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30 BRIGADE COMBAT TEAMS: IS THE ARMY TOO SMALL?

by

Asfandyar Khan

December 2016

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30 BRIGADE COMBAT TEAMS: IS THE ARMY TOO SMALL?

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ABSTRACT

The purpose of this thesis is to determine the impact of a contingency operation on Army dwell time. The Department of Defense (DOD) goal for the active Army is for every one year a unit is deployed, the unit gets two years at home. We use a simulation to model the number of times a Brigade Combat Team (BCT) deploys in support of a contingency operation over a specified period of time. This enables us to estimate the amount of time a unit was deployed and its dwell time. The results of the simulation show that the current force structure is not sufficient to sustain a prolonged contingency operation and support existing requirements. To meet the dwell time goal established by DOD, the Army must increase its capacity. In order to increase the number of BCTs, the Army will have to increase its end strength.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABCT	Armored Brigade Combat Team
AOR	Area of Responsibility
BCA	Budget Control Act
BCT	Brigade Combat Team
BOG	Boots on the Ground
BOG:Dwell	Boots on the Ground to Dwell Time Ratio
CENTCOM	Central Command
DOD	Department of Defense
FY	Fiscal Year
IBCT	Infantry Brigade Combat Team
ISIL	Islamic State
MOS	Military Occupational Skill
NDAA	National Defense Authorization Act
NMS	National Military Strategy
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
PB	President’s Budget
RA	Regular Army
SASC	Senate Armed Services Committee
SBCT	Stryker Brigade Combat Team
VEO	Violent Extremist Organizations

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EXECUTIVE SUMMARY

The United States Army is in the midst of one of the most significant transformations in recent history. The active Army is in the process of eliminating 120,000 soldiers and modifying force structure by reducing Brigade Combat Teams (BCTs) from 45 to 30. The 30 BCTs include 9 Armored Brigade Combat Teams (ABCT), 13 Infantry Brigade Combat Teams (IBCT) and 8 Stryker Brigade Combat Teams (SBCT) (Deputy Chief of Staff for Programs, Program Analysis and Evaluation Directorate 2015).

The purpose of this study is to determine whether the Army with, 30 BCTs, has the capacity to respond to a contingency operation, while maintaining a boots-on-the-ground to dwell-time ratio of at least 1:2. We use a simulation to model the number of times a BCT deploys in support of a contingency operation over a specified period of time. The contingency operation called for 3 ABCTs, 5 IBCTs and 2 SBCTs.

The model varied the available capacity of the BCTs, the demand for the BCTs and the length of the deployment. There were a total of 68 scenarios for all the BCTs; each scenario was replicated 100 times with a run time of 10 years. The model was then able to determine the number of times each BCT had to deploy for each scenario. We used this data to determine the total number of months a unit was deployed and its dwell time.

The results showed that in the event of another contingency operation, the Army will not be able to meet the DOD's dwell-time goals and have the capability to sustain a prolonged conflict. The Army should increase the number of BCTs to a minimum of 39. This includes 13 ABCTs, 17 IBCTs and 9 SBCTs. However, to grow the force structure, the Army will have to increase end strength, which it has no control over. The Army must continue to make the case to both, current and future federal administrations and Congress that the security landscape has

become increasingly unpredictable and more challenging, requiring an adjustment to the drawdown.

Reference

Deputy Chief of Staff for Programs, Program Analysis and Evaluation Directorate. 2015. *Senior Review Group 1—Force Structure and Military Manpower.* Briefing to Army Senior Leaders. Washington, DC. 2015.

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I. BACKGROUND AND LITERATURE REVIEW

This chapter will establish that despite the uncertain global environment, the reduction in federal spending has forced the Army to massively restructure. When comparing pre- and post-war active-duty end strength[1] to the projected strength, the potential demand on the force in the event of another large-scale contingency operation will far exceed the Army's capacity.

A. BACKGROUND

The U.S. Army is in the midst of one of the most significant transformations in recent history. Unlike previous drawdowns where change was necessary either to dissuade an adversary or to adapt to a security environment, this makeover is being forced upon the Army as a result of the Budget Control Act (BCA). Signed into law on August 2, 2011, the BCA reduced budgetary resources for the Department of Defense (DOD) by $55 billion per year between 2013 and 2021 (Congressional Budget Office 2011). As a result, the Regular Army[2] (RA) is in the process of eliminating 120,000 soldiers and modifying force structure by reducing Brigade Combat Teams (BCTs) from 45 to 30. Although a reduction in end strength was to be expected as the wars in Iraq and Afghanistan concluded, the BCA has increased the size and the speed at which the drawdown is occurring.

1. The Budget Control Act

The intent of the BCA was to increase the debt limit by $2.1 trillion in exchange for reducing the federal deficit by at least $2.1 trillion over a 10-year period beginning in fiscal year (FY) 2012 (Labonte and Levit 2011). The BCA established a Joint Select Committee for deficit reduction to find $1.2 trillion in savings in addition to the $900 billion reduction in discretionary spending. The

[1] End strength refers to the authorized military personnel at the end of the fiscal year.

[2] The active-duty force is referred to as the Regular Army.

law stipulated that if the committee did not identify the required savings by January 15, 2013, automatic cuts divided evenly between defense and non-defense spending would go into effect in January 2013 (Labonte and Levit 2011). The committee was unable to agree on spending cuts and after a two-month extension, automatic cuts went into effect in March of 2013.

Under the BCA, DOD funding decreased from $558 billion in FY 2012 to $518 billion in FY 2013. In FY 2014 and 2015, defense spending was held at $521 billion without an increase to cover the cost of inflation (Belasco 2015).

Figure 1 depicts the impact of the BCA on the Army. The dark blue line shows funding levels based on the FY 2012 President's Budget (PB) prior to enactment of the BCA. The FY 2012 funding level was $144.9 billion increasing to $153.2 billion in FY 2016. The black line sloping down from left to right shows appropriations enacted after Congress passed the BCA. The Army executed $137.3 billion in FY 2012; steadily decreasing to $120.8 billion in FY 2015 (this was revised from $119.9 billion). The light blue line represents funding levels in PB 2014 while the green line depicts the program as outlined in the Program Objective Memorandum[3] (POM) 2017–2021, which also happens to be the best case scenario moving forward. The red line shows the anticipated funding levels if sequestration continues (Deputy Chief of Staff for Programs, Program Analysis and Evaluation Directorate [DCS, PA&E] 2015a).

[3] The POM is the primary document used by the Department of Defense to submit programming proposals. It includes an analysis of missions, objectives, alternative methods and allocation of resources.

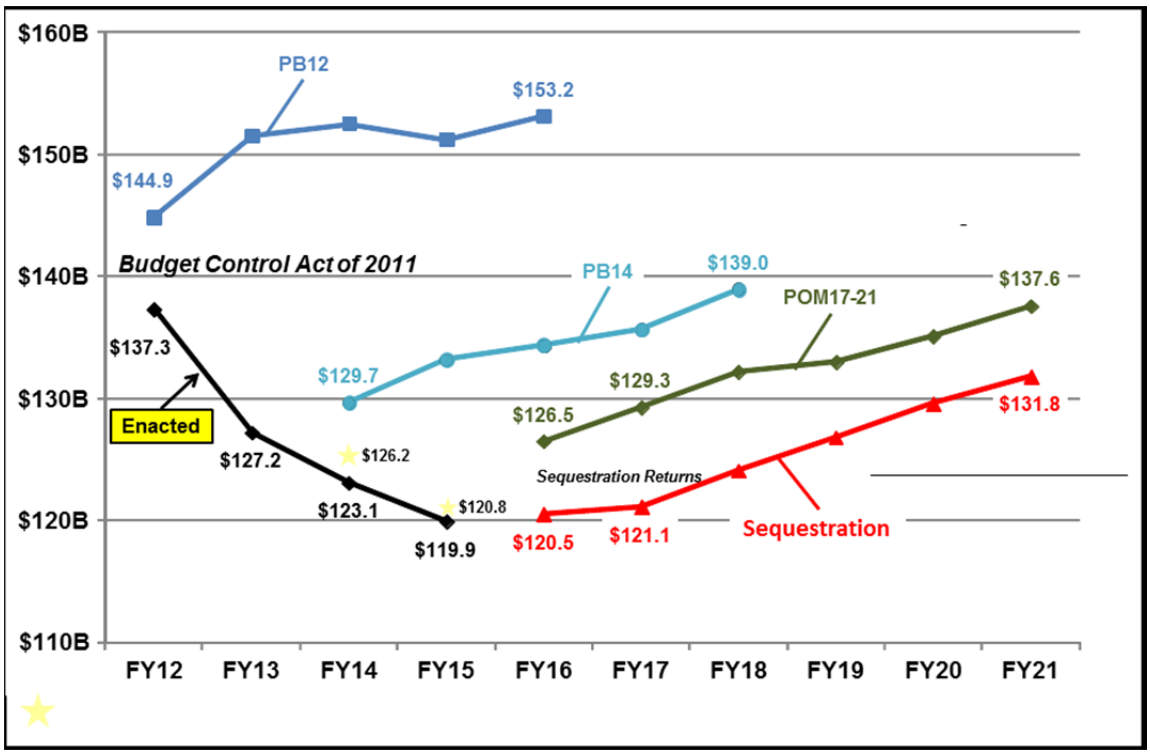

Figure 1. Army Funding FY 2012–2021. Adapted from DCS, PA&E (2015a).

At POM 2017–2021 levels, the Army can maintain an active component of 450,000 soldiers. If funding drops to sequester levels the Army will have to further reduce to 420,000 soldiers.

2. The Security Environment

The global security environment is unpredictable at best. The 2015 National Military Strategy (NMS) assesses the current environment perfectly. It states, “We now face multiple, simultaneous security challenges from traditional state actors and transregional networks of sub-state groups—all taking advantage of rapid technological change. Future conflicts will come more rapidly, last longer, and take place on a much more technically challenging battlefield. They will have increasing implications to the U.S. homeland” (Department of Defense [DOD] 2015, i). The security challenges come from both state and non-state actors.

Russia has begun to reassert itself as a military power with global aspirations. Their recent actions in Ukraine as well as Syria have made it clear that they seek greater a role in the world and are more than willing to use force to advance their cause.

After the removal of Saddam Hussein from power in 2003, Iran took full advantage of the subsequent vacuum and now has arguably become the dominant force in the Middle East. Despite the nuclear agreement between Iran and the major world powers in 2015, Iran continues to develop missile delivery technologies and is a state sponsor of terrorism creating instability across the Middle East (DOD 2015).

North Korea continues its pursuit of nuclear weapons and ballistic missile technologies. It has repeatedly conducted missile tests and is a direct threat to U.S. allies in the region, namely Japan and South Korea. On April 24, 2016, North Korea conducted a submarine launched ballistic missile test (Kim, and Park 2016). Then on September 10, 2016, North Korea detonated a 10 kiloton nuclear warhead, the largest in its history, and claims that the warhead can be mounted on a ballistic missile (Hunt, Kwon, and Hanna 2016). North Korea is a threat to our allies; it is only a matter of time before it becomes a direct threat to the United States.

China also seeks to expand its influence in the Pacific. It continues to disregard international law by claiming land in the South China Sea. This will allow China to position its military forces along strategic and vital international sea lanes (DOD 2015). Although its island-building reclamation effort is not a direct threat to the United States, it is contributing to the tension in the Asia-Pacific region.

Non-state actors pose a clear and present threat to the United States. Violent extremist organizations (VEO) such as Al-Qaeda and now the Islamic State (ISIL) operate in the Middle East and North Africa and continue to radicalize populations both here in the United States and abroad. The recent

terror attacks in Paris, Brussels, San Bernardino and Orlando have made it absolutely clear that ISIL has the ability to strike within our populations.

Figure 2 shows the United States' probability of becoming involved in a conflict. We are currently involved in a conflict with a non-state actor in Iraq and Syria. It is highly probable that this conflict may develop into a hybrid[4] conflict and as such will increase the demand for resources. "Hybrid conflicts serve to increase ambiguity, complicate decision-making, and slow the coordination of effective responses. Due to these advantages to the aggressor, it is likely that this form of conflict will persist well into the future" (DOD 2015). Additionally, General Mark Milley, the Army Chief of Staff, in testimony before the Senate Armed Services Committee (SASC) stated, "Right now the level of uncertainty, the velocity of instability, and potential for significant inter-state conflict is higher than it has been since the end of the Cold War in 1989–91." (Goure 2016).

[4] "Hybrid conflicts may consist of military forces assuming a non-state identity, as Russia did in the Crimea, or involve a VEO fielding rudimentary combined arms capabilities, as ISIL has demonstrated in Iraq and Syria. Hybrid conflicts also may be comprised of state and non-state actors working together…" (DOD 2015).

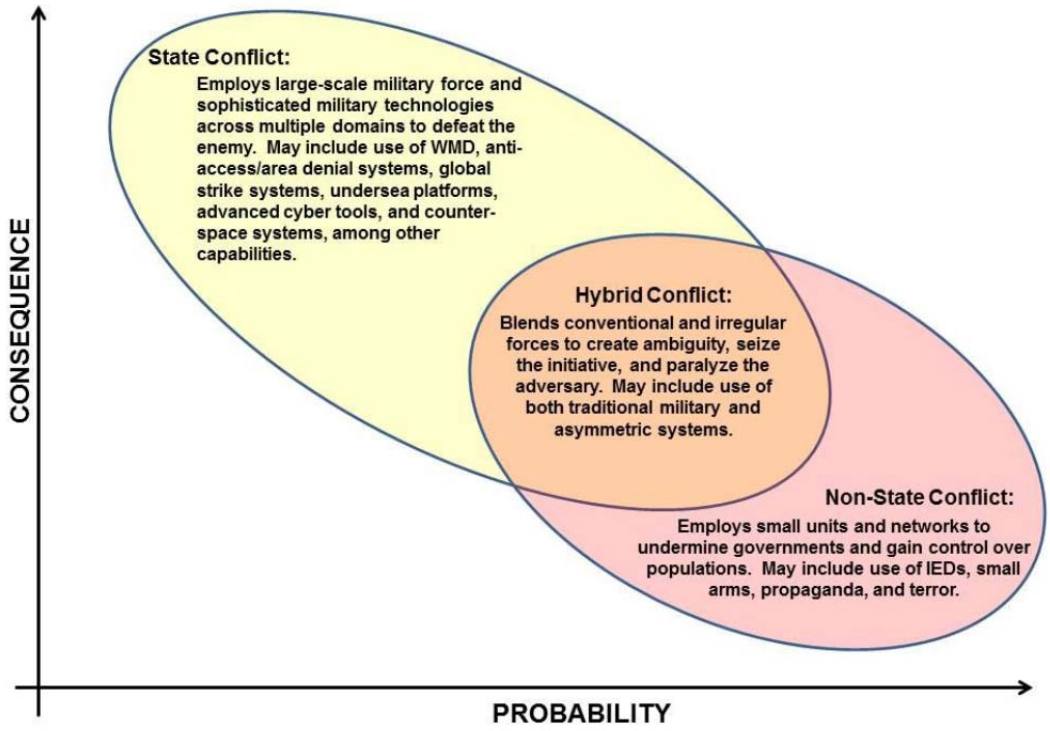

Figure 2. Continuum of Conflict. Source: DOD (2015).

Despite the increase in uncertainty and the advent of new threats, the Army, on its current path will shed 120,000 active duty soldiers (Feickert 2014). In the last decade the Army was involved in two long term operations in Afghanistan and Iraq. It is noteworthy that even though the active component grew by 90,000 soldiers over this time, the Army conducted the two campaigns sequentially (Goure 2016). The Army surged in Iraq in 2007 and only when that country stabilized, the Army was able to reallocate resources to Afghanistan in 2010. Reducing end strength will significantly limit the Army's capability to meet any similar current and emerging challenges.

3. An Army in Transition

The Army has been in a state of flux since 2002. Since that time the RA has seen its end strength increase to a high of approximately 570,000 soldiers in 2010 and at best is projected to reduce to a size of 450,000 soldiers by the end of FY 2017 (DCS, PA&E 2015a). That is a 21 percent decrease in end strength

from the 2010 high or a six percent decrease from the end strength in 2001. The Army is also planning an active duty force of 420,000 soldiers in the event that additional budget cuts are enforced.

Figure 3 depicts the growth as well as the reduction of active duty end strength since 2001. Although comparing end strength over time provides an indication of capacity, it does not offer a comprehensive picture.

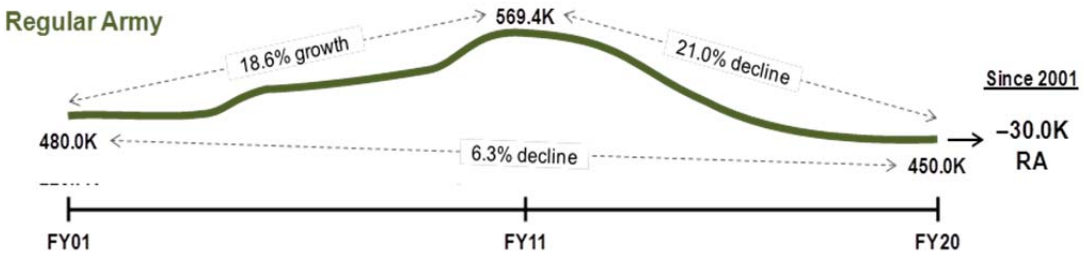

Figure 3. Active Army End Strength FY 2001–FY 2020.
Adapted from DCS, PA&E (2015a).

The Army can be divided into three distinct force pools. The generating force consists of organizations responsible for generating and sustaining the operational Army's capability for employment. The operating force is the pool available for contingency operations. Lastly Trainees, Transients and Students (TTHS) include initial entry soldiers and soldiers assigned to educational or career broadening assignments. Table 1 shows the categorical break-down of the Army at 450,000 soldiers.

Table 1. Break-down of Army End Strength. Adapted from DCS, PA&E (2015b).

Generating Force	87,400
Operating Force	304,100
TTHS	58,500
Total	450,000

The operating force of 304,100 soldiers includes forces that are committed to continuing rotational missions in Korea, Europe and the Central Command (CENTCOM) Area of Responsibility (AOR) (DCS, PA&E 2015). This ongoing commitment further reduces the actual number of soldiers available for contingency operations. In contrast the operating force in 2009 was more than 400,000 soldiers. This included forces assigned to continuing missions but available for rotation into contingency operations (Bonds, Baiocchi, and McDonald 2010). Consequently, such a significant change in end strength has had an equally substantial impact on the force structure. In conjunction with the drawdown, the Army has reduced from 45 to 30 BCTs.

4. The Brigade Combat Team

The Army states “the BCT is the Army’s primary combined arms, close combat force.” (Department of the Army [DA], 2015). The BCT functions as part of a division, which can control up to six BCTs during combat operations. The BCT has the ability to detach subordinate units and if needed can be augmented by additional units. This organizational flexibility gives it a necessary advantage and enables it to accomplish missions across the spectrum of operations (DA, 2015).

BCTs have three variants; The Armored Brigade Combat Team (ABCT), the Stryker Brigade Combat Team (SBCT) and the Infantry Brigade Combat Team (IBCT). Table 2 shows the total number of BCTs by type in the active component.

Table 2. Army BCTs by Type. Adapted from DCS, PA&E (2015a).

ABCT	9
SBCT	8
IBCT	13
Total	30

a. Armored Brigade Combat Team

The ABCTs use devastating combat power to destroy enemy forces in close combat, to repel enemy attacks and to counterattack in order to control land, resources and population areas. Capable of world wide deployment, the ABCT can conduct sustained offensive, defensive and stability operations without additional combat power.

The ABCT is comprised of three combined arms battalions. Each combined arms battalion consists of two armor companies and two mechanized infantry companies and serves as the primary maneuver force for the ABCT. Other organizations organic to an ABCT include artillery, engineer, signal, sustainment and reconnaissance units. The ABCT can be modified or augmented with additional forces to meet specific mission requirements (DA, 2015).

b. Infantry Brigade Combat Team

The IBCT primarily operates in environments that are conducive for dismounted operations. The IBCT lacks the combat power of the ABCT and the SBCT but is suited to function in complex and restricted terrain such as heavily populated urban environments.

Like the SBCT, the IBCT is also comprised of three infantry battalions. Each battalion consists of three infantry companies and a weapons company. The lack of heavy armored vehicles allows the IBCT to rapidly deploy into austere environments with little advanced notice. The reduced logistics requirement increases flexibility enabling the IBCT to arrive at any location by ground, amphibious, air assault or airborne operations (DA, 2015).

c. Stryker Brigade Combat Team

The SBCT does not possess the overwhelming firepower of the ABCT. However, unlike the ABCT the SBCT is capable of rapid strategic deployment.

The SBCT is organized around mounted infantry but primarily fights as a dismounted infantry formation.

The SBCT is comprised of three infantry battalions. Each infantry battalion consists of three infantry companies and serves as the primary maneuver force for the SBCT. Like the ABCT, the SBCT also has organic artillery, engineer, signal, sustainment and reconnaissance units (DA, 2015).

B. LITERATURE REVIEW / PREVIOUS STUDIES

Two significant studies have sought to determine the demand on the active duty Army. In 2009, the RAND Corporation conducted a study to determine the demand being placed on the Army due to the wars in Iraq and Afghanistan. In 2011, the Army G-1 conducted a simulation also focused on the demand on the Army. Both studies came to a similar conclusion that the demand on the Army was too high and soldier dwell time was too short.

1. 2009 RAND STUDY—BOOTS ON THE GROUND: DWELL TIME

In 2009 the RAND Corporation, on behalf of the Vice Chief of Staff of the Army, conducted a study to determine the demand and ensuing stress being placed on the Army due to the repeated deployments to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). The study found that the "boots on the ground" (BOG) to dwell time ratio (referred to as BOG:Dwell) was at best 1:1 and in most cases worse. That is for every one year that a soldier is deployed, the same soldier got one year of dwell time at his or her home station. The Department of Defense (DOD) goal for the active duty Army at that time was a BOG:Dwell ratio of 1:2, while the Army's goal was a BOG:Dwell ratio of 1:3. The study also claims that the active-duty Army was being utilized at 94 percent of its capacity and as such had little capacity available to deploy additional soldiers. Finally, through December 2008, over one million troop-years had been committed to OEF and OIF, the Active component bearing the majority of the burden, contributing more than 70 percent of the manpower (Bonds, Baiocchi and McDonald 2010).

The reason behind these findings was the increase in operational tempo attributed to the increased demand in both theaters of operation. Figure 4 shows the number of active duty soldiers committed to OIF and OEF from September 2001 through March 2009. From September 2005 through April 2009 the average monthly number of active duty soldiers deployed was 128,000. The peak demand of approximately 160,000 active duty soldiers occurred in September of 2007, at the height of the surge in Iraq (Bonds, Baiocchi and McDonald 2010).

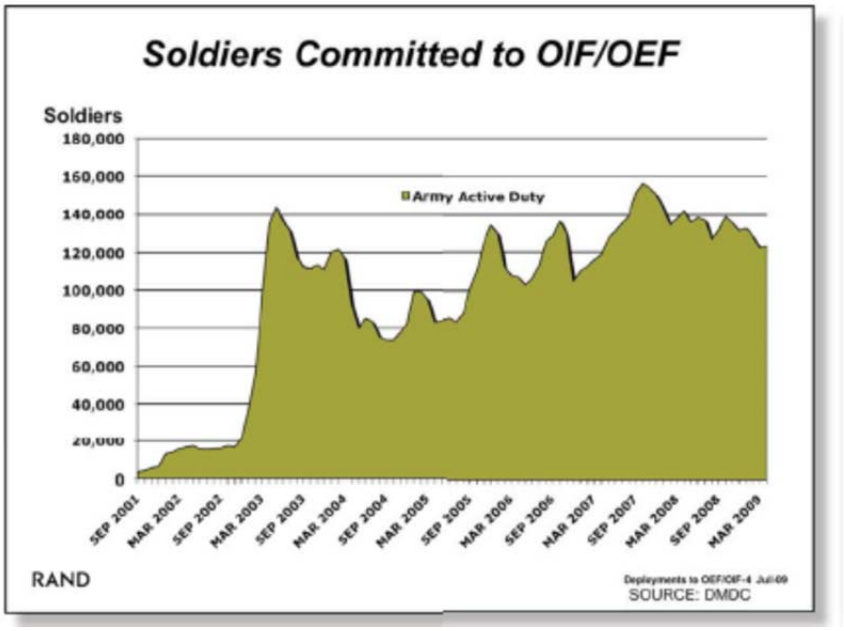

Figure 4. Soldiers Deployed to OIF and OEF. Source: RAND (2009).

The number of deployed soldiers means little by itself especially when compared against the total end strength of 570,000 soldiers. Strictly using these numbers would lead us to believe that only 23 percent of the active duty was deployed at any given month during the five year period from 2005 to 2009 and that the Army had excess capacity to meet the required demand. This is not the case. A further breakdown of the end strength is required to fully comprehend the study findings.

In 2002, the Army's reported active duty strength was 487,000. However, that is not the pool of soldiers available to deploy. Figure 5 shows the breakdown of active duty soldiers. Of the reported total, 63,000 soldiers were in the trainees, transients and students account. Another 104,000 soldiers were in the generating force. As a result, 167,000 of the 487,000 soldiers were not in the pool available for deployment. Additionally, 95,000 soldiers were serving in Korea and Europe and another 15,000 were dedicated to missile defense and a global response force. The end result is that only 210,000 soldiers were available for deployment. An active duty BOG:Dwell ratio of 1:1 would allow only 105,000 soldiers to be deployed at any given time where as a BOG:Dwell ratio 1:2 would limit the number of boots on the ground to 70,000. In either scenario, the available capacity was not sufficient to meet the required demand shown in Figure 3 (Bonds, Baiocchi and McDonald 2010).

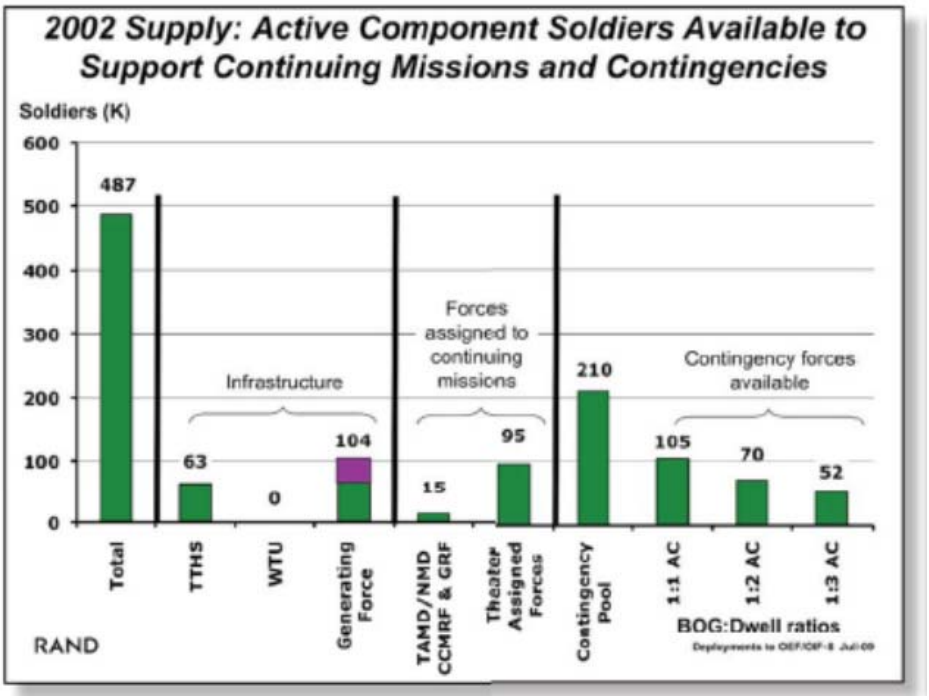

Figure 5. Active Duty Soldiers Available for Operations in 2002.
Source: RAND (2009).

To meet the demands of OIF and OEF the Army was authorized to increase its end strength to 570,000. As a result, by 2008 the contingency pool had increased from 210,000 to 315,000, largely due to the increase in end strength but also by reducing the generating force to 80,000 and reducing overseas theater forces by approximately 30,000 soldiers. This allowed the active duty Army to meet the demands placed on it. Still this was only possible by maintaining a BOG:Dwell ratio of 1:1. As shown in Figure 6, a BOG:Dwell ratio of 1:1 enabled the Army to deploy up to 157,000 soldiers at any given time. Despite the increase in end strength and the reallocation of forces the Army was unable to meet its ambitious goal of a BOG:Dwell ratio of 1:3 or DOD's goal of 1:2.

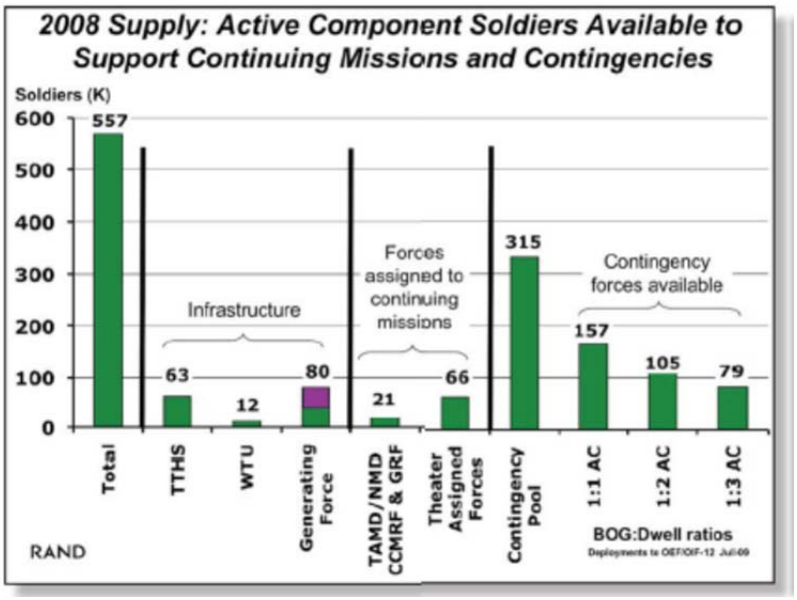

Figure 6. Active Duty Soldiers Available for Operations in 2008.
Source: RAND (2009).

The increased end strength did not have an impact on the Army's utilization rate either. As of December 2008, 67 percent of the soldiers in the active Army had deployed to either OIF or OEF. An additional 20 percent were new to the Army and were still engaged in initial individual or unit training. Of the remaining 13 percent, over half were supporting current operations in theater or

were stationed in Europe or Korea. The Army was operating at a 94 percent utilization rate and had very little capacity to deploy additional active duty soldiers (Bonds, Baiocchi and McDonald 2010).

Under the circumstances the Army did the best they could to minimize the stress on the force. The demand was too great and all the mitigation efforts were absorbed by that demand. The BOG:Dwell ratio remained at 1:1, the Army provided more manpower than all the other services combined and as a result operated at close to capacity for the better part of a decade.

What is alarming is that the findings in this study, involve a time when the active duty end strength was at 570,000 soldiers. In comparison, the active Army end strength in 2016 is approximately 470,000 soldiers with further reduction coming in subsequent years. One cannot help but question the impact on the ability of the Army to conduct a large scale operation in the future.

2. 2011 ARMY G-1—ARFORGEN BOG:DWELL SIMULATION

In 2011 the Army G-1[5] sponsored a study to investigate the BOG:Dwell statistics. This detailed study not only considered unit BOG:Dwell but also analyzed individual BOG:Dwell based on Military Occupational Skill (MOS) and rank. The scenario developed for this study had the following parameters:

- Start Date: October 1, 2014
- End Date: September 30, 2034
- Deployment Length: 365 days
- RIP-TOA[6] Overlap: 25 days
- Active Component Demand: 1 Corps; 3 Divisions; 15 BCTs; 41K Enablers

[5] G-1 is the Office of the Deputy Chief of Staff for personnel, responsible for developing, management and execution of all manpower and personnel plans and policies

[6] Relief in Place— Transfer of Authority overlap is the time where an incoming unit and outgoing unit share the same battle space

The simulation was constructed on Pro-Model, a simulation software, and determined unit and individual dwell time. The results, although better than the Rand study, did not achieve DOD's goal of a BOG:Dwell ratio of 1:2 across the Army. According to the model the median dwell times based on MOS ranged from 12 months to 24 months, the majority being fewer than 20 months (Hughes, et al. 2011). This model kept the deployment length constant at 12 months. It would have been interesting to whether increasing the deployment length would impact the dwell time.

C. SUMMARY

Threats from hostile nation-states as well as from VEOs have led to an uncertain and unpredictable global security environment. Despite the uncertainty the Army is in the process of reshaping itself. This restructure is not threat-based, but has been forced upon the Army due to the fiscal constraints of the BCA. The Army active component will draw down to a maximum end-strength of 450,000 soldiers by FY 2017. At this level the Army would have reduced 21 percent from its 2010 high of 570,000 soldiers and is 30,000 soldiers fewer than 2001 levels. This end-strength reduction has affected the force structure. The Army has reduced from 45 BCTs to 30 BCTs. At these levels it is highly likely that the Army will be unable to sustain a long term contingency operation.

The 2009 Rand study showed the enormous demand placed on the Army by the wars in Iraq and Afghanistan. Despite the growth in the force the Army was operating at 94 percent capacity and the BOG:Dwell ration remained at 1:1. The 2011 Army G-1 study further substantiated the claims of the Rand study by showing that dwell time for the majority of the force ranged between 12 and 20 months.

The simulation model that I describe in the next chapter determines the BOG:Dwell ratio based on the current force structure. The model focuses on BCT dwell time and does not consider enablers and individual dwell time.

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II. THE SIMULATION

The purpose of the simulation is to examine the Army's capacity and ability to respond to a future operation. The model captures the number of times a BCT has to deploy within a certain time period based on varying deployment lengths and demand. This allows us to determine the number of BCTs required to maintain a BOG:Dwell of 1:2.

A. BACKGROUND

To keep up with requirements, the Army has transitioned to a rotational force due to the decrease in Army end strength and the subsequent reduction in the number of BCTs. The Army currently supports missions in Korea and Kuwait by rotating ABCTs to those AORs on a continuous basis (Tan 2016). This means that two of the nine ABCTs are deployed, two have recently returned from their deployment and another two are getting ready to deploy. In order to sustain these rotations, six of the nine ABCTs are not readily available to respond to a contingency operation if one were to arise.

The Army is now planning to begin ABCT rotations to Europe to increase its defensive posture in the region in response to increased Russian activity and aggression (Tan 2016). As a result of this additional requirement, one third of the Army's ABCTs will be deployed at any given time, establishing a BOG:Dwell of 1:2. In the event of an unexpected contingency, the Army would only have three ABCTs available to respond and in doing so would not be able to continually support the existing requirements with ABCTs. SBCTs and IBCTs will have to fill the gaps created due to the contingency operation. This is problematic as the IBCT, and to a lesser extent the SBCT lack the capabilities that are available in an ABCT. Although, the Army is in the process of incorporating a 30 millimeter cannon to increase the lethality of the Stryker Vehicles (Tomkins 2016), it still does not provide a substitute for the 120 millimeter cannon on a tank. According to retired General Cater Ham, the chairman of the National Commission on the

Future of the Army “there’s no excess capacity in the Regular Army to meet an unforeseen contingency” (Tan 2016).

B. SCENARIO AND ASSUMPTIONS

- At onset of simulation, nine ABCTs, 13 IBCTs and eight SBCTs are in the system.
    - Two ABCTs are committed to ongoing rotations in South Korea and Kuwait.
    - One SBCT is committed to the rotation in Europe (SBCT will replace ABCT).
- Initial demand for the contingency operation will be three ABCTs, five IBCTs and two SBCTs for a total of 10 BCTs (total demand increases to 13 BCTs).
- Deployment length will vary between nine, 12 and 15 months.
- The contingency operation lasts 10 years.
- The capacity at the Deploy _Ops server will vary to determine the DOD dwell time objective. The capacity at this server will represent the demand on the number of BCTs required.
- Upon redeployment a BCT will be unavailable for a period of three months. This is the stabilization period that includes block leave and maintenance and recovery operations.
- BCT will then undergo a nine month training period giving it a total of 12 months before being available to redeploy.
- There is sufficient capacity to receive incoming BCTs as well as outgoing BCTs
- The queuing system will function in a first-in first-out manner.

C. MODEL CONSTRUCTION

The simulation model (queuing model) was created using the commercial software Simio. This simulation software can be applied across several industries to include healthcare, transportation, manufacturing and the military.

The model consists of three entities, which are the three different types of BCTs, a source node for each entity and 15 servers. Each entity arrives into the

system through the source node. From the source node the entities will flow through their respective server chain, each server representing a different process of the deployment cycle. The entities loop through the system as many times as needed for the duration of the simulation. Figure 7 shows a snapshot of the model created in Simio.

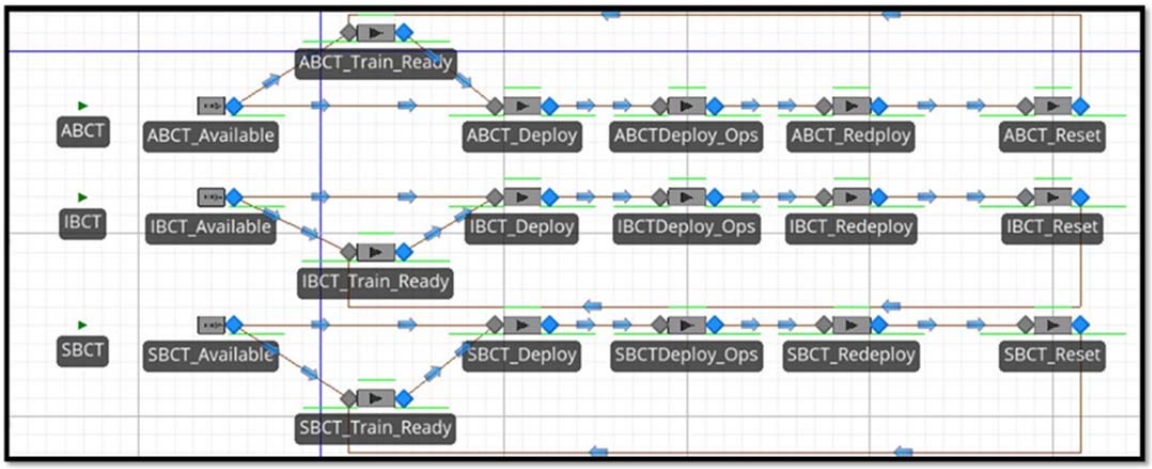

Figure 7. Simulation Model Created Using Simio

Servers have different processing distributions and durations. These estimations based on actual deployment experience and judgement. Table 3 provides details on the sever distributions.

Table 3. Distribution Parameters

Server	Distribution/Duration	Capacity
ABCT Deploy	Triangular (2,4,6) Weeks	2
ABCT Redeploy	Triangular (2,3,4) Weeks	1
IBCT Deploy	Traingular (2,3,4) Weeks	3
IBCT Redeploy	Traingular (1,2,3) Weeks	2
SBCT Deploy	Traingular (2,3,4) Weeks	2
SBCT Redeploy	Traingular (1,2,3) Weeks	2
BCT Reset	Uniform (12,12) Weeks	--
BCT Train	Uniform (37,37) Weeks	--

1. Model Description

The objects in the model are as follows:

- Source: The source generates the entities in the system with an arrival pattern (Kelton, Smith and Sturrock 2011). In this model the entities are the three different types of BCTs. There are three source objects in the model, one for each type of BCT.
    - ABCT_Available: This source generates the nine ABCT.
    - IBCT_Available: This source generates the 13 IBCT.
    - SBCT_Available: This source generates the 8 SBCT.
- Servers: Servers represent the process that is required to complete operation (Kelton, Smith and Sturrock 2011). Servers have a capacity as well as processing times that are described in Table 3. Each entity travels through five servers.
    - Deploy: This server represents the time it takes to deploy from home station to theater of operations.
    - Deploy_Ops: This server represents the time spent in theater of operations. The capacity and processing time varied to simulate changing demand and deployment length.
    - Redeploy: This server represents the time it takes to redeploy from theater of operations to home station.
    - Reset: This server represents the time that a BCT is unavailable for any training or operations. This allows the BCT to conduct post deployment administrative, maintenance and personnel actions.
    - Train_Ready: This server represents the time taken for a BCT to prepare for combat operations.

2. Operational Flow

The operational flow chart shown in Figure 8 depicts the process represented in the simulation model. The number of BCTs produced at each source is limited to the number of BCTs in the Army. 9 ABCTs, 13 IBCTs, and 8 SBCTs are created at their respective source objects. These are the BCTs that are in the Army inventory and are available to deploy. From the source the BCTs have the option of beginning the deployment process (moving to the Deploy

server) or go through their training cycle (the Train_Ready server). The demand on the number of BCTs required to deploy determines the direction of travel for the entities. For instance if there is a demand for three IBCTs, three IBCTs will move from the source to the Deploy server while the remaining IBCTs will queue at and proceed through the Train_Ready server. Upon completion of training, the IBCTs will move from the Train_Ready server to the Deploy server. The capacity at the Train_Ready server varies based on the demand for the operation. The capacity for IBCTs at the Deploy server is three, that is, three IBCTs are able to go through the deployment process simultaneously. The distribution and capacity for each server is listed in Table 3. The model also assumes that the first three IBCTs are trained and ready to begin the deployment process.

From the Deploy server, the BCTs move to the Deploy_Ops server. As mentioned in sub-paragraph II-C-1 this server represents the combat operation. The duration at this server varies between 9, 12 and 15 months. The demand for BCTs for combat operations is listed in Table 4. Upon completion of the deployment the BCTs go through the redeployment process (Redeploy server) followed by reintegration into the pool of available BCTs (the Reset server). Upon completion of a deployment, that is, when a BCT vacates the Deploy_Ops server the next BCT to complete training replaces it. After the BCT completes the process it cycles around and returns to the Train_Ready server to prepare for its next operation or deployment.

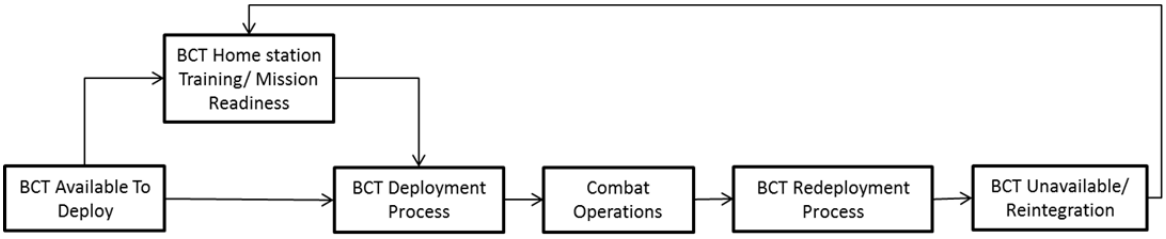

Figure 8. Operational Flow Chart

D. EXPERIMENTS

The simulation model has to determine how changing different variables would impact the BOG:Dwell ratio. For each type of BCT, three different series of experiments were conducted. Each series had a primary control and two secondary controls. The primary control was the length of the deployment which ranged between 9, 12, and 15 months. The secondary controls were the number of BCTs in the system or the capacity and the number of BCTs required to deploy or the demand. For instance, a series would include a single deployment length along with varying BCT capacity and demand. This resulted in a total of 68 scenarios for all BCTs. Table 4 describes the full factorial design used in this simulation model.

Table 4. Design of Experiments

Full Factorial Design		
Factor	Description	Levels
Duration	Number of months deployed	9, 12, 15 (months)
Demand	Number of BCTs required to deploy at one time	ABCT: 5, 6, 7
		IBCT: 5, 6, 7, 8
		SBCT: 3, 4
Capacity	Number of BCTs available in the system	ABCT: 9, 11, 12, 15, 17
		IBCT: 13, 15, 17
		SBCT: 8, 9, 10

The outputs included the maximum number of times a BCT had to deploy, the average number of times that BCTs deployed and the utilization level at the Deploy_Ops server. The utilization level at this server measures the ability to accomplish the mission. For the purpose of these experiments we focused on the maximum number of deployments that a BCT will complete during the course of the operation. The average number of deployments for the BCTs were noted but not used in the analysis. Additionally, utilization rate greater than or equal to 98 percent at the Deploy_Ops server was considered to be fully utilized.

The maximum number of deployments for each BCT functions as the measure of effectiveness. The number of deployments directly corresponds to the number of months deployed and the number of months at home station which ultimately provides us with the BOG:Dwell ratio. The utilization rate at the Deploy_Ops server serves as the measure of performance. That is, when the utilization rate was greater than or equal to 98 percent the mission was being accomplished. In other words at 98 percent utilization demand for BCTs in theater of operations is being fully met.

The time between redeployment back to home station and when a BCT was ready to deploy again was held constant at 12 months. This included three months for reintegration and nine months for training and mission readiness. Each experiment was replicated 100 times with a run time of 10 years per replication.

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III. ANALYSIS AND RESULTS

Based on the number of BCTs available we can expect the largest shortfall to be for the ABCT. We can estimate that with a demand of five ABCTs (two for existing missions and three for the contingency operation) the Army will only be able to support this requirement for a single rotation. The four remaining ABCTs are not enough to replace the five ABCTs conducting operations.

The IBCTs and SBCTs appear to be better positioned to respond to a contingency operation however it is unlikely that they will achieve the target BOG:Dwell of 1:2.

A. REGRESSION ANALYSIS

A regression analysis was performed for the results obtained from the simulation. The purpose of the analysis was to determine relationships between the independent and the dependent variables and verify the accuracy of the model. Duration, capacity, and demand are the independent variables and number of deployments is the dependent variable.

The relationship between the independent and the dependent variables came out as expected. As the duration of the deployment increases, the number of deployments decreases. As the capacity of the BCTs increase, the number of deployments also decreases. As the demand on the BCTs increase the number of deployments increase.

Table 5 shows the results of the regression analysis for the ABCT. Approximately 90 percent of the variability (adjusted R squared value) is accounted for by the three independent variables. The coefficients quantify the relationship between each independent variable and the dependent variable. Similarly, Tables 6 and 7 show the regression data for the IBCT and the SBCT respectively.

Table 5. ABCT Regression Analysis

ABCT Regression Analysis	
Observations	29
Adjusted R Squared	0.8927

Term	Coefficients	P - Value
Intercept	7.7773	< 0.001
Duration	-0.3148	< 0.001
Capacity	-0.2032	< 0.001
Demand	0.6005	< 0.001

Table 6. IBCT Regression Analysis

IBCT Regression Analysis	
Observations	27
Adjusted R Squared	0.8847

Term	Coefficients	P - Value
Intercept	8.9511	< 0.001
Duration	-0.3148	< 0.001
Capacity	-0.2622	< 0.001
Demand	0.5555	< 0.001

Table 7. SBCT Regression Analysis

SBCT Regression Analysis	
Observations	12
Adjusted R Squared	0.7239

Term	Coefficients	P - Value
Intercept	9.3333	0.002
Duration	-0.2916	0.001
Capacity	-0.6667	0.059
Demand	1.3333	0.014

B. RESULTS

The results of the simulation are displayed in four separate tables, two for the ABCT and one each for the IBCT and the SBCT. There are 29 scenarios for the ABCT, 27 for the IBCT and 12 for the SBCT. The tables are organized by the deployment length followed by capacity and then demand for the BCT. Each scenario is numbered for reference purposes.

1. Armored Brigade Combat Team

The experiments confirmed that in a rotational force structure, nine ABCTs are not sufficient for the Army to respond to a contingency operation while sustaining existing operational requirements. Table 8 shows 27 scenarios and how varying deployment length, capacity and demand impacted the number of deployments and subsequently ABCT dwell time.

Table 8. ABCT Rotational Deployment Model

Armored Brigade Combat Team Rotational Force								
S	Deployment Length (Months)	ABCT Capacity	Demand	Max Number of Deployments	Total Deployed Time (Months)	Total Dwell Time (Months)	BOG:Dwell	Utilization
1	9	9	5	6	54	66	1:1.22	70%
2	9	12	5	6	54	66	1:1.22	90%
3	9	12	6	6	54	66	1:1.22	77%
4	9	15	5	5	45	75	1:1.67	94%
5	9	15	6	6	54	66	1:1.22	92%
6	9	15	7	6	54	66	1:1.22	82%
7	9	17	5	4	36	84	1:2.33	94%
8	9	17	6	5	45	75	1:1.67	94%
9	9	17	7	6	54	66	1:1.22	90%
10	12	9	5	5	60	60	1:1	83%
11	12	12	5	5	60	60	1:1	98%
12	12	12	6	5	60	60	1:1	91%
13	12	15	5	4	48	72	1:1.5	99%
14	12	15	6	4	48	72	1:1.5	98%
15	12	15	7	5	60	60	1:1.5	95%
16	12	17	5	3	36	84	1:2.33	99%
17	12	17	6	4	48	72	1:1.5	99%
18	12	17	7	5	60	60	1:1	98%
19	15	9	5	4	60	60	1:1	92%
20	15	12	5	4	60	60	1:1	99%
21	15	12	6	4	60	60	1:1	99%
22	15	15	5	3	45	75	1:1.67	99%
23	15	15	6	4	60	60	1:1	99%
24	15	15	7	4	60	60	1:1	99%
25	15	17	5	3	45	75	1:1.67	99%
26	15	17	6	3	45	75	1:1.67	99%
27	15	17	7	4	60	60	1:1	99%

Under no circumstances can the Army meet its BOG:Dwell objective with nine ABCTs. The best the Army can do is nine month deployment with a BOG:Dwell of 1:1.22 (scenario one). Apart from the fact that this does not meet our target BOG:Dwell, the operation utilization is only 70 percent. This means that 30 percent of the time the Army cannot meet its requirement.

The results show that in order to meet a demand of five the Army needs at least 17 ABCTs (scenarios seven and 16). The Army achieves the target BOG:Dwell of 1:2 with either nine or 12 months deployments. The results also show that 12 month deployments are better than 9 month deployments as the former ensures complete operational utilization. Additionally, if the need arises as it did in Iraq in 2007 the Army can surge two additional ABCTs to the theater of operations for a short duration. A surge of two additional ABCTs would reduce the BOG:Dwell to 1:1 but would provide the Army with increased capability and flexibility.

It is unlikely, given the current environment, that the Army can grow an additional eight ABCTs. An alternative solution can be reached if the Army permanently based ABCTs in Korea and Kuwait alleviating the burden on the rotational force. Table 9 shows that 11 ABCTs would be sufficient to support a demand of three ABCTs while maintaining a BOG:Dwell of at least 1:2. As a result the ABCT capacity would decrease from 17 to 13. This hybrid ABCT force would have two ABCTs permanently located in Korea and Kuwait and 11 ABCTs available to rotate into and out of an operational theater.

Table 9. ABCT Hybrid Deployment Model

Armored Brigade Combat Team Hybrid Force								
S	Deployment Length (Months)	ABCT Capacity	Demand	Max Number of Deployments	Total Deployed Time (Months)	Total Dwell Time (Months)	BOG:Dwell	Utilization
28	12	11	3	3	36	84	1:2.33	99%
29	12	11	5	5	60	60	1:1	96%

As with the rotational model the Army will still have the ability to surge an additional two ABCTs in support of combat operations for a short duration.

2. Infantry Brigade Combat Team

Although 13 IBCTs are sufficient to meet a demand of five, they are not enough to achieve the desired BOG:Dwell of 1:2. At best the Army can achieve a BOG:Dwell of 1:1.5 with 12 month deployments (scenario 10). Table 10 shows 27 scenarios and their impact on IBCT dwell time.

Table 10. IBCT Deployment Model

Infantry Brigade Combat Team								
S	Deployment Length (Months)	IBCT Capacity	Demand	Max Number of Deployments	Total Deployed Time (Months)	Total Dwell Time (Months)	BOG:Dwell	Utilization
1	9	13	5	6	54	66	1:1.22	98%
2	9	13	6	6	54	66	1:1.22	88%
3	9	15	5	5	45	75	1:1.67	99%
4	9	15	6	6	54	66	1:1.22	98%
5	9	15	7	6	54	66	1:1.22	88%
6	9	17	5	4	36	84	1:2.33	99%
7	9	17	6	5	45	75	1:1.67	99%
8	9	17	7	6	54	66	1:1.22	96%
9	9	17	8	6	54	66	1:1.22	87%
10	12	13	5	4	48	72	1:1.5	99%
11	12	13	6	5	60	60	1:1	98%
12	12	15	5	4	48	72	1:1.5	99%
13	12	15	6	4	48	72	1:1.5	99%
14	12	15	7	5	60	60	1:1	97%
15	12	17	5	3	36	84	1:2.33	99%
16	12	17	6	4	48	72	1:1.5	99%
17	12	17	7	5	60	60	1:1	99%
18	12	17	8	5	60	60	1:1	97%
19	15	13	5	4	60	60	1:1	99%
20	15	13	6	4	60	60	1:1	99%
21	15	15	5	3	45	75	1:1.67	99%
22	15	15	6	4	60	60	1:1	99%
23	15	15	7	4	60	60	1:1	99%
24	15	17	5	3	45	75	1:1.67	99%
25	15	17	6	3	45	75	1:1.67	99%
26	15	17	7	4	60	60	1:1	99%
27	15	17	8	4	60	60	1:1	99%

The results show that the Army needs 17 IBCTs to meet demand (scenarios six and 15). Both, nine and 12 month deployments can be executed while maintaining a BOG:Dwell of at least 1:2. The Army would then have the ability to surge two additional IBCTs (scenario eight) or three additional IBCTs (scenario 18) depending on the duration of the deployment.

3. Stryker Brigade Combat Team

As with the IBCTs, eight SBCTs are adequate to fulfill their requirements. However, they are not enough to achieve the desired BOG:Dwell of 1:2. The Army can achieve a BOG:Dwell of 1:1.5 (scenario six) with 12 month deployments. Table 11 shows the 12 scenarios and their impact on SBCT dwell time.

Table 11. SBCT Deployment Model

Stryker Brigade Combat Team								
S	Deployment Length (Months)	SBCT Capacity	Demand	Max Number of Deployments	Total Deployed Time (Months)	Total Dwell Time (Months)	BOG:Dwell	Utilization
1	9	8	3	6	54	66	1:1.22	98%
2	9	9	3	4	36	84	1:2.33	99%
3	9	9	4	6	54	66	1:1.22	91%
4	9	10	4	6	54	66	1:1.22	98%
5	12	8	3	4	48	72	1:1.5	99%
6	12	9	3	4	48	72	1:1.5	99%
7	12	9	4	5	60	60	1:1	98%
8	12	10	4	4	48	72	1:1.5	99%
9	15	8	3	4	60	60	1:1	99%
10	15	9	3	3	45	75	1:1.67	99%
11	15	9	4	4	60	60	1:1	99%
12	15	10	4	4	60	60	1:1	99%

The results show that the Army needs nine SBCTs in order to achieve a BOG:Dwell of 1:2 (scenario two). However, the SBCTs can only deploy for nine month durations. If a surge capability is required an additional SBCT can be deployed (scenarios three, seven and 11). In this case the deployment length is not a limiting factor as we are not concerned with maintaining a BOG:Dwell of 1:2.

IV. CONCLUSION AND RECOMMENDATION

The purpose of this study was to determine if the Regular Army in its current form was too small to respond to a future contingency operation. We have determined that the Army is too small and does not have the appropriate force structure to respond to a sustained contingency operation.

A. CONCLUSION

The Army in its current form is too small. If the Army preserves its existing force structure it would be able to deploy 1 ABCT, 4 IBCTs and 2 SBCTs to support a contingency operation while maintaining a BOG:Dwell ratio of 1:2. Based on recent conflicts in Iraq and Afghanistan we can safely accept that this is dangerously inadequate.

A fully rotational force needs to grow from 30 to 43 BCTs. The Army would have to increase the number of ABCTs from 9 to 17, increase the number of IBCTs from 13 to 17 and increase the number of SBCTs from 8 to 9.

If the Army permanently stationed ABCTs in Korea and Kuwait, this hybrid force would have to grow from 30 to 39 BCTs. The only difference being that the number of ABCTs would increase from nine to 13.

Additionally, deployment duration cannot be standardized across the Army. ABCTs should ideally deploy for 12 months, IBCTs can deploy for either 9 or 12 months and SBCTs should deploy for 9 months. Table 12 summarizes the number of BCTs required and the optimal deployment duration.

Table 12. Comparison of Existing and Simulated BCT Structure

BCT	Present #	Rotational Force	Hybrid Force	Deployment Duration
ABCT	9	17	13	12 months
IBCT	13	17	17	9, 12 months
SBCT	8	9	9	9 months
Total	30	43	39	--

B. RECOMMENDATION

The Army has to increase its end strength in order to grow the number of BCTs thereby increasing capacity. The Army must grow to 39 BCTs, an addition of four ABCTs and IBCTs each and one SBCT. To achieve this, the Army must continue to make the case that the security landscape has become increasing unpredictable and more challenging than what it was when the BCA was passed in 2013.

There is an ongoing debate in congress about the size of the Army. This is evident in the divergence between the House of Representatives and the Senate versions of the 2017 National Defense Authorization Act (NDAA). The House bill calls for an Army end strength of 480,000 soldiers, an increase of 5,000 soldiers in comparison to the level authorized in 2016. The Senate version authorizes an end strength of 460,000, a decrease of 15,000 soldiers (Kapp, et al. 2016).

Former Secretary of Defense Robert Gates stated “I was also convinced, based on history and experience, that we were utterly unable to predict what kinds of future conflicts we would face” (Gates 2015, 118). The DOD and the Army can plan for the type of conflict that it wants to fight but it is the enemy that decides the type of fight and where it will occur. The Army is ill prepared for another conflict similar to that in Iraq and Afghanistan. Increasing the end strength to the numbers recommended in the House version of the NDAA is a start and a move in the right direction. The Army for its part needs to begin planning for a potential increase in end strength and determine how and where to employ these soldiers.

C. FURTHER STUDY

This thesis focuses on how a contingency operation would impact the Regular Army. This study can be further developed by incorporating the BCTs available in the Army National Guard and the Army Reserves. This would strengthen the analysis and provide a holistic view of the demand placed on the Army. This study would have to consider the following:

- The actual demand for the number of BCTs. This would be greater than 10 similar to the requirement in Iraq
- The different BOG:Dwell requirement for the Active component and Guard and Reserve forces. The BOG:Dwell goal for Guard and Reserve forces is 1:5.

Additionally, this study could be further expanded to determine BOG:Dwell based on Military Occupational Skill (MOS). Some Army MOS are in more demand than others. This could determine individual BOG:Dwell and identify specifically where the Army needs to grow.

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LIST OF REFERENCES

Belasco, Amy. 2015. *Defense Spending and the Budget Control Act Limits.* CRS Report No. R44039. Washington, DC: Congressional Research Service. https://www.fas.org/sgp/crs/natsec/R44039.pdf.

Bonds, Timothy M., Dave Baiocchi, and Laurie L McDonald. 2010. *Army Deployments of OIF and OEF.* Santa Monica: RAND Corporation.

Congressional Budget Office. 2011. *Estimated Impact of Automatic Budget Enforcement Procedures Specified in the Budget Control Act*. CBO Report No. 42754. Washington, DC: https://www.cbo.gov/publication/42754.

Department of the Army. 2015. *Brigade Combat Team* (FM 3–96). Washington, DC: Department of the Army.

Department of Defense. 2015. *National Military Strategy of the United States of America*. Washington, DC: http://www.jcs.mil/Portals/36/Documents/Publications/2015_National_Military_Strategy.pdf.

Deputy Chief of Staff for Programs, Program Analysis and Evaluation Directorate. 2015a. *Senior Review Group 1—Force Structure and Military Manpower.* Briefing to Army Senior Leaders. Washington, DC. 2015.

Deputy Chief of Staff for Programs, Program Analysis and Evaluation Directorate. 2015b. *Senior Review Group 2—Readiness*. Briefing to Army Senior Leaders. Washington, DC. 2015.

Feickert, Andrew. 2014. *Army Drawdown and Restructuring*. CRS Report No. R42493. Washington, DC: Congressional Research Service. https://fas.org/sgp/crs/natsec/R42493.pdf.

Gates, Robert M. *Duty: Memoirs of a Secretary at War*. Knopf Doubelday Publishing Group, 2015.

Goure, Dan. 2016, May 5. “America Needs a Larger, More Modern, More Lethal Army.” The National Interest. http://nationalinterest.org/print/blog/the-buzz/america-needs-larger-more-modern-more-lethal-army-16052.

Hughes, David W, Mark M Zais, Paul Kucik, and Fernando M Huerta. *ARFORGEN BOG:Dwell Simulation*. West Point, NY: Operations Research Center of Excellence, 2011.

Hunt, Katie, K.J. Kwon, and Jason Hanna. 2016, September 10. “North Korea claims successful test of nuclear warhead.” CNN. http://www.cnn.com/2016/09/08/asia/north-korea-seismic-activity/index.html.

Kapp, Lawrence, Andrew Feickert, Kathleen J. McInnis, and Lynn M. Williams. 2016. *How Big Should the Army Be? Considerations for Congress*. CRS Report No. R44612. Washington, DC: Congressional Research Service. http://www.fas.org/sgp/crs/natsec/R44612.pdf

Kelton, David, Jeffrey S Smith, and David T Sturrock. *Simio and Simulation.* McGraw Hill, 2011.

Kim, Jack, and Ju-Min Park. 2016, April 24. “North Korea says submarine ballistic missile test ‘great success.’” Reuters. http://www.reuters.com/article/us-northkorea-missile-idUSKCN0XK08U.

Labonte, Marc, and Mindy R Levit. 2011. *The Budget Control Act of 2011: Effects on Spending Levels and the Budget Deficit*. CRS Report No. R42013. Washington, DC: Congressional Research Service. https://www.fas.org/sgp/crs/misc/R42013.pdf

Tan, Michelle. 2016. “Back-to-Back Rotations to Europe Could Stress the Army’s Armored BCTs. *Army Times.* https://www.armytimes.com/story/military/pentagon/2016/02/11/back--back-rotations-europe-could-stress-armys-armored-bcts/80243786/.

Tomkins, Richard. 2016, March 03. “Army Looks at Stryker Upgrade Program.” United Press International. http://www.upi.com/Business_News/Security-Industry/2016/03/03/Army-looks-at-Stryker-upgrade-program/6071457026532/.

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