are inherent due to the complexity of the operations and the because of the uniqueness of each nation. As presented in the Harvard Business School's New York City Police Department case study, one effective method of building cohesion and morale within the organization and the community involved implementing unique, improved, and more authoritative uniforms (Heskett, 1999). Uniforms elicit positive reinforcement of honor, commitment, and discipline, which offer the potential for cohesion for organizations as large as a multinational coalition military force. This leads to the potential for better command and control, better communication, and decreased negative cultural stereotypes.

Along with studies that show positive outcomes with uniform standardization, there are also external potential benefits. Standardized uniforms worn by multinational forces could potentially be a deterrent for enemy combatants by removing distinctions of levels of capabilities. The potential is for the enemy to assume that coalition forces wearing a joint uniform will be similarly trained, similarly equipped, have a certain level of

competence, and be connected to a much larger network of support and reinforcement. By the same token, interaction with the local community will have the potential to be more successful and substantial because standardized uniforms offer a singular effort made by a united group and not from a specific country or culture.

Standardization of uniforms across multinational forces will require pooling of resources. Major coalition nations already have robust procurement processes and supply chains. Consolidating efforts to design, develop, manufacture, and distribute has the potential to decrease overall costs. With an overwhelming majority of coalition forces having flexible procurement policies and sources, the opportunity to improve the ability and ease to outfit all member forces is increased.

4. Threats

Risks and uncertainties are inherent in any competitive environment. Organizations have to mitigate those risks and manage how to guard against the negative effects of uncertainties from competitors and external organizations. The efforts to standardize uniforms and its potential negative effects when implemented pose threats from all different sources:

- Resistance to the joint uniform could degrade cohesion and threaten mission accomplishment.
- Rejection of the uniform could compel certain nations to pull out of the coalition.
- Coalition forces always have the possibility of not being well received.
- Unique identity and individuality are suppressed and not readily apparent when dealing with local populations (that could have been otherwise used as a leverage to connect with the community).
- Uniforms could be stolen or copied by enemy combatants and used against coalition forces.

- Risk of classified performance parameters could be leaked to adversaries.
- Design development could be delayed due to disagreements among coalition forces.

In the American Journal of Sociology article by Joseph and Alex titled, "The Uniform: A Sociological Perspective," one important aspect of uniforms involves rejection and resistance (Joseph & Alex, 1972, p. 729). This threat is critical because it negatively affects the cohesion within the organization. The authors cite the possibility of manifesting obstacles, discontent, and the denial of individuality as a result of wearing standardized uniforms (Joseph & Alex, 1972, p. 729). Dissent and insubordination could spark pockets of resistance that could jeopardize the success of missions.

While resistance exerts internal risks, external risk factors with equal severity can be found among adversaries that always try to exploit gaps in security and steal camouflage patterns to infiltrate coalition forces. Going a step further, performance parameters as well as actual material composition and manufacturing could fall into enemy hands due to vulnerabilities in the complexity of the network that involves multiple nations and a wider range of suppliers are involved in the supply chain.

Finally, the prospect of lowered overall costs due to pooling of resources throughout the development and implementation of the standardized uniforms are vulnerable to delays. Negotiations and coming to an agreement to a final design pose risks of setbacks, interruptions, and roadblocks that could be initiated by any one of the controlling stakeholders in the coalition. For U.S.-led coalitions, appearance and performance minimum standards could be dictated during the planning phase to reduce resistance, but still cannot guarantee a process that is free of challenges.

C. CORRELATION OF CASUALTIES AGAINST UNIFORM SHIFTS

U.S. military personnel suffered 3,481 hostile deaths and 31,958 were wounded in action (WIA) during OIF, which ended in August 2010 ("Defense Casualty," 2018). A total of 1,844 hostile deaths occurred during OEF and about 20,094 were WIA ("Defense

Casualty," 2018). OEF and OIF casualty numbers are broken down by year in Figures 38 and 39.

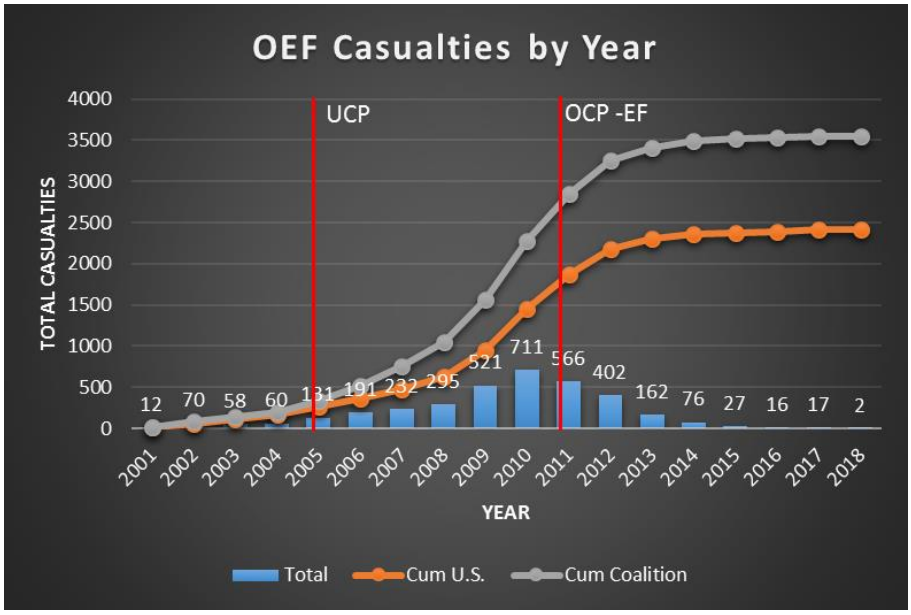

Figure 38. OEF casualties. Adapted from "Operation Enduring Freedom" (n.d.).

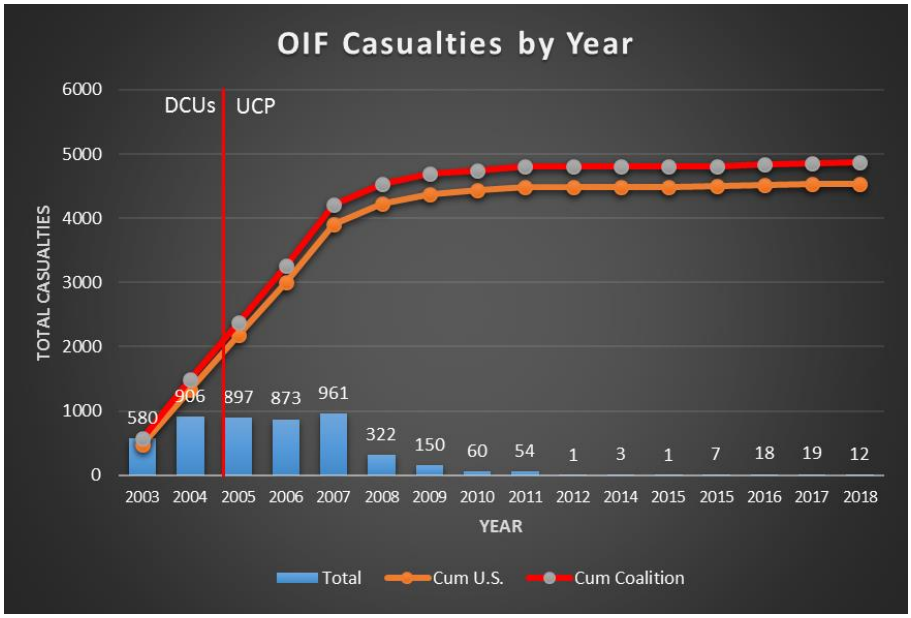

Figure 39. OIF casualties. Adapted from "Operation Iraqi Freedom" (n.d.) and "Defense Casualty" (2018).

1. OEF: United States

A closer look at U.S. casualty rates was conducted with the available data from iCasualties and NATO's Placemat data archives. Two different camouflage uniform shifts occurred, once in 2005 and the other in 2011. The data presented is from January 2007–November 2014. Within the period of this research, we were not able to gather data points prior to January 2007. Figure 40 visually indicates fatality rates with the red vertical line approximating the uniform change.

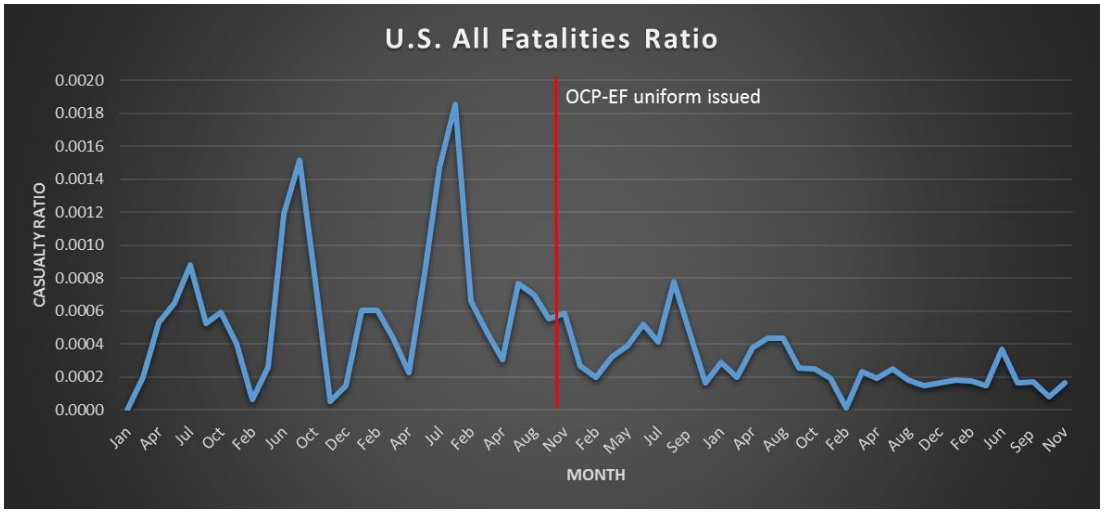

Figure 40. Overall U.S. fatalities ratio. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Further analysis before and after the 2010 uniform change yielded the following data (Figures 41 and 42, Table 2):

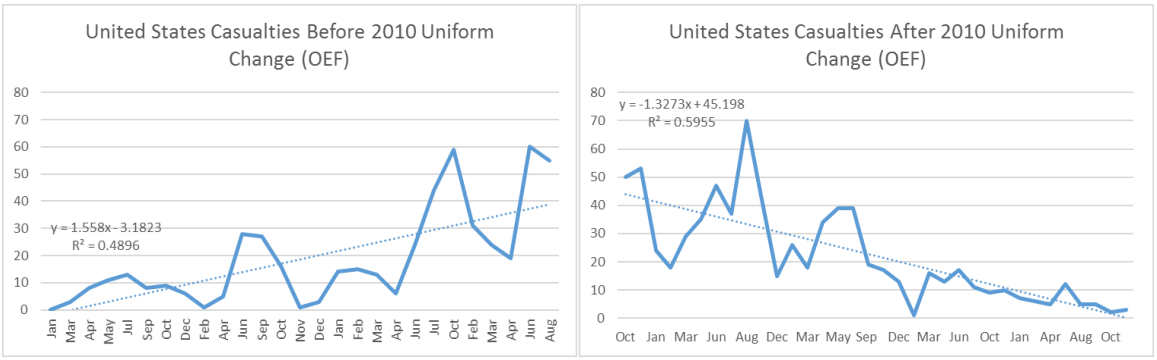

Figure 41. U.S. average monthly casualties before and after 2010 uniform change. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

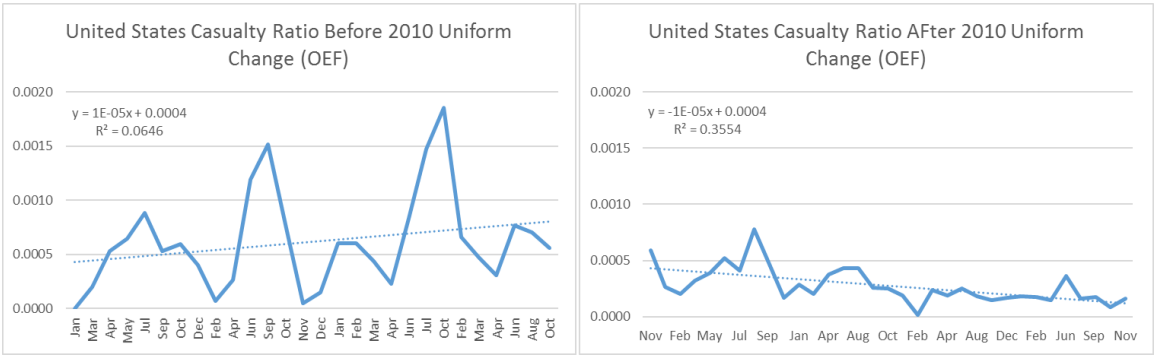

Figure 42. U.S. average monthly casualty ratio before and after 2010 uniform change (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Table 2. U.S. average monthly OEF casualty data. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

U.S. Average Monthly OEF Casualty Data		
	Before	**After**
Casualties	18.62962963	21.97058824
Casualties Ratio	0.0006	0.0003

Although the monthly average of casualties after the uniform change increased from 18.63 to 21.97, the average casualty ratio decreased from 0.0006 to 0.0003. There also was a decreasing trend line observed after the uniform change was executed.

On further analysis of the regressions, it is important to note the significance of the R2 values displayed. Trendlines are constrained and fitted as closely as possible to the available data. In order to assess how closely a trendline can explain the linear relationship, the correlation of coefficient derived from the coefficient of determination must be calculated (E. Dahel, lecture, June 5, 2017). As presented by Dr. Eddine Dahel in his Managerial Statistics course at the Naval Postgraduate School, the following Correlation Coefficient interpretations are as follows (Figure 43 and Table 3) (E. Dahel, lecture, June 5, 2017):

$|r| = 0$, no correlation
$0 < |r| < .2$, very weak correlation
$.2 \leq |r| < .4$, weak correlation
$.4 \leq |r| < .6$, moderately strong correlation
$.6 \leq |r| < .8$, strong correlation
$.8 \leq |r| < 1$, very strong correlation
$|r| = 1$, perfect correlation

Figure 43. Correlation coefficient interpretation. Source: E. Dahel, lecture, June 5, 2017.

Table 3. Correlation coefficient interpretation for U.S. average monthly OEF casualty data. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Correlation Coefficient Interpretation U.S. Average Monthly OEF Casualty Data		
	Before	**After**
Casualties	0.6997 (strong)	0.7717 (strong)
Casualties Ratio	0.2542 (weak)	0.5962 (moderately strong)

The results of the trendline analysis from the U.S. monthly average casualties before and after the 2010 uniform change have correlation coefficients of 0.6997 and 0.7717, respectively, indicating that there is a strong correlation. The casualty ratios correlation coefficients are 0.2542 for a weak correlation and 0.5962 with a moderately strong correlation. While the initial results provide an interpretation of strong correlation, this and the following correlation coefficient interpretations do not indicate any kind of causality between the uniform shifts and the change in trends.

2. OEF: United Kingdom and Australia

The UK and Australia also adopted new camouflage patterns in Afghanistan. The UK started to issue MTP to its troops deployed to Afghanistan in March 2011 (Copping, 2009) whereas Australia issued the new camouflage uniforms to its soldiers in 2011 (McPhedran, 2010). We observed the following for both the countries in Afghanistan (see Figure 44). Detailed data is provided in Appendix A.

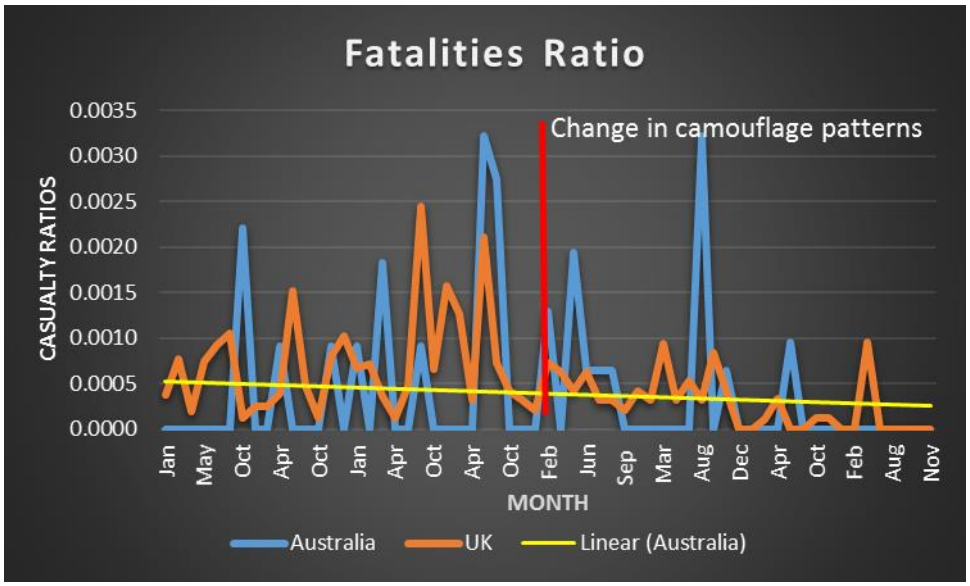

Figure 44. UK and Australia fatalities in Afghanistan (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Further breakdown before and after the 2011 uniform change is given in Figures 45 to 48:

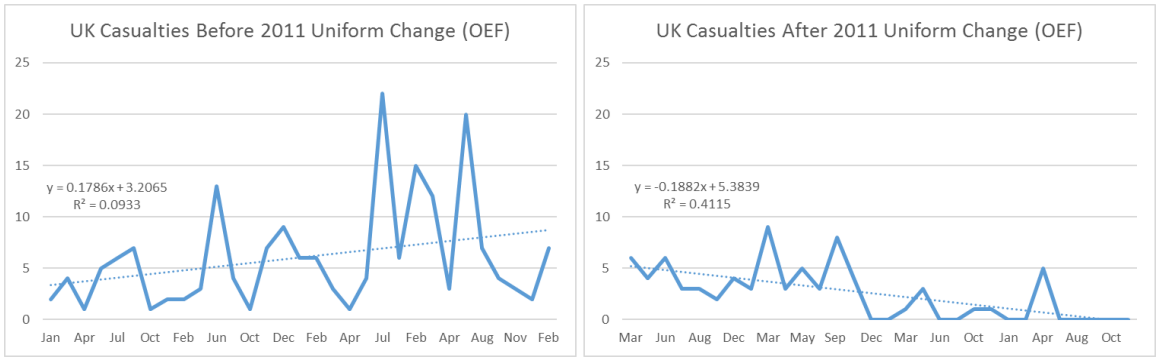

Figure 45. UK casualties before and after 2011 uniform change (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

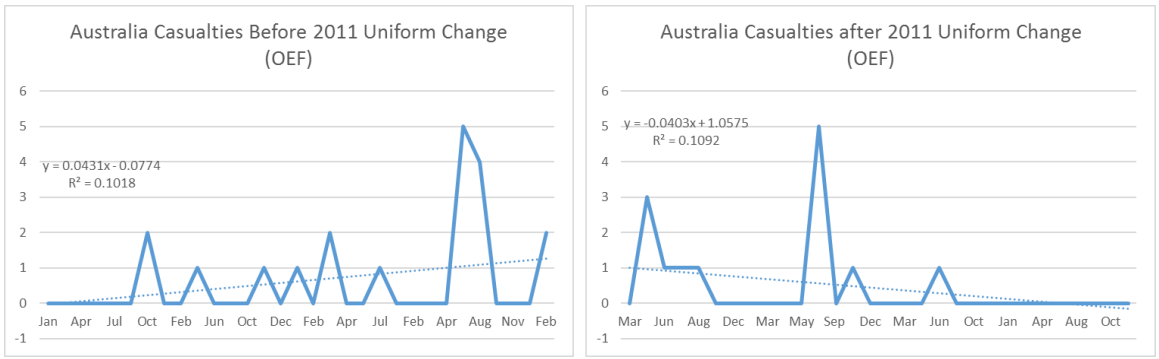

Figure 46. Australia casualties before and after 2011 uniform change (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

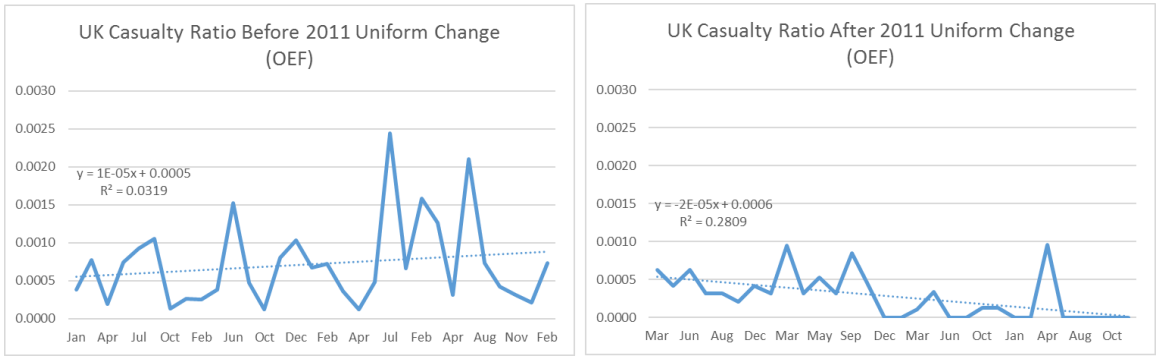

Figure 47. UK casualty ratio before and after 2011 uniform change (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

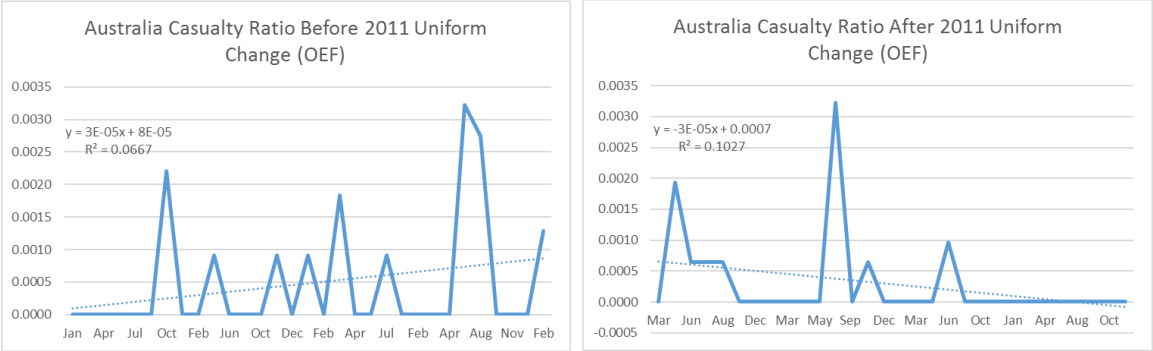

Figure 48. Australia casualty ratio before and after 2011 uniform change (OEF). Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Table 4. UK and Australia average monthly OEF casualty data. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

UK and Australia Average Monthly OEF Casualty Data		
	Before	**After**
UK Casualties	6.064516129	2.466666667
Australia Casualties	0.612903226	0.433333333
UK Casualty Ratio	0.0007	0.0003
Australia Casualty Ratio	0.0005	0.0003

UK and Australian armed forces show a decrease in average monthly casualty rates from 6.06 to 2.47 deaths per month, with ratios also reflecting a decrease from 0.0007 to 0.0003 for the UK and 0.0005 to 0.0003 in Australia after the two countries implemented their uniform changes, please refer to Table 4 for the breakdown.

The correlation coefficient interpretation as presented in Table 5 shows that the trendline prior to the uniform shift has a weak relationship while UK casualties and the corresponding UK casualty ratio after the shift is displaying a stronger relationship.

Table 5. Correlation coefficient interpretation for UK and Australia average monthly OEF casualty data. Adapted from "Operation Enduring Freedom" (n.d.) and "North Atlantic" (2017).

Correlation Coefficient Interpretation UK and Australia Average Monthly OEF Casualty Data		
	Before	**After**
UK Casualties	0.3055 (weak)	0.6415 (strong)
Australia Casualties	0.3191 (weak)	0.3305 (weak)
UK Casualty Ratio	0.1786 (very weak)	0.5300 (moderately strong)
Australia Casualty Ratio	0.2583 (weak)	0.3205 (weak)

3. OIF: United States

OIF data analysis was conducted only for the U.S. due to the constraints of available information for other coalition nations. In OIF, the U.S. changed its uniform from Desert Camouflage Uniform (DCUs) to UCP in February 2005 (Team Quinstreet, 2005). We normalized the casualties based on the number of soldiers deployed and examined the correlation between uniform changes and casualty numbers. The two charts depicted in Figures 49 and 50 are from data gathered from DMCA and *Al Jazeera* news and represent an overall picture of deaths and wounded from January 2004 to January 2006, again with the red vertical line representing the uniform change implementation in 2005. A detailed table is available in Appendix A.

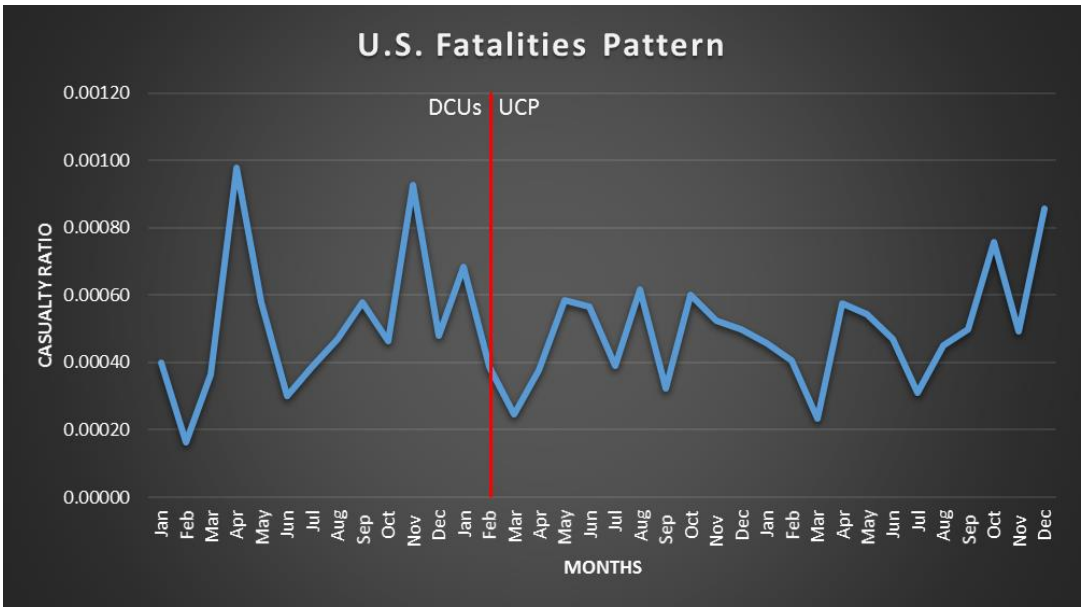

Figure 49. U.S. total deaths in OIF. Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

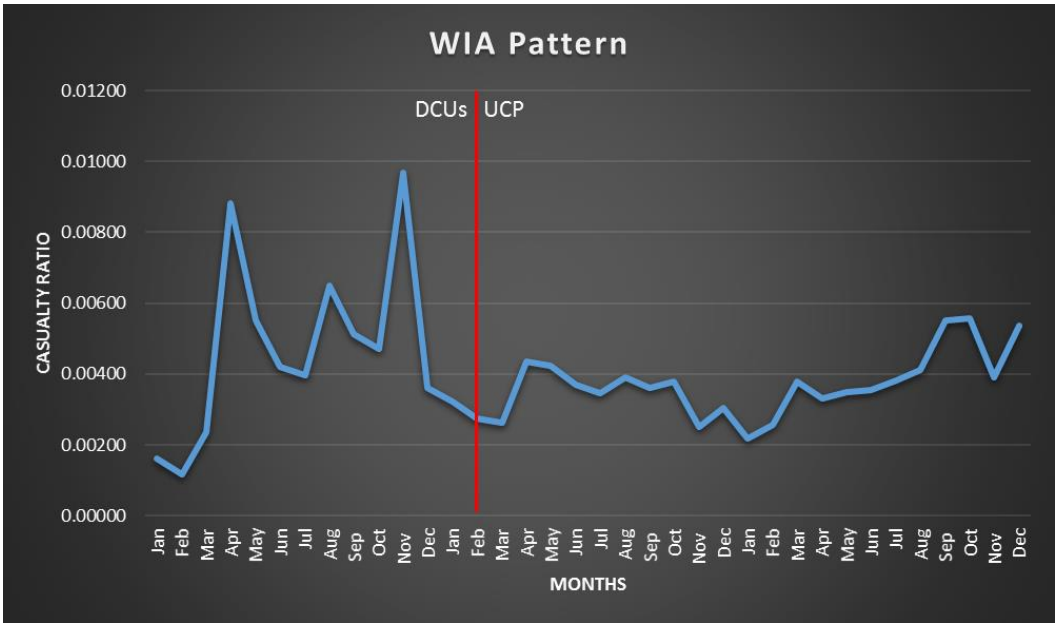

Figure 50. WIA OIF. Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

Further analysis comparing data prior to the uniform change in 2005 and data for the subsequent months is shown in Figures 51 to 54:

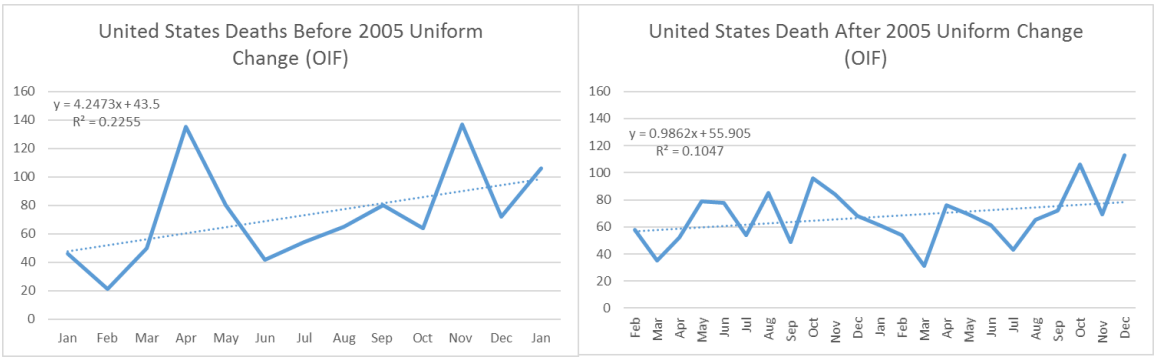

Figure 51. U.S. deaths before and after 2005 uniform change (OIF). Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

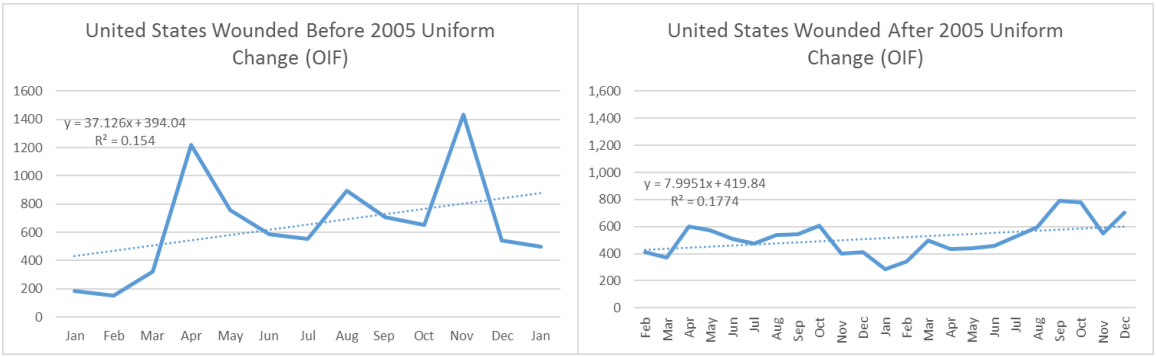

Figure 52. U.S. wounded before and after 2005 uniform change (OIF). Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

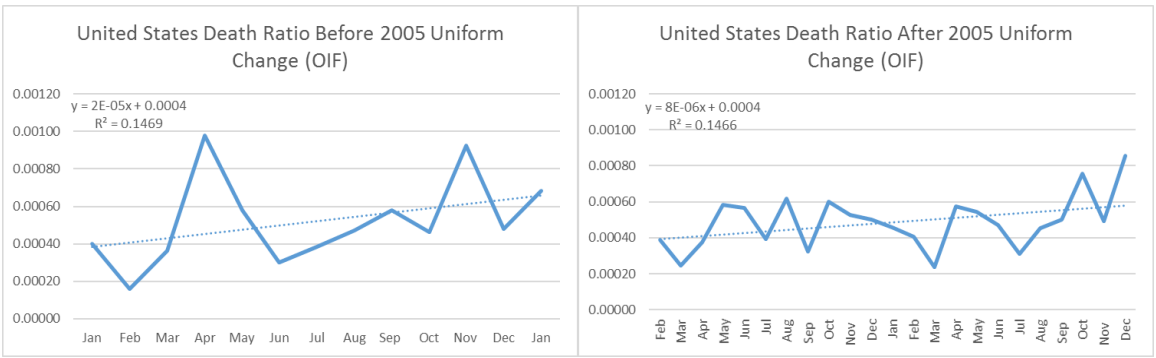

Figure 53. U.S. death ratio before and after 2005 uniform change (OIF). Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

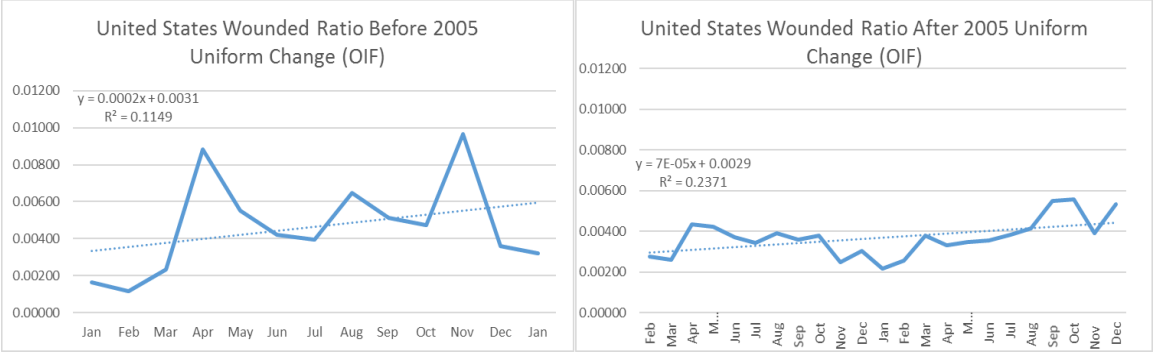

Figure 54. U.S. wounded ratio before and after 2005 uniform change (OIF). Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

As shown in Table 6, although the trend lines show an upward trend for the death and wounded data charts, the average monthly casualties actually show a decrease after the uniform change was implemented in 2005. Deaths decreased from 73.23 to 67.74 while average monthly wounded numbers decreased from 653.92 to 516.00. Ratios for both death and wounded also decreased. An important observation to note is that the slopes are lower, indicating that the rates of casualty have decreased. Mixed interpretations of the data regarding the correlations of coefficient can be seen in Table 7, ranging from weak to moderately strong.

Table 6. U.S. monthly average OIF casualty data. Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

U.S. Monthly Average OIF Casualty Data		
	Before	**After**
Deaths	73.23076923	67.73913043
Wounded	653.9230769	516
Deaths Ratio	0.00052	0.00049
Wounded Ratio	0.00465	0.00370

Table 7. Correlation coefficient interpretation for U.S. monthly average OIF casualty data. Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

Correlation Coefficient Interpretation U.S. Monthly Average OIF Casualty Data		
	Before	**After**
Deaths	0.4749 (moderately strong)	0.3236 (weak)
Wounded	0.3924 (weak)	0.4212 (moderately strong)
Deaths Ratio	0.3833 (weak)	0.3829 (weak)
Wounded Ratio	0.3390 (weak)	0.4870 (moderately strong)

D. LEGAL CONSTRAINTS FOR IMPLEMENTATION

DoD Instruction (DoDI) 4140.63 makes the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) in charge of policies on development and implementation of military clothing (Department of Defense, 2017). The revised policy on ground uniforms prohibits the Secretaries of military departments from "adopt[ing] any new camouflage pattern design or uniform fabric for any combat or camouflage utility uniform or family of uniforms for use by an Armed Force" ("The Uniform," 2011). The Secretary of Defense, however, can grant an exception as well based on unique operational requirements. Laws are often amended and revised. We can summarize the legal constraints and opportunities for the implementation of a joint coalition uniform:

- Provisions of Berry Amendment and the Buy American Act (BAA) regulate the procurement of military uniforms. These provisions restrict the federal government from foreign access and give preference to domestic products.

- Each respective military establishment regulates any changes to the adoption of a new uniform for most coalition partners. In the UK, approval has to be sought from the Army Dress Committee for changing the dress pattern (United Kingdom Ministry of Defense, 2011). In Canada, the Chief of Defense Staff approves any changes in the uniform designs and uniform

related policies (Canadian Chief of Defense Staff, 2017). Taking different coalition partners on board can be a challenge.

- Sensitive equipment that is essential for national security remains protected by Article 346 of the Treaty on the Functioning of EU (Randazzo, 2014). This article can still be an impediment for implementing any joint policy for uniforms.

- NATO STANAG on the performance and protectives properties of combat clothing ("North Atlantic," 1992) has been in place since 1992. STANAG 2335 specifies equivalent uniform sizing systems between the member countries to facilitate interchangeability of uniforms ("North Atlantic," 2012). These STANAGS are a step forward towards commonality in military uniforms between the member states. They can be leveraged and used as a catalyst for camouflage pattern standardization.

- The EU adopted the Defense and Security Procurement Directive 2009/81/EC in 2009 ("The European Parliament," 2009). This directive provides a legal framework for procurement of defense-related equipment within the EU. The Defense and Security Directive has opened up the EU defense sector to open competition and has strengthened the EU defense technological and developmental base. This Directive has also simplified the procedures for the award of the defense-related contracts and has increased the coordination between the EU member states in the field of all the defense-related equipment. This can also pave the way for moving towards joint uniform for EU member states.

E. FUNDING CONSIDERATIONS

One of the most highly visible joint acquisition programs is the F-35 Joint Strike Fighter (JSF). Although this program has been plagued with controversy due to delays and cost overruns, it is a very prominent example of a joint collaboration among many nations to create a revolutionary weapons system. Originally conceived by the U.S., the JSF

program evolved to attract other coalition nations: The UK, Canada, Australia, The Netherlands, Norway, Italy, Turkey, and Denmark (Sullivan, 2017). Memorandums of understanding (MOU) were created among all international partners that "identified the roles, responsibilities, and expected benefits for all participants and are negotiated for each acquisition phase" (Schinasi, 2003). These MOUs also outlined all aspects of financial management, funding sources, and audit processes (Schinasi, 2003). As seen in Table 11 (Appendix B), the JSF international partner contributions towards system development and demonstration are over 13.7% over the overall cost, with the U.S. providing the rest of the 86.3% (Schinasi, 2003).

Votes on critical decisions of the program depend on the level of financial contribution of the partner nations (Schinasi, 2003). Various stipulations are included in the MOU to address burden sharing for any cost increases, technology transfer, and disclosures (Schinasi, 2003).

Another example of a joint program is the EF-2000 Eurofighter Typhoon (Eurofighter) conceived by a small group of multinationals from the UK, Germany, Italy, Spain, and France. The breakdown for current ownership of the consortium: UK with 33%, Germany with 33%, Italy with 21%, and Spain with 13% (Eurofighter Typhoon, n.d.). Challenges to the process eventually caused cost increases but a foundation for multinational collaboration has been established (Global Security, n.d.) to oversee the program cost impacts.

Programs like the JSF and the Eurofighter can provide insights on the framework for the development and rollout of joint standardized camouflage uniforms. Although the development of camouflage uniforms is not as complex as either aircraft program, it still requires the same attention for all phases in the acquisition life cycle. Financial contributions from partner nations will allow each member to assert some level of input in the design and development process. In both aircraft development programs, it is evident that major coalition powers will naturally provide a significant percentage of funding, which will be beneficial for other partner nations to take advantage of the technological innovation that results in the final product.

F. LOGISTICAL CONSIDERATIONS

Individual deployment and sustainment of forces can be very challenging in a multinational operational environment. Deployment and sustainment of forces can be more effective and efficient if the coalition partners form a centralized logistic support arrangement. MIC Steering Group (SG) consisting of senior officers from Australia, Canada, France, Germany, Italy, the UK, and the U.S., has already approved and endorsed a set of guidelines for addressing the coalition partners' logistic issues (Multinational Interoperability Council [MIC] Vol III.6, 2015). The potential benefits for a multinational logistics system for joint uniforms can simply the provision of uniforms in theater. This will not only reduce the logistic footprint but will also optimize the overall logistic support. Some of the challenges to adoption of a single supply chain of the uniforms are:

- Advance planning for the uniforms will be very difficult at the onset of a crisis. There will not be enough time to analyze the number of coalition partners, number of troops to use, and duration of the coalition operation.
- Issues related to the financial reimbursements among the coalition partners.
- Lack of commonality for the uniform sizes and the passage of information for the supply of uniforms.

MIC SG has suggested adoption of NATO STANAGs and quadrennial agreements between America, Australia, Britain, and Canada to facilitate the logistic standardization within the coalition (MIC Vol III.6, 2015). Mutual Logistic Support Arrangements (MLSA) is another way to establish a working framework for the exchange of logistic support for the provision of uniforms.

G. CHALLENGES TO IMPLEMENTATION

Implementation of any joint venture requires careful planning and close collaboration. While the potential benefits are legitimate and have lasting positive implications, the complexity, size, and scope of the joint standardized uniform program could reveal the following challenges:

- Resistance and rejection from any of the coalition partners
- Design and development collaboration roadblocks
- Restrictions in procurement policies
- Reimbursement and transfer of funds for distribution funds among the coalition forces
- Technology transfer and disclosure agreements

There have been numerous efforts within the DoD to standardize combat camouflage uniforms. Within the fiscal year 2010 NDAA under section 352 "Policy on Ground Combat and Camouflage Utility Uniforms," the U.S. government has introduced the policy to establish joint camouflage uniform criteria for materials, capabilities, and technology that may be shared across all branches ("National Defense," 2009). While congressional leadership saw the potential of joint uniforms and enacted policies to do so, the challenge of executing this policy at the DoD level proved to be difficult. In a 2012 GAO report, the service branch leaders were not able to agree on joint criteria for the uniforms. In addition, the differences among the various branch uniform programs did not comply with the NDAA directive to develop equivalent performance parameters for protection and wear (Russell, 2012). The lack of successful collaboration resulted in a missed opportunity for the Army and another branch to save over $82 million in initial inventory fees (Russell, 2012). The Navy's efforts with the Type I desert and Type II woodland uniforms had the potential to save $6 million in initial inventory costs if inter-service collaboration were utilized (Russell, 2012). Found in the NDAA for FY14, the combat uniform policy under section 352 remained, and to this date, no significant progress has been made to a successful collaboration across all four service branches ("National Defense," 2013). This resistance to change and collaboration is one of the major barriers to implementation because established organizations have the tendency to maintain their identity and uniqueness. As Joseph and Alex pointed out in their American Journal of Sociology article, rejection has many sources: the uniform, the organization that the uniform represents, the ideals that the uniform represents, suppression of the individuality

(Joseph & Alex, 1972, pp. 727–728). The degree of rejection is compounded according to size as individual groups involved are the size of nations.

In addition to the sociological aspect of resistance and acceptance of joint uniforms, the efforts could be further strained by the procurement policy restrictions across the spectrum of potential coalition partners. Although the U.S. probably is the most restrictive with its Buy American Act and the Berry Amendment, the EU nations explicitly direct non-discriminatory practices that allow foreign vendors to bid on contracts. Exceptions do exist. In the case of the Berry Amendment, the DoD can submit request waivers if items "produced in the U.S. cannot be acquired as and when needed in a satisfactory quality and sufficient quantity at U.S. market prices" while the branch secretaries "have the authority to approve domestic non-availability determinations for their respective requirements" ("International Trade," 2018). Along with the challenges in procurement policies, coalition partner nations could face roadblocks to consensus for funding percentage and reimbursement among all coalition forces. As seen in the JSF and Eurofighter programs, funds contribution could be agreed to and voting and representation used as incentives.

Finally, consensus regarding transfer of sensitive technological innovation and disclosure policies poses a potential barrier to implementation. Collaboration to design and develop a superior set of camouflage uniforms provides a great competitive advantage over non-coalition adversaries. Establishing and managing such a policy that involves many nations can be hindered by the uncertainty of changing political relationships and alliances.

H. SUMMARY OF ANALYSIS

The use of PESTLE and SWOT framework analysis allowed a holistic look into the intricacies and nuances of the feasibility of implementation for joint camouflage combat uniforms. Both analyses, not surprisingly, revealed many sources of complications. Resistance and rejection of the joint uniform have roots in all aspects, from political differences, the desire to maintain a national identity, unique procurement policies, and the complexity of each country's logistics and supply chain. One capability that the MIC has highlighted is the ability to standardize.

Standardization of terminology, doctrine, logistics, tactics, and strategy all ensure effective command and control. These benefits could be taken a step further by the effective implementation of joint uniforms, which has the potential to improve operational cohesion, cultural normalization, and performance, as well as enhancing personnel protection. While potential benefits become apparent for the coalition, the potential value on the battlefield could not be understated. Visual standardization could potentially provide effective deterrent against the enemy and have improved relations and interactions with the community.

Other constraints stem from each nation's legal parameters, funding constraints, and commercial and military logistics complexities. As we have seen during the efforts to execute the JSF and Eurofighter programs, there are existing avenues within the legal and policy frameworks to allow for proper support of coalition forces.

Finally, a correlation analysis between casualties and uniform implementation in OEF and OIF revealed interesting results that highlighted a general decrease rate of casualty and a decrease in incidences of spikes in the data. A correlation coefficient interpretation was conducted to ensure that the trend lines for the linear regression was addressed. Because the data set presented in this research did not go into detail regarding under what specific operation or instance these casualties occurred, we can only infer correlation and not causality.

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V. CONCLUSIONS, RECOMMENDATIONS, AND AREAS FOR FUTURE RESEARCH

A. CONCLUSIONS

The evolution of camouflage combat uniforms has come a long way. It is easy to see that every service branch from every nation recognizes the value of both its ability to conceal and protect the service member. More importantly, uniforms establish the organization's identity. It is very apparent even at the microcosm level within the U.S. Navy's various uniforms that distinguish sailors from those permanently attached to surface vessels to those serving in expeditionary units. As the uniforms within these smaller organizations provide what they perceive to be the best personnel protection, they also provide the much-needed standardization to ensure unit cohesion psychologically, sociologically, and at the command and control level. The benefits of effective combat camouflage uniforms could be translated to any size organizations. Although as the size of the organization grows, certain challenges also compound. Through proper implementation, however, long-range planning, close collaboration, careful execution, and being flexible will make the joint combat camouflage uniform feasible for U.S.-led coalition use.

B. SUMMARY OF ANSWERS TO PRIMARY AND SECONDARY RESEARCH QUESTIONS

Our primary research question was to evaluate the feasibility for U.S.-led coalition forces to wear the same camouflage uniform in combat operations. According to our research and analysis in Chapter 4, a joint uniform for U.S.-led coalition force is feasible for future multinational operations. To examine the issues related to our primary research question we developed six secondary questions. Our answers to these questions are as follows:

Under what conditions would a coalition uniform make sense and how it might be implemented? Future military operations will be increasingly multinational in character. These operations will be conducted within the framework of an alliance or a

coalition as it was evident in the case of Iraq and Afghanistan. These operations will be facilitated by lead nations, which will assume the bulk of the responsibilities. Therefore, a joint uniform can be implemented in any future military operation within the framework of an alliance or coalition.

What are the affordability impacts? Who will fund the effort? The lead nations will lead the funding effort. This is consistent with the history of joint multinational programs. The U.S. contributed 86.3% of the funding towards the development of F35 JSF program (Schinasi, 2003). Similarly, the ownership of the costs in the case of the Eurofighter is distributed between UK (33%), Germany (33%), Italy (21%), and Spain (13%) (Global Security, n.d.). Collaboration for a joint uniform can potentially reduce the unit production costs by 10% (Hartley, 1997). This argument is also supported by the GAO, which suggests potential savings of over $82 million, if the Army had collaborated for the initial inventory with another service branch (Russell, 2012).

What are the logistical considerations? The U.S. and NATO are already collaborating on the in-theater logistic support. NATO STANAGs and mutual agreements between the lead nation and major partners in the coalition can facilitate the logistic standardization within the alliance or coalition.

Are there legal constraints for different countries? There will be many legal constraints due to the involvement of different countries. The U.S. has the most stringent policies through the Berry Amendment and the Buy American Act (BAA) to regulate the procurement of military uniforms. As James Mattis states in the National Defense Strategy document, however, "The Department's management structure and processes are not written in stone, they are a means to an end—empowering the warfighter with the knowledge, equipment and support systems to fight and win" (Mattis, 2018). In case of EU member states, more commonalities have been observed in the shape of EU Defense and Security Procurement Directive 2009/81/EC. This directive simplifies the legal constraints for the procurement of defense-related equipment within the EU.

Are there any sociological impacts within coalition forces' cohesiveness and camaraderie? Standardizing uniforms will have potential impact on the morale of the

smaller nations and there will be a potential increase in force cohesiveness and coordination as well (refer to our PESTLE and SWOT analysis). There is a general understanding that standardization is a prerequisite for joining the military. As the organizations grow, interoperability requirements become top priority for successful completion of the mission. From our research, uniforms allow for legitimacy of the coalition, normalization of ranks, and normalization of culture. Social equality has the potential to improve morale and cohesion among the partner nations. As with large organizations implementing change, especially with a large coalition force, resistance and rejection are both expected. Retaining national identity, individuality, and uniqueness could be a challenge for compliance.

Are there any correlations in the number of casualties with more superior forces vs. secondary (lesser-equipped/less numbers/not well trained) forces within the coalition? We analyzed the casualty data before and after the implementation of a specific camouflage uniform pattern. Our analysis showed potential positive effects and the number of casualties reduced in both OEF and OIF. Casualty reduction cannot be directly attributed to the uniform change, however. During OEF, the U.S. executed two uniform changes, the first in 2005 and the second in 2011. Available data was gathered from January 2007 to November 2014, which only allowed analysis for the second uniform shift. A linear regression was conducted for the data before and after the 2011 uniform shift. The analysis yielded a decreasing trend after the shift with a strong correlation coefficient interpretation. Australia and the UK also displayed a decreasing trend after their respective uniform change in 2011 as well. Interestingly, the overall average monthly casualties for both countries show a significant decrease. Due to the variance in data, however, R-values displayed a general weak coefficient correlation. OIF data analysis looked at data from January 2004 to January 2006 with a uniform change implemented early 2005 for the U.S. The regression analysis before and after produced an upward trend for both, although it is important to note that the average monthly casualties significantly decreased while the rate of casualty was also lower after the uniform shift. As in OEF, the OIF data has some variability displaying both weak and moderately strong coefficient correlations.

C. RECOMMENDATIONS

Through our research questions, the following recommendations are presented:

- While correlations exist, they do not indicate causality between decreases in casualties attributed to the respective shifts in uniform. A more detailed study on the shifts in uniforms and the pattern of causalities is recommended to analyze the effectiveness of a specific uniform being implemented.

- Each nation has varying degrees of restriction for defense procurement policies. It is recommended that a thorough research be conducted on feasibility to implement lessons learned from the JSF and Eurofighter programs to establish a better approach to joint procurement projects such as a standardized coalition uniform.

- Establish a joint working group within the framework of MIC to work on joint criteria for aspects including ground combat uniforms as a key factor of standardization. Coalition nations can initially standardize basic materials, ranks, patches, and accessories and subsequently move towards a joint uniform pattern when there is enough consensus among the member states. They can collect data from the major coalition partners about their concerns and formulate a joint policy document for future implementation of a single camouflage pattern for future coalition operations.

D. FUTURE RESEARCH CONSIDERATIONS

- Develop a survey to analyze the views of major nations that have already participated with the U.S. in recent multinational operations. Survey questions can be asked of the representatives of the U.S., UK, Australia, France, Canada, Germany, and Italy, which are already collaborating with each other through the MIC and NATO platform.

- Conduct a study on executing a pilot program centered on standardized uniforms during joint multinational exercises.

- Conduct a cost-benefit analysis to assess the impact of collaboration among the major coalition partners on development, production, and distribution.
- Evaluate the effects of standardized uniforms on unit cohesion, morale, and overall interoperability by moving towards a joint uniform.

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APPENDIX A. CASUALTY DATA OF OEF AND OIF

Table 8. Casualty data analysis. Adapted from "Defense Casualty" (2018) and "Troop Numbers" (2011).

Year	Month	U.S. Troop Level	Total Deaths**	WIA	Death Ratio	WIA Ratio
2004	Jan	115,000	46	187	0.00040	0.00163
2004	Feb	130,000	21	150	0.00016	0.00115
2004	Mar	137,000	50	322	0.00036	0.00235
2004	Apr	138,000	135	1,217	0.00098	0.00882
2004	May	138,000	80	760	0.00058	0.00551
2004	Jun	140,000	42	588	0.00030	0.00420
2004	Jul	140,000	54	553	0.00039	0.00395
2004	Aug	138,000	65	895	0.00047	0.00649
2004	Sep	138,000	80	709	0.00058	0.00514
2004	Oct	138,000	64	651	0.00046	0.00472
2004	Nov	148,000	137	1,432	0.00093	0.00968
2004	Dec	150,000	72	540	0.00048	0.00360
2005	Jan	155,000	106	497	0.00068	0.00321
2005	Feb	150,000	58	413	0.00039	0.00275
2005	Mar	142,000	35	371	0.00025	0.00261
2005	Apr	138,000	52	599	0.00038	0.00434
2005	May	135,000	79	570	0.00059	0.00422
2005	Jun	138,000	78	511	0.00057	0.00370
2005	Jul	138,000	54	476	0.00039	0.00345
2005	Aug	138,000	85	540	0.00062	0.00391
2005	Sep	152,000	49	546	0.00032	0.00359
2005	Oct	160,000	96	608	0.00060	0.00380
2005	Nov	160,000	84	400	0.00053	0.00250
2005	Dec	136,000	68	414	0.00050	0.00304
2006	Jan	133,000	61	288	0.00046	0.00217
2006	Feb	133,000	54	342	0.00041	0.00257
2006	Mar	132,000	31	499	0.00023	0.00378
2006	Apr	132,000	76	435	0.00058	0.00330
2006	May	126,900	69	443	0.00054	0.00349
2006	Jun	130,000	61	460	0.00047	0.00354
2006	Jul	138,000	43	526	0.00031	0.00381
2006	Aug	144,000	65	594	0.00045	0.00413
2006	Sep	144,000	72	793	0.00050	0.00551
2006	Oct	140,000	106	781	0.00076	0.00558
2006	Nov	140,000	69	548	0.00049	0.00391
2006	Dec	132,000	113	706	0.00086	0.00535

Table 9. U.S. fatalities in OEF. Adapted from NATO Placemat Archive and "Operation Enduring Freedom" (n.d.).

Year	Month	U.S. Troop Level	U.S. Fatalities	Casualty Ratio
2007	Jan	14,000	0	0.0000
	Mar	15,000	3	0.0002
	Apr	15,000	8	0.0005
	May	17,000	11	0.0006
	Jul	14,750	13	0.0009
	Sep	15,154	8	0.0005
	Oct	15,108	9	0.0006
	Dec	15,038	6	0.0004
2008	Feb	15,000	1	0.0001
	Apr	19,000	5	0.0003
	Jun	23,550	28	0.0012
	Sep	17,790	27	0.0015
	Oct	20,600	16	0.0008
	Nov	19,950	1	0.0001
	Dec	19,950	3	0.0002
2009	Jan	23,220	14	0.0006
	Feb	24,900	15	0.0006
	Mar	29,820	13	0.0004
	Apr	26,215	6	0.0002
	Jun	28,850	24	0.0008
	Jul	29,950	44	0.0015
	Oct	31,855	59	0.0019
2010	Feb	47,085	31	0.0007
	Mar	50,590	24	0.0005
	Apr	62,415	19	0.0003
	Jun	78,430	60	0.0008
	Aug	78,430	55	0.0007
	Oct	90,000	50	0.0006
	Nov	90,000	53	0.0006
2011	Jan	90,000	24	0.0003
	Feb	90,000	18	0.0002
	Mar	90,000	29	0.0003
	May	90,000	35	0.0004
	Jun	90,000	47	0.0005
	Jul	90,000	37	0.0004
	Aug	90,000	70	0.0008

Year	Month	U.S. Troop Level	U.S. Fatalities	Casualty Ratio
	Sep	90,000	42	0.0005
	Dec	90,000	15	0.0002
2012	Jan	90,000	26	0.0003
	Mar	90,000	18	0.0002
	Apr	90,000	34	0.0004
	May	90,000	39	0.0004
	Aug	90,000	39	0.0004
	Sep	74,400	19	0.0003
	Oct	68,000	17	0.0003
	Dec	68,000	13	0.0002
2013	Feb	68,000	1	0.0000
	Mar	68,000	16	0.0002
	Apr	68,000	13	0.0002
	Jun	68,000	17	0.0003
	Aug	60,000	11	0.0002
	Oct	60,000	9	0.0002
	Dec	60,000	10	0.0002
2014	Jan	38,000	7	0.0002
	Feb	33,600	6	0.0002
	Apr	33,500	5	0.0001
	Jun	32,800	12	0.0004
	Aug	30,700	5	0.0002
	Sep	28,970	5	0.0002
	Oct	24,050	2	0.0001
	Nov	18,180	3	0.0002

Table 10. UK and Australian fatalities in Afghanistan. Adapted from NATO Placemat Archives and "Operation Enduring Freedom" (NATO, n.d.).

		Troop Levels		All Fatalities		Fatality Ratio	
Year	Month	Australia	UK	Australia	UK	Australia	UK
2007	Jan	500	5200	0	2	0.0000	0.0004
	Mar	500	5200	0	4	0.0000	0.0008
	Apr	500	5200	0	1	0.0000	0.0002
	May	500	6700	0	5	0.0000	0.0007
	Jul	700	6500	0	6	0.0000	0.0009
	Sep	883	6678	0	7	0.0000	0.0010
	Oct	907	7740	2	1	0.0022	0.0001
	Dec	892	7753	0	2	0.0000	0.0003
2008	Feb	1070	7800	0	2	0.0000	0.0003
	Apr	1100	7750	1	3	0.0009	0.0004
	Jun	1100	8530	0	13	0.0000	0.0015
	Sep	1080	8380	0	4	0.0000	0.0005
	Oct	1080	8330	0	1	0.0000	0.0001
	Nov	1090	8745	1	7	0.0009	0.0008
	Dec	1090	8745	0	9	0.0000	0.0010
2009	Jan	1090	8910	1	6	0.0009	0.0007
	Feb	1090	8300	0	6	0.0000	0.0007
	Mar	1090	8300	2	3	0.0018	0.0004
	Apr	1090	8300	0	1	0.0000	0.0001
	Jun	1090	8300	0	4	0.0000	0.0005
	Jul	1090	9000	1	22	0.0009	0.0024
	Oct	1200	9000	0	6	0.0000	0.0007
2010	Feb	1550	9500	0	15	0.0000	0.0016
	Mar	1550	9500	0	12	0.0000	0.0013
	Apr	1550	9500	0	3	0.0000	0.0003
	Jun	1550	9500	5	20	0.0032	0.0021
	Aug	1455	9500	4	7	0.0027	0.0007
	Oct	1550	9500	0	4	0.0000	0.0004
	Nov	1550	9500	0	3	0.0000	0.0003
2011	Jan	1550	9500	0	2	0.0000	0.0002
	Feb	1550	9500	2	7	0.0013	0.0007
	Mar	1550	9500	0	6	0.0000	0.0006
	May	1550	9500	3	4	0.0019	0.0004
	Jun	1550	9500	1	6	0.0006	0.0006
	Jul	1550	9500	1	3	0.0006	0.0003
	Aug	1550	9500	1	3	0.0006	0.0003

Year	Month	Troop Levels		All Fatalities		Fatality Ratio	
		Australia	UK	Australia	UK	Australia	UK
	Sep	1550	9500	0	2	0.0000	0.0002
	Dec	1550	9500	0	4	0.0000	0.0004
2012	Jan	1550	9500	0	3	0.0000	0.0003
	Mar	1550	9500	0	9	0.0000	0.0009
	Apr	1550	9500	0	3	0.0000	0.0003
	May	1550	9500	0	5	0.0000	0.0005
	Aug	1550	9500	5	3	0.0032	0.0003
	Sep	1550	9500	0	8	0.0000	0.0008
	Oct	1550	9500	1	4	0.0006	0.0004
	Dec	1550	9500	0	0	0.0000	0.0000
2013	Feb	1096	9000	0	0	0.0000	0.0000
	Mar	1096	9000	0	1	0.0000	0.0001
	Apr	1084	9000	0	3	0.0000	0.0003
	Jun	1039	8065	1	0	0.0010	0.0000
	Aug	1031	7700	0	0	0.0000	0.0000
	Oct	1029	7900	0	1	0.0000	0.0001
	Dec	1045	7953	0	1	0.0000	0.0001
2014	Jan	348	5200	0	0	0.0000	0.0000
	Feb	351	5200	0	0	0.0000	0.0000
	Apr	351	5200	0	5	0.0000	0.0010
	Jun	356	5200	0	0	0.0000	0.0000
	Aug	272	3936	0	0	0.0000	0.0000
	Sep	273	3606	0	0	0.0000	0.0000
	Oct	271	2839	0	0	0.0000	0.0000
	Nov	268	2837	0	0	0.0000	0.0000

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APPENDIX B. JSF PARTNER FINANCIAL CONTRIBUTIONS

Table 11. JSF program partner financial contributions.
Adapted from Schinasi (2003).

Partner Country	Partner Level	Financial Contribution (in millions)	Percentage of Total Costs	Projected Quantities	Percentage of Total Quantities
UK	Level I	$2,056	6.2	150	4.7
Italy	Level II	$1,028	3.1	131	4.1
Netherlands	Level II	$800	2.4	85	2.7
Turkey	Level III	$175	0.5	100	3.2
Australia	Level III	$144	0.4	100	3.2
Norway	Level III	$122	0.4	48	1.5
Denmark	Level III	$110	0.3	48	1.5
Canada	Level III	$100	0.3	60	1.9
Total Partner		$4,535	13.7	722	22.8
U.S.		$28,565	86.3	2,443	77.2

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