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Halting the Advance: The Synergistic Effects of Heavy Bombers and Carrier Air

"...no matter what the central feature of the enemy's power may be--the point on which your efforts must converge--the defeat and destruction of his fighting force remains the best way to begin, and in any case will be a significant feature of the campaign."

Clausewitz, *On War*, 1984.

Abstract of

HALTING THE ADVANCE: THE SYNERGISTIC EFFECTS OF HEAVY BOMBERS AND CARRIER AIR

One of the major challenges facing the United States military in the post-Cold War world is how to halt an armored invasion in a country half-way around the globe. The continuing U.S. shift to a home-based "rapid response" strategy will give aggressor nations an advantage in regions that depend on American military strength for defense. If aggressor nations strike quickly enough, their armored forces can seize strategic ports and airfields and deny U.S. and coalition forces lodgment. By the turn of the century, however, the theater commander (CINC) will be able to quickly halt a major armored invasion in a region with little or no U.S. forces present through the use of CONUS based heavy bombers and a carrier battle group (CVBG).

CONUS based bombers provide CINCs the timely, flexible, and long-range firepower required to halt an armored invasion. Bombersrequire in-theater command and control and defense from enemy threat systems, however, for a coordinated attack and to reduce the risk of being targeted and destroyed. The CVBG, the other half of the equation, provides these capabilities.

Also timely if deployed on warning, the CVBG is a self-contained strike force whose operational capabilities of command, control, and surveillance, battlespace dominance, and power projection allow the carrier to effectively direct and protect the bombers. The CINC's use of Navy CVBG assets and Air Force bombers together provides a synergistic effect--neither force capable of accomplishing the objective alone, yet together achieving the CINC's goal of halting the advance quickly, effectively, and with minimum risk to the joint force.

HALTING THE ADVANCE: THE SYNERGISTIC EFFECTS OF HEAVY BOMBERS AND CARRIER AIR

"The most persistent sound which reverberates through men's history is the beating of war drums."

Arthur Koesther, Janus: *A Summing Up*, 1978.

The United States of America, given enough time, can meet any threat. The recent shift from a "forward presence" military establishment to a predominantly home-based "rapid response" strategy, however, has limited our ability to respond quickly to a crisis. The National Military Strategy uses two methods to reduce deployment time; pre-positioned supplies and fast sealift.[1] These methods are not foolproof, however, for if an aggressor moves quickly enough he can seize pre-positioned supplies, airfields and seaports to delay or even deny U.S. forces lodgment. To prevent such an occurrence, the 1993 Bottom-Up Review (BUR) concluded that the first phase of a major campaign must be to "halt the invasion--to keep to a minimum the territory and critical facilities an invader can capture. Deploy U.S. forces rapidly to the theater and enter battle as quickly as possible."[2]

This strategy is common sense--any competent commander knows that halting a fast moving armored advance is a top priority. Less clear, however, is *what and how*--what forces at the CINC's disposal would best achieve the objective and how these forces should be used. For instance, what U.S. forces can strike quickly and decisively enough to halt a large armored invasion halfway around the world in a "cold-start" (little or no U.S. forces present) scenario? How would these forces best be used to halt the armored advance?

The purpose of this paper is to answer these questions--to show that by the beginning of the next century, heavy bombers and a carrier battle group (CVBG) will be the CINC's best combination of forces to halt a "cold-start" invasion halfway around the globe.[3] CONUS based heavy bombers would provide the range, mass, [4]and flexibility to halt the advance, while the CVBG provides in-theater command and control and defense for the bombers. Mutually supportive, these forces can achieve the CINC's goal of halting the advance quickly, effectively, and with minimum risk to the joint force.

WHY BOMBERS?

"The tank was the beginning of the bullet-proof army."

Winston Churchill, *The World Crisis*, 1923.

An armored invasion is a powerful, quick-moving attack; in the 1990 invasion of Kuwait, Iraqi armored divisions penetrated an average of 83 kilometers a day.[5] At this rate of movement, a tremendous amount of territory, strategic facilities, and ports of entry could be taken in very little time. Invading armored forces must be attacked on the first day, not a week later when enemy forces may be on hand to greet deploying U.S. tactical forces.[6]

Heavy bombers are the perfect tool for a CINC or Joint Force Commander (JFC) to use in halting an armored advance. Capable of responding anywhere in the world within 24

hours,[7]CONUS based bombers combine three elements that will make them uniquely qualified as "assault breakers." These qualities are range, payload, and advanced munitions.

RANGE AND PAYLOAD

Bombers, originally designed to penetrate and strike targets deep in enemy territory, are all-weather, extremely long-range aircraft with tremendous payload capability. The actual range of each bomber type varies by method of employment, though all have intercontinental reach without refueling: [8]

B-1B	5,600 nm (10,377 km)
B-2A	6,600 nm (12,230 km)
B-52	6,200 nm (11,482 km)

While they have impressive range without refueling, it is air-refueling that has allowed bombers to circumnavigate the globe.[9] Such long-range missions are not just publicity stunts; each quarter, every bomber wing in Air Combat Command has a long-endurance, "Global Power" mission of twenty to thirty hours to train both crews and planners in the intricacies of long-range operations. [10]

Bombers combine extensive range with a large payload capability. The B-1, B-2, and B-52 can carry weapons loads of up to 40,000 pounds. Payload capacity is not enough, however, to make the bomber an effective platform. General George Butler, CINCSAC, in assessing the B-52s performance in Desert Storm, said "...if we had to do the Persian Gulf six or seven years from now, and all SAC could do was come over with B-52s and drop banded high-drags (free-fall bombs) from 40,000 feet, then we would not be invited to participate."[11] General Butler's criticisms were acted upon, and the Air Force continues to enhance the bomber's conventional weapons capability.[12]

Long-range and massive payload enable the bomber to project massive firepower quickly to any point in the world. No longer does the CINC or JFC have to wait for shorter range tactical aircraft to be brought into the theater--he/she can maintain the initiative even at the start of a distant conflict. CONUS based bombers can immediately go on the offensive, attacking targets across the depth and breadth of the battlefield, destroying not only the traditional strategic targets, but also neutralizing enemy reserves, isolating areas, restricting enemy freedom of movement and other operational fires.

Besides timeliness, CONUS based bombers also provide the CINC with several other advantages. One is logistics--the CINC or JFC need not deploy or maintain an extensive operational logistics tail for the bomber, thus freeing up valuable cargo assets. CONUS based bombers also do not require in-theater airfields, allowing additional shorter-range or "tactical" assets to be deployed (suitable in-theater airfields may be at a premium in less developed countries). The availability of cargo and ramp space could facilitate the deployment of tactical forces into the theater in support of phase two of the campaign: building up U.S. and allied combat power in the theater while reducing the enemy's.[13] In addition, basing bombers out-of-

theater and tactical air forces in-theater maximize the combat power a commander can bring against the enemy in time and space--it increases mass and improves synchronization. Lastly, bombers based outside the theater are located safely away from the theater and thus are not vulnerable to theater threats.

There are also drawbacks to CONUS basing, the first being crew fatigue. While a concern, it is not a large one--bombers have crews that can take over duties to provide relief time, even sleep. Bomber crews entering the theater after a 17 hour sortie will, however, be more fatigued and perhaps less alert than crews flying shorter sorties. Two additional drawbacks to long-endurance sorties are sortie rates and tanker requirements, which will be discussed later.

ADVANCED MUNITIONS

> "The means of destruction are approaching perfection with frightful rapidity." Lieutenant General Antoine-Henri Baron de Jomini, *Summary of the Art of War,*1838.

The bomber's range and payload make it an excellent strike platform, but it is technological innovation which will make Air Force bombers so effective in halting armor. The innovation is Sensor Fuzed Weapon (SFW), a 1,000-pound, unpowered, multiple kill per pass "smart" munition designated CBU-97.[14] Designed specifically for use against mobile hard (tanks and armored personnel carriers) and soft targets (trucks, mobile missile launchers), CBU-97 is many times more effective against mobile hard targets than previous area weapons. A RAND study estimates the effectiveness of CBU-97 at 3.6 vehicles destroyed per munition (in road march formation), though this will vary based on the interval between vehicles.[15] SFW effectiveness will be further improved by adding an active laser seeker, an improved warhead, and a greater target search range to the munition. The Air Force will have 1,172 CBU-97 in the inventory by FY98 and 3,264 by FY01; the full buy is 5,000, of which more than half will be the improved variant.[16]

The improved SFW munition will also be incorporated into standoff weapons such as the Joint Standoff Weapon (JSOW). The JSOW is an unpowered Global Positioning System (GPS) aided "glide bomb" that has a stand-off range of 40 miles.[17] This weapon can be released well out of range of most surface-to-air threats and, using GPS information, guide itself to a pre-selected point where it will release the anti-armor submunitions over the armored column. Delivery of the anti-armor JSOW starts in FY01 for the Navy and FY03 for the USAF. Quantities will be limited, however. By FY05 the Navy will have 421 of a planned 1,200; the USAF 709 of a planned 3,000.[18]

Another weapon system that will enhance bomber survivability and flexibility is the Wind Corrected Munitions Dispenser (WCMD), an inertially guided tail kit that can be bolted to the CBU-97. WCMD allows weapons normally released from low altitudes to be dropped from up to 40,000 feet, beyond the range of the most numerous air defense weapons.[19] The Air Force is planning to purchase 40,000 WCMD units; 734 will be delivered by FY00 and over 7,000 by FY03.[20]

GPS jamming, if employed, will have little effect on these weapons.[21] SFW is an area munition; it does not need 10 meter accuracy. If the GPS signal is jammed, the inertial navigation backup in WCMD and JSOW are accurate enough to guide these weapons to their targets.

ASSAULT BREAKING

"...no matter what the central feature of the enemy's power may be--the point on which your efforts must converge--the defeat and destruction of his fighting force remains the best way to begin, and in any case will be a significant feature of the campaign."

Clausewitz, *On War*, 1984.

SFW destroys armor, but it is the number and payload capacity of delivery platforms which determines the number of munitions delivered. The Air Force currently has 95 B-1s, six B-2s and 95 B-52s; [22]in FY01 the programmed force is 95 B-1s, 20 B-2s and 66 B-52s.[23] With the assumptions and calculations listed in Appendix II, the Air Force can put 46 bombers per day over the target with CONUS-SWA-CONUS operations.[24] Multiplying the SFW carry capacity by bomber type gives 1,256 CBU-97 dropped in a single day.[25] With a 3.6 kill rate per CBU, over 4,400 vehicles, *or the equivalent of two and one-half full divisions could be totally destroyed in a single 24 hr period!*[26] As an aggressor in a major regional contingency is expected to field eight to ten armored/mechanized divisions,[27] asymmetric attacks on armor by bombers could destroy up to 22% of the attacking armored force per day.

Assuming a more reasonable kill rate of two vehicles per CBU-97 (dispersal and/or countermeasures) and the use of the stand-off anti-armor JSOW[28]on the older and more vulnerable B-52, 46 bombers would still be able to destroy over 2,000 vehicles, still an equivalent of over one division per day.[29] Four to five days of such devastating attacks would reduce each division to less than 50% strength, destroying the morale, will and effectiveness of the advancing forces.[30] Total annihilation of the armor columns, the operational center of gravity, is not necessary--the CINC's objective for this phase is to halt the advance.

TANKER SUPPORT

Tanker support for this operation would be sizable, but not prohibitive. For a CONUS-SWA-CONUS flight, the B-1s and B-52s would require three KC-135R refueling sorties per aircraft; the B-2 would require two.[31] Precision scheduling could reduce the tanker requirement on a maximum 46 bomber per day sortie rate to 109-145 tankers,[32] less than 18-24% of the existing tanker fleet.[33] The deployment of people and equipment into the theater may be slowed for the first week while the bombers are attacking armor, but deployment would also cease if enemy forces were not stopped before they seized strategic ports and airfields. Depending on the depth of the theater, the CINC may deem it too risky to deploy troops and equipment until the armored invasion is actually halted. The sequential phasing of the campaign's operations could make tankers readily available. Even if the "go" order was given (simultaneous operations), it would take time to mobilize units. For example, on October 6, 1994, CENTCOM detected the southward movement of Republican Guard units from central Iraq. In response, the United States quickly launched "Operation Vigilant Warrior," the rapid deployment of troops to the Gulf

region. It was not until October 10, 1994, however, that the first tactical aviation units began landing at airfields in the Gulf region, and on that date lead elements of the 24th Infantry Division were still moving to their tactical assembly areas. [34]

One possible restriction to using CONUS based bombers is the need for overseas based tanker support. Round-robin bomber sorties to SWA will require tankers to operate out of existing overseas bases. If tanker flights in support of bomber operations from these bases were denied, bombers would need to be deployed closer to the theater, for example, on Diego Garcia. The deployment would take time, however, something the CINC may not have. If allies denied the use of existing overseas bases to refuel bombers, however, it is doubtful these governments would then allow the use of these bases to refuel C-5, C-141, and C-17 aircraft carrying rapid reaction forces from CONUS--these aircraft also require refueling to reach the CENTCOM theater.[35] Without a capability to use bombers or rapidly deploy troops and equipment, the CINC's options in theater would be severely limited at best.

LIMITATIONS

While bombers can get to the theater of operations with enough munitions to halt the advance, there are additional challenges. First, which targets do the bombers strike? Armored columns are not fixed targets, and after a 17 hour flight from CONUS, the positions and dispositions of the enemy divisions may have changed dramatically. Which armored column now presents the greatest threat to the CINC's goals? Which target, if attacked, will provide the greatest return for the least risk? Bombers expose themselves to considerable and unnecessary risk loitering in a threat area while the crew attempts to locate a suitable target.[36] The danger is not only to the bomber, for both enemy and friendly armor look the same on a bomber's radar scope. As the bombers enter the theater of operations, they require updated target and threat information for coordinated and effective results.

The second challenge is bomber vulnerability. Bombers, as discovered in both WW II and in Vietnam, are vulnerable to both fighter attack and ground based air defense weaponry. Sending bombers in alone goes against the Air Force's own doctrine--achieve air superiority first.[37]Vulnerability varies by aircraft. The B-2 *Spirit*, with its reduced infra-red and radar signature, is a true stealth aircraft--it is difficult to detect electronically. The stealthy B-1 [38]and the B-52, however, utilize speed and electronic counter-measures (ECM) for survivability. The B-1's ECM gear is undergoing upgrade and will make the B-1 more survivable against current and future threats in the beginning of the next century. Until this time, however, the B-1 has limited survivability against modern threats. The B-52's radar cross section (RCS), 100 times greater than the B-1, [39]is truly heroic. To compensate, the B-52 has more powerful ECM equipment, but the aircraft is slower than the B-1 and overall, more vulnerable.[40]

The use of stand-off weapons such as JSOW give some protection from medium and short range threats organic to armored divisions, but all three bombers are still susceptible to attacks from enemy aircraft, especially during daylight operations. Round the clock operations would be required to maintain pressure and not give enemy forces time to recover.[41] Bombers, striking at targets 24 hours a day without combat air patrol (CAP) and suppression of enemy air defenses (SEAD) support, are at significant risk.[42]

WHY THE CARRIER BATTLE GROUP?

"To get harmony in battle, each weapon must support the other. Team play wins."

General George S. Patton, *The Patton Papers*, 1974.

Like bombers, the CVBG can be in-theater quickly, providing capabilities that both complement and enhance the bomber's mission. Ingressing bombers have little self-defense capability and brief loiter time to find their targets; the CVBG, however, fairly bristles with offensive and defensive weaponry and can remain in-theater for months. The bombers need forces in the theater to provide both command and control and defense of the bombers. The CVBG assists in three ways consistent with the Navy's four key operational capabilities;[43] it provides command, control, and surveillance, battlespace dominance, and power projection.

COMMAND, CONTROL AND SURVEILLANCE

"Communications dominate war: broadly considered, they are the most important single element in strategy, political or military."

Alfred Thayer Mahan, *The Problem of Asia*,1900.

As the CVBG arrives in-theater, it can remain in international waters yet immediately assess the theater situation and communicate this information to the National Command Authorities (NCA). Crammed with diverse and interoperable communications equipment,[44] the CVBG's command, intelligence and planning staff can monitor large portions of the theater by datalinking[45] with deployed Air Force assets such as the Joint-STARS[46] and AWACS. If the Air Force surveillance platforms are unavailable, organic assets such as the *Hawkeye* and the carrier's escort ships' radars can be used to monitor the air environment while new generations of UAVs provide real-time data on ground activity.[47] Additional intelligence can also be gained by carrier aircraft flying reconnaissance sorties and through other national assets, for example, satellites.

The carrier's surveillance capabilities and interoperable C^4I, coupled with the its command, intelligence and planning staff and loiter time make the carrier an ideal command and control location for the Joint Forces Air Component Commander (JFACC).[48] The addition of 47 Air Force bomber aircraft per day in-theater to normal carrier operations should not exceed the capability of the carrier's air operations center (AOC),[49] or in this case, JAOC. Moreover, a naval aviation officer as the seabased JFACC is more efficient--he/she is familiar with carrier based aircraft and operations and Tomahawk Land Attack Missile (TLAM) capabilities, and is thus better able to plan offensive counter-air (OCA) and SEAD operations in support of the bombers.

With command, control, and surveillance responsibilities, the carrier would remain on station to monitor the evolving battlefield, analyze armor movement, aircraft activity and other threat data. Ingressing bombers would be directed to attack priority targets as designated by the JFC and JFACC.[50] The real-time battlefield picture would enable the JFC to designate the application of forces, sequencing and synchronizing operations to maximize combat power and destroy the enemy's center of gravity. Centralized command and control would increase the effectiveness of

all forces by directing them to priority targets (and avoiding fratricide) as the battlefield evolves. Moreover, the ability of the JFACC to perform real or near-real time damage assessment with Joint-STARS, UAV or tactical air reconnaissance pod system (TARPS) sorties and instantly retarget bombers based on this information both maintains operational momentum and lets the JFC get inside the enemy's "observe-orient-decide-act" or OODA loop.

BATTLESPACE DOMINANCE AND POWER PROJECTION

The carrier's ability to provide theater command, control, and surveillance would solve one challenge, but bombers would still be attacking without air superiority--enemy aircraft and air defense weapons remain a significant threat. The CVBG can also assist the bomber in this area through two inherent operational capabilities--battlespace dominance and power projection.[51]

First, why should the CVBG defend the bombers? Why not attack armor? The answer is, in short, unity of effort. The CINC's primary objective is to stop the armored advance--bombers can accomplish this task *if* provided command and control and protected from threats. Naval air assets could assist--they can destroy hundreds of armored vehicles per day.[52] But bombers can destroy armor by the thousands; CVBG assets can supplement but not replace the bombers.[53] Naval air resources can, however, defend the bombers, improving the survivability of these assets and enhancing the overall operation.

The primary landward power projection assets that allow the CVBG to attain battlespace dominance and project power are the TLAM and the carrier air wing.[54] The TLAM C/D (conventional and dispenser variants), are carried by the majority of surface combatants and attack submarines in a CVBG.[55] The carrier air wing, in the Navy's new "50 TACAIR" configuration, has total of 71 aircraft.[56] With 66 fixed wing aircraft, this mobile "composite wing" can launch 120-150 fixed-wing sorties in a 12-15 hr period per day.[57]

Allocation and apportionment of these air assets would be at the JFC and JFACC's discretion, but TLAMs could be used against airfields, command and control nodes, supply depots or staging areas; F/A-18 and F-14 aircraft could fly offensive counter-air (OCA) missions to protect bombers from air threats. The EA-6B and high speed anti-radiation missile equipped F/A-18s could fly suppression of enemy air defenses (SEAD) missions to assist bombers against the air-defense weaponry organic to the armored columns. The JFC and JFACC would plan and schedule [58]bombers arrival numbers/times with carrier deck operations to maximize both bomber protection and carrier sortie rates--since bombers face the greatest threat in daylight operations, most carrier operations would occur in daytime. The actual allocation and apportionment of CVBG assets to OCA, SEAD, TARPS, strike and other missions would be situation dependent. Carrier air could be augmented with land based allied forces or other U.S./coalition assets when they arrived in theater and were combat ready.

The CVBG provides the CINC two additional advantages. The first is rescue. Despite the best planning and protection efforts, it is likely that U.S. aircraft will be shot down. When this occurs, the carrier's two HH-60H *Seahawk* helicopters can function as combat search and rescue (CSAR) aircraft. These helicopters may be able to pick up aviators downed within the helicopter's 1,100 kilometer range, eliminating possible enemy propaganda ploys. The second advantage the

CVBG brings the CINC is a possible active theater missile defense (TMD) capability.[59] While a TMD capability is not necessary for defense of the bombers, it can defend areas into which friendly forces are deploying for the next phase of the campaign.

The carrier battle group also has limitations. CVBGs are not numerous, thus may not be able to get to a crisis area quickly. This is not an insurmountable problem, however. With current satellite and communications technology, a warning of a least one or two days may be available. The NCA will have to act on warning, however, and get the CVBG moving to the area and not wait for the actual invasion. The second limitation is range--carrier aviation is very capable, but most carrier fighter and attack platforms are short to medium range, though the addition of the longer range F-18E/F next century [60]will increase capabilities. In addition, the carrier itself can be excluded temporarily from some waters by mining, further limiting it's effectiveness.

While it is possible an Aegis cruiser or a command and control ship such as the U.S.S. Mount Whitney (LCC-20) could fulfill the command, control and surveillance role, these ships would do little for bomber defense. It is the carrier, the heart of the CVBG, that combines adequate command and control with landward battlespace dominance assets that makes the combination of heavy bombers and naval forces work. The bombers bring the firepower to destroy armor; the CVBG acts as a "force multiplier," providing effective command and control and battlespace dominance.

OTHER CONSIDERATIONS

It must be stressed that halting the advance is only the *first* phase of the campaign; it does not equal winning the war. U.S. and coalition tactical air, maritime and ground forces may not be able to be deployed in time to halt the advance, but they will be needed for the next phases of the campaign. As these forces deploy and become available, they can begin to relieve hard-tasked bomber and carrier assets, eliminating operational pauses. Bombers can then deploy closer to the theater to be used in the next phases of the campaign.

The bomber and the CVBG, however, complement each other perfectly in the "cold-start" scenario, though this is not the only possible force combination. If American military forces are already in-theater, as they currently are in Korea and SWA, they may be sufficient to fulfill the command and control and defense roles the CVBG would fill. In this case, both bombers and carrier air assets could be used to attack armor, as directed by the JFC and JFACC. In the case in which no other forces are present, bombers have the capability of performing the mission alone, but this would raise the risk to the aircrews and lessen the overall effectiveness of the operation for reasons already discussed.

The major roadblock to using bombers today is weapons availability--SFW stockpiles in FY98 would be insufficient for even one day's operations. The operation could be executed, however, albeit on a smaller scale with less effective munitions--the CINC would have to determine whether the risk was worth the gain. The pieces, however, start to come together in FY01. At this time, sufficient quantities of SFW will be available, all B-2 bombers will have been delivered (in their final Block 30 configuration), and the B-1 fleet will have upgraded ECM. The landward

naval battlespace "umbrella" would also be expanding, for the long-range F-18E/F would be entering service at this time.[61]

By the turn of the next century, CINCs will have more options than just deploying defensive forces in response to an uncertain threat, as was done for Operation Vigilant Warrior. The U.S. deployment in response to the southward movement of the Iraqi Republican Guard took three weeks and cost an estimated one billion dollars.[62] In the future, CINCs may respond to a like threat by using a less costly, pre-planned flexible deterrent option of putting conventionally armed bombers on alert and moving a CVBG to the area.

CONCLUSION

Heavy bombers and a CVBG are the best forces a CINC can employ to halt a major armored advance in a future cold-start scenario. CONUS based bombers will provide a CINC the timely, flexible, and long-range firepower required to halt an armored invasion. Use of the bomber also brings the theater commander the added advantage of reducing forward basing and deployment requirements. Bombers, however, require in-theater command and control and defense from enemy threat systems for a coordinated and efficient attack and to reduce risk of being targeted and destroyed. The CVBG, the other half of the equation, provides these capabilities.

Also timely if deployed on warning, the CVBG is a self-contained strike force whose operational capabilities of command, control, and surveillance, battlespace dominance, and power projection allow the carrier to effectively direct and protect the bombers. The CINCs use of Navy CVBG assets and Air Force bombers together provides a synergistic effect--neither force capable of accomplishing the objective alone, yet together achieving the CINC's goal of halting the advance.

APPENDIX I

Conventional Weapons Carriage Capability

General Purpose Bombs	**B-1B**	**B-2A**	**B-52H Int/Ext**
Mk 82	84	80	27/18
M 117	12[1]	36[1]	27/18
Mk 84	24[1]	16	8/10
Cluster Bomb Units	**B-1B**	**B-2A**	**B-52H Int/Ext**
CBU-52,58,71			27/18
CBU-87 CEM	30	34	6/18
CBU-89 GATOR	30	34	6/18
CBU-97 SFW	30	34	6/18
Mk 20 ROCKEYE			0/18

CBU-59	12[1]		
SUU-30	12[1]		
Special Operations	**B-1B**	**B-2A**	**B-52H Int/Ext**
M129 LEAFLET			18/18
MJU-1/B			27/18
MC-1 LD			0/18
Naval Sea Mines	**B-1B**	**B-2A**	**B-52H Int/Ext**
Mk 36DST			27/18
Mk 40DST			0/18
Mk 41DST			8/10
Mk 52			12/18
Mk 55/56	24[1]		8/12
Mk 60			8/10
Mk 62	84	80	27/18
Mk 63			0/18
Mk 64/65			0/10
Guided Weapons	**B-1B**	**B-2A**	**B-52H Int/Ext**
GBU-10 PAVEWAY 1			0/8
GBU-10/12 PAVEWAY II, III			0/10
AGM 84 HARPOON			0/8
AGM 86C CALCM			8/12
AGM-142 RAPTOR			0/4
JDAM I	24[2]	16[3]	12[4]
JSOW	12[5]		12[2]
WCMD	30[5]		16[4]

[1]Integration requested, test dates uncertain.
[2]Planned integration date is FY00.
[3]Planned integration date is FY95 on Block 20 B-2 aircraft.
[4]Planned integration date is FY98.
[5]Planned integration date is FY02.
Information was provided by HQ ACC/DRPB and HQ ACC/DR/SMO-2

APPENDIX II

Bomber Sortie Generation

The 1992 Bomber Roadmap states that bombers will be able to generate a .4 sortie rate and a 75% mission capable rate in 35 hour CONUS-CONUS flights. Of the planned force of 95 B-1s, 66 B-52s, and 20 B-2s, the maximum number of bombers that will be available to theater commanders are 80 B-1s, 56 B-52s and 16 B-2s (due to depot maintenance, test, etc.)[63] These numbers, multiplied by .4, equal:

B-1	80 * .4 =	32		
B-2	16 * .4 =	6	=	60
B-52	56 * .4 =	22		

At a .4 sortie rate, the Air Force states it can theoretically launch 60 bombers to the theater per day. This number is optimistic, however. A more likely sortie rate is .3. The rationale behind this number is based on a typical 12 aircraft bomber squadron. On the first day the squadron launches four aircraft, leaving eight to prepare for the next day's flight. Twenty-four hours later the squadron launches four additional aircraft, leaving only four remaining on the ramp. Eleven hours later, however, the four aircraft launched the first day return, giving the squadron eight aircraft of which four have to be ready in 13 hours. Four sorties per day can continue as long as airframes, parts, munitions, and maintenance personnel are available.

With a 1.3 crew ratio, crews are not a problem. With 16 crews, a squadron need only fly a crew once every four days. Since the armored invasion may be countered in less than a week, some crews may fly only once during this phase of the campaign.

B-1	80 * .3 =	24		
B-2	16 * .3 =	5	=	46
B-52	56 * .3 =	17		

At a .3 sortie rate, the Air Force can theoretically put 46 bombers in the theater each day. Air aborts, attrition, and tanker problems may decrease the actual number of sorties that arrive in-theater.

APPENDIX III

Tanker Operations

RAND, in the study "The Use of Long-Range Bombers in a Changing World: A Classical Exercise in Systems Analysis" states the B-2 will require one tanker for CONUS-SWA-CONUS flights and the B-1 and B-52 three. A quick look at the unrefueled ranges of the bombers bears out the B-52 and B-1 numbers; the B-2 tanker requirement, however, is suspect.

<u>The requirement -- A CONUS-SWA-CONUS sortie--35 hours and approximately 14,000 nm.</u>

Aircraft	Unrefueled Range	Per Tanker Fuel Transfer capacity	Number of Tankers	Refueled Range
B-1	5,600 nm	120,000 lbs	3	15,680 nm
B-2	6,600 nm	120,000 lbs	2	15,180 nm
B-52	6,200 nm	120,000 lbs	3	17,360 nm

From these calculations, the B-2 would require at least two tankers, the B-1 and B-52 three.

With 41 B-1s/B-52s and five B-2s daily, a quick calculation ((41*3) + (5*2) = 132) finds that 132 tankers are required to refuel a bomber strike. It is unlikely, however, that all bombers will be launched in one wave--to maintain pressure on the armored invasion, round-the-clock operations will be necessary. A more likely scenario (though actual operations will be determined by the CINC/JFC's requirements) is one in which the 46 bombers would be divided into five packages spread randomly (to maintain tactical surprise) throughout a 24 hour period. This division would generate nine bombers per air-refueling, and, worst case (all B-1s/B-52s), would require 27 tankers, nine for each of three orbits, per mission. One tanker would be able, in a 12 hour crew day, to refuel at least two flights of bombers. With five flights, three shifts of tankers would be needed, or (27*3) 81 tanker sorties per day. With a mission capability rate of at least 75%, actual tanker requirements would be 109. If less direct routing or low-level flight was required, an additional tanker orbit will be needed. This will require an additional 27 tankers, bringing the total requirement to 108 KC-135s. At a .75 mission capability rate (the Air Mobility Command standard is .85),[65] 145 tankers will be needed.

APPENDIX IV

CVBG Sortie Rates

An aircraft carrier may have the capability to launch 150 fixed-wing sorties per day, but a more realistic number is 125. This figure is based not only with conversations with Navy officers, but upon sorties generated by the U.S.S. Theodore Roosevelt (CVN-71) in support of the NATO air campaign against Bosnia in the fall of 1995. In this operation, the Roosevelt launched about 125 sorties daily. Of these sorties, 20-24 were SEAD, two or three TARPS sorties, two ES-3A electronic intelligence missions and six close air support patrols.[66] Total strike sorties per day, based on these numbers, is approximately 100.

This is a best case situation, however--no ASW/ASUW patrols or CAP were required. It is unlikely that the threat situation will be as benign in the scenario proposed in this paper. In a best case situation, however, approximately 100 strike sorties could be generated against an armored invasion.

The 50 TACAIR squadron has 14 F-14s and 36 F-18s. The proportional number of sorties per aircraft type will be 28 F-14 and 72 F-18 sorties. The F-14 can carry four weapons; the best choice would be GBU-12s, a laser guided 500 lb. bomb with a probability of kill of .88.[67] To maximize kill potential, the F-18s will carry two anti-armor JSOW.[68] With these weapons, carrier-based aviation can kill 386 armored vehicles per day:

72 F-18 with JSOW * 2 = 144 JSOW * 2 kills per weapon = 288 kills

28 F-14 with GBU-12 * 4 = 112 GBU-12 * .88 kills per weapon = 98 kills

386 vehicles destroyed

The Navy is currently planning to purchase only 1,200 anti-armor JSOW, [69]and it is unlikely the carrier and its escorts will carry even two days supply of these weapons. After multiple kill per pass munitions such as JSOW are exhausted, the kill rate on armor will decrease. Moreover, the F-14, with it's four laser-guided weapons, would be required to fly repeatedly over the armored column, greatly increasing the aircraft's chances of being destroyed. The F-18E/F, to be delivered next century, will be more capable in both range and payload than either the current F-18 and F-14, but the problem of precision weapons supply remains.

The CVBG's other long-range power projection weapon, the TLAM C/D, is relatively ineffective against mobile armor.[70] The Block IV Tomahawk MultiMission Missile (TMMM), to be introduced in the year 2000,[71] gives the TMMM additional flexibility by allowing the missile to be redirected to alternate *pre-programmed* targets while in flight. The warhead remains the same, making this a better Tomahawk, but still not very effective against armor. The Navy is considering developing an anti-armor TLAM that could be datalinked with Joint-STARS or UAVs to deliver "smart" submunitions such as SFW against fixed and mobile armor targets, but this weapon is not yet planned or funded.[72] This weapon would give the CINC added flexibility and mass against mobile armor if purchased.

A caveat--the numbers above are an example; weapons carry capacity per aircraft can be greater and the actual sortie count lower, depending on fuel requirements, threats anticipated, sortie duration, etc.. The point is that a single or even two carrier based aviation wings will never approach the overall sustained kill rate of the bombers. CVBG air assets can, however, provide battlespace dominance to protect the bombers, something the bombers cannot.

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NOTES

1. U.S. Department of Defense, National Military Strategy of the United States of America, 1995, 7.
2. John T. Correll, "The High Risk Military Strategy" Air Force Magazine, September 1994, 37.
3. For the purposes of this paper, the "cold-start" theater will be the CENTCOM AOR, for it is the most restrictive theater of the two current "trouble" areas in terms of both distance and accessibility.
4. The ability to concentrate combat power at the decisive time and place. See the U.S. Department of the Air Force, Basic Aerospace Doctrine of the United States Air Force, Vol. I, (Washington D.C.: U.S. Government Printing Office, March 1992), 11.
5. Jasper Welch, Conventional Long-Range Bombers: How Many and What Type do we Need?, (n.p.: n.p.), January 1992, 15.
6. In Desert Shield, it took *five* days before even the first air-to-ground fighters entered the theater. Iraq would have had time to overrun Saudi Arabia before the United States could have responded with tactical forces. See "More Data from Desert Storm," Air Force Magazine, January 1996, 64; Glenn Buchan, Use of Long-Range Bombers to Counter Armored Invasions, (Santa Monica, CA: RAND, 1992), 8.
7. U.S. Department of the Air Force, The Air Force Bomber Program, February 1995, 2.
8. Timothy Laur and Steven Llanso, Encyclopedia of Modern U.S. Military Weapons, (New York: The Berkley Publishing Group, 1995), 19-28.
9. In August, 1994, two B-52s took off from their home base and circumnavigated the globe. The flight released 54 MK-82s on the Udairi range in Kuwait and landed at home after 47 hours. Not to be outdone, two B-1s also circumnavigated the globe, releasing weapons on three different ranges in June, 1995. The B-1 flight took 36 hours. Telephone conversation with Captain Dale Williams, HQ ACC/DOXE, 25 January 1996.
10. John A. Tirpak, "Heavyweights for the New Strategy," Air Force Magazine, October 1995, 26.
11. George L. Butler, "Disestablishing SAC," Air Power History, Fall 1993, 8.
12. See Appendix I for a table of current and programmed weapons capability.
13. U.S. Department of Defense, FY97-01 Defense Planning Guidance, (Washington, 1995), 18-19.
14. Each CBU-97 contains ten BLU-108 submunitions, each of which contains four projectiles. Each projectile contains a two-color infrared sensor which scans a wide area for both hard (tanks) and soft targets. When a target is detected, the projectile destroys the target with an explosively formed penetrator warhead. If a projectile does not detect a target in a fixed elapsed time, it detonates, causing damage to material and personnel. SFW is currently in production. See Duncan S. Lennox and Arthur Rees, Jane's Air Launched Weapons, Issue 19 (United Kingdom: Sentinel House, 1994).

15. Glen C. Buchan and others, Use of Long Range Bombers to Counter Armored Invasions, (Santa Monica, CA: RAND, 1992), 4.
16. Over 3,000 of the 5,000 CBU-97 will be the improved SFW. Telephone conversation with Major Dave Silva, HQ ACC/DRW, 17 January 1996.
17. Lennox.
18. Information provided by George L. Hart, Naval Air Systems Command (PMA-201), Crystal City, Va, 12 January 1995.
19. David A. Fulghum, "Secret Warhead Near to Fielding" Aviation Week and Space Technology, 3 April 1995, 62.
20. Telephone conversation with Major Dave Silva, HQ ACC/DRW, 17 January 1996.
21. "GPS Meets New Challenges" International Defense Review, October 1995, 57.
22. The FY96 Defense Budget retains 95 B-52's; the Air Force programmed for only 66. It is uncertain in what status and for what period of time the Air Force will maintain the additional 29 B-52 bombers. Telephone conversation with Major Jay Freeman, HQ ACC/XPP, 17 Jan 1995.
23. John A. Tirpak, "The Pentagon Declines More B-2s" Air Force Magazine, July 1995, 13.
24. Sorties per day could be increased if "shuttle bombing" techniques were used. For example, B-1/B-52 bombers launched from CONUS could land at Diego Garcia (for the CENTCOM theater) or Guam (for the PACOM theater), reconstitute, strike, then land in CONUS.
25. The bomber weapons configuration used in this calculation is: 15 B-1s w/30 CBU-97, 9 B-1s w/24 JSOW; B-2 w/34 CBU-97; 17 B-52 w/ 24 CBU-97.
26. A modern armored division today consists of approximately 2,000 vehicles (1,000 fighting vehicles (tanks, personnel carriers, motorized artillery), 500 electronically intensive vehicles (air defense, communications), and 500 special purpose vehicles (engineers, decontamination, medical)). See Welch, 18.
27. Christopher Bowie and others, The New Calculus, (Santa Monica, CA: RAND, 1993), 16.
28. Standoff weapons increase survivability, but reduce payload capacity. See Appendix I.
29. Bomber survivability can be further enhanced by not attacking the armored divisions directly. Armor can be delayed/stopped by other means, e.g., destroying bridges or mining chokepoints with air delivered anti-armor mines such as the CBU-89/B GATOR. In addition, lines of communication and supply can be attacked.
30. "Defeating armor at a rate of one division per day would have halted any armored invasion in history except the U.S. invasion of Iraq in Desert Storm." See Glen Buchan, The Use of Long-Range Bombers in a Changing World: A Classical Exercise in Systems Analysis, (Santa Monica, CA: RAND, 1994), 421.
31. Glen Buchan and others, The Use of Long-Range Bombers in a Changing World: A Classical Exercise in Systems Analysis, 413.
32. See Appendix III for details.
33. The Air Force inventory currently contains 390 KC-135R, 159 KC-135E and 59 KC-10 tankers. Telephone conversation with Lieutenant Colonel Rogelio Herrera, HQ USAF/XOFM, 5 February 1996.
34. J. H. Binford Peay, "The Five Pillars of Peace in the Central Region," Joint Force Quarterly, Autumn 1995, 32.

35. The range of airlift aircraft without refueling is less than that of bomber aircraft. See the Encyclopedia of Modern U.S. Military Weapons, 19-48.
36. Jeffrey Record, "The Never-Ending Bomber Debate, Strategic Review, Fall 1995, 9.
37. Basic Aerospace Doctrine of the United States Air Force, Vol. I, 10.
38. The front aspect B-1 Radar cross section, at $1m^2$, is 1/7th the size of the much smaller F-111A. See the Encyclopedia of Modern U.S. Military Weapons, 20.
39. V. Frank Vollmar, The Conventional Bomber Force: War-Horses for Global Conflicts, Research Report No. AU-ARI-91-6 (Maxwell AFB, Al: Air University Press, October 1992), 69.
40. U.S. Department of the Air Force, The Bomber Roadmap, (Washington, June 1992), 8.
41. Daylight operations are mandatory. If strikes were made only at night, the armored divisions could road march in the day and spread out, dig in and shut down at night. SFW senses heat sources in vehicles: cold tanks offer poor targets. The Brilliant Anti-armor submunition (BAT) P^3I will be capable against cold armor, but this munition is still in development. See U.S. General Accounting Office, Weapons Acquisition, Report to Congressional Committees (Washington: 1995), 16.
42. Tirpak, "Heavyweights for the New Strategy," 31; Welch, 73.
43. The four key operational capabilities are: command, control, and surveillance; battlespace dominance; power projection; and force sustainment. See Roger W. Barnett, "Seapower Littorally," American Defense Annual, 1994, 9th ed., 113.
44. The exercise Kernal Blitz '95 integrated an amphibious ready group, a simulated carrier battle group, and Air Force bombers, fighters and surveillance platforms for a joint warfare interoperability demonstration See Jeremy M. Boorda, "Leading the Revolution in C^4I," Joint Force Quarterly, Autumn 1995, 16.
45. The Pentagon has approved the Joint Tactical Information Distribution System (JTIDS) for full scale production following a successful test by the Navy. JTIDS is a jam-resistant, secure and high-capacity data and voice distribution system that can transfer tactical data from an AWACS, Joint-STARS, and E-2C to ships and other JTIDS equipped platforms. See "JTIDS Passes Production Hurdle," Aviation Week and Space Technology, March 13, 1995, 29.
46. The Joint-STARS is an airborne, multi-mode radar with associated C^3 equipment. It can detect, track and classify ground forces, and can offer targeting information to attacking aircraft for precise, real-time attacks on moving enemy targets. See Albert R. Hochevar and others, "Deep Strike," Joint Force Quarterly, Autumn 1995, 84.
47. The Navy is purchasing the *Predator*, a Tier 2 UAV with a 24 hour on-station time and a range of over 900 km. The *Predator* will also be the first UAV with a synthetic aperture radar, giving it an all-weather day/night surveillance capability. The *Darkstar*, a stealthy UAV about to undergo flight tests, is more capable than the *Predator* and is "highly survivable even in a high-threat environment." See David A. Fulgham, "International Market Eyes Endurance UAVs," Aviation Week and Space Technology, 10 July 1995, 40-46.
48. As long as maritime forces provide the preponderance of air capability or secure, sufficient, land based facilities are insufficient, a seabased JFACC is doctrine. Once these conditions no longer exist, a planned JFACC transition will occur. See Joint Publication 3-56.1, Command and Control for Joint Air Operations, (Washington, D.C.: U.S. Government Printing Office, 14 November 1994), II-8.

49. The AOC is the senior control agency in the Tactical Air Control System. The AOC provides centralized command and control and monitors the conduct of current operations. See U.S. Department of the Navy, FMFM 5-60, Control of Aircraft and Missiles, (Washington, D.C.: U.S. Government Printing Press, 22 June 1993), 9-1.
50. Information would be passed to bombers through secure radio or satellite communications (SATCOM). Bomber program managers in Air Combat Command have also been directed to request funding to install the Joint Tactical Information Distribution System (JTIDS) in all bombers. This system would optimize information transfer. Telephone conversation with Major Scott Menser, HQ ACC/DRPB, 17 January 1996.
51. Battlespace dominance is maintaining "zones of superiority surrounding one or more units or even the entire force, which are shifted as required. The zones are regions in which we maintain superiority by detecting, identifying, targeting, and neutralizing anything hostile that passes through." Power projection is "taking the battle to the enemy." See U.S. Department of the Navy, Naval Doctrine Publication 1, Naval Warfare. (Washington, D.C.: U.S. Government Printing Press, 28 March 1994), 63.
52. See Appendix IV for details.
53. CVBGs on station at C+0, C+7, C+28 took over four weeks to halt an advance. See Bowie and others, xvii.
54. Marine forces, naval surface fire support, special warfare forces, command and control warfare and maritime prepositioning are other power projection assets. See Naval Doctrine Publication 1, 65-66.
55. Employment of Navy and Marine Forces, (Maxwell AFB, Al: Air University Press, 1994), 59.
56. The "50 TACAIR" wing has 36 F/A-18 *Hornet*, 14 F-14 *Tomcat*, four EA-6B *Prowler* electronic-warfare, four E-2C *Hawkeye* early warning/control, eight S-3 *Viking* ASW aircraft, three SH-60F and two HH-60H *Seahawk* helicopters. See Bernard Prezelin, ed., Combat Fleets of the World, 1995, (Annapolis: Naval Institute Press, 1995), 117.
57. Employment of Navy and Marine Forces, 25.
58. The carrier is now joint-ATO capable. See Employment of Navy and Marine Forces, 28.
59. The HH-60H can be supplemented by the three SH-60s on the carrier. Some ships in the CVBG, notably cruisers, also carry helicopters that can be used in the rescue role, if necessary. The rescue capability provided is very limited, however. See Employment of Navy and Marine Forces, 20.
60. The F-18E/F is expected to have a 40% increase in range over present F-18s. See Paul Jackson, ed., Jane's All the Worlds Aircraft 1995-96, (London: Butler and Tanner, Ltd., 1995), 585-586.
61. Jackson, 585.
62. Marr, 54.
63. The Bomber Roadmap actually states 80 B-52s rather than 56, but force structure has since been reduced. The 35 hour flight approximates a CONUS-SWA-CONUS sortie. See The Bomber Roadmap, 6.
64. The KC-135R can offload 120,000 lbs of fuel in a 1,100 nm radius. The KC-10 can offload 200,000 lbs of fuel in a 1,900 nm radius. See the "Encyclopedia of Modern U.S. Military Weapons, 153-157.
65. Telephone conversation with Captain Robert Shaw, HQ AMC TACC/LOCC, 8 February 1996.

66. "Precision Missiles Bolster NATO Strikes," Aviation Week and Space Technology, 18 September 1995, 23.
67. Weapons Acquisition, 27.
68. Interview with Lieutenant Commander Scott Craig, F-18 Pilot, College of Naval Command and Staff student, Newport, R.I.: 5 February 1996.
69. Weapons Acquisition, 38.
70. The long flight time of the missile against mobile, variable speed and direction forces and lack of "smart" anti-armor submunition make the TLAM unsuitable against mobile armor. See Glen Buchan, The Use of Long-Range Bombers in a Changing World, 439; Weapons Acquisition, 48.
71. Vincent C. Thomas, "1996 Almanac Issue," Sea power, January 1996, 176.
72. The concept is called the "Tomahawk Stops Advancing Regiments (TSAR)." See Barbara Starr, "USN Studies anti-armour Version of Tomahawk," Jane's Defense Weekly, 11 November 1995, 8.