August 2008

The 2018 Bomber:

The Case for Accelerating the Next Generation Long-Range Strike System

by
Robert Haffa and Michael Isherwood

NORTHROP GRUMMAN

Contents

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Executive Summary

In 2006, the Defense Department's Quadrennial Defense Review (QDR) concluded that the Air Force should accelerate the fielding of its Next Generation Long-Range Strike System (NGLRS) from 2037 to 2018. This paper inquires into the rationale behind that decision.

The QDR decision to accelerate fielding the NGLRS was based largely on anticipated requirements for future U.S. military

forces to operate in increasingly challenging theaters of operation against both sophisticated and asymmetric adversaries. These changed conditions included:

- Operating in theaters where U.S. base access declined from 37 airfields per million square miles, as the U.S. experienced during the Cold War, to 15 airfields per million square miles along the Asian-Pacific rim. U.S. air forces will be expected to operate over greater ranges than required in the past.

- Operating against hostile nations capable of fielding more effective anti-access offensive weapon systems, such as ballistic and cruise missiles, of increasingly greater accuracy and effect, and potentially armed with weapons of mass destruction. In addition, defensive weapons systems are proliferating—in the form of sophisticated SA-10, SA-12 and SA-20 surface-to-air missile systems and advanced fighter aircraft. These capabilities limit the ability of the United States to deploy short-range forces to the region, and to operate them from allied bases.

- Operating with a reduced fighter inventory. Future Joint Force Air Component Commanders can expect more restrained resources to execute an air campaign, resulting potentially in fewer targets struck. When required to operate at further distances, the reduced fighter fleet will not generate the sorties required to support the typical joint campaign during major combat operations.

The decision to accelerate the next generation strike aircraft from 2037 to 2018 addresses the above concerns and with the intent of providing a marked improvement in U.S. long-range strike capability within a decade.

- The NGLRS will operate over the increased distances thus mitigating the decline of airbase availability.

- The NGLRS will ease access into any airspace, in the face of adversaries adopting an anti-access/area denial strategy.

- The NGLRS will provide increased capacity, operating over extended ranges and within these environments, to deliver ordnance and effects, alone or as part of a "wolfpack" of netted manned/unmanned weapon systems that swarm over hostile targets.

In addition, the 2018 bomber will bring other needed capabilities.

- It will operate at a higher sortie tempo demanded in conventional theater operations.

- It will be integrated into a netted C^2ISR enterprise allowing it to receive and send targeting data from space assets, other airborne systems, surface and even sub-surface platforms. It will offer an open architecture for rapid upgrades and modifications. As such, it will be distinguished from previous bomber aircraft by its ability to conduct netted cyber operations that range from monitoring, intercepting and attacking enemy information nodes to augmenting the theater commander's capacity to deliver highly survivable lethal effects.

- It will also provide a critical capability for the nation's leadership. An adequate NGLRS inventory will be able to hold at risk any hostile leadership, infrastructure, forces, or resources in a timely fashion with the required precision and command and control.

The decision to accelerate the nation's next generation long-range strike system makes sense. The case for the 2018 bomber is strong.

I. Introduction: The 2037 Bomber

Long-range strike is the reason we have a separate Air Force. It was the Army Air Corps' unique capability to conduct long-range strike missions during World War II that enabled it to argue successfully for the independence it gained in 1947. Contemporary Air Force leaders have declared that the "soul of the Air Force is range, payload and persistence"—capabilities inherent in the long-range bomber force. Today, U.S. bombers routinely demonstrate the nation's power projection capability with flights carving long arcs across the globe. And while other nations have long-range aircraft, none have as powerful a force as the United States, whose fleet features the stand-off capability and range of the B-52 and B-1, combined with the stealth, survivability and all-weather precision of the B-2.

As good as it is, the aging U.S. bomber force no longer reflects state-of-the-art technology. In the decade after the Cold War's end, the Air Force accorded long-range strike capability a low priority, as modernizing the fighter and airlift fleets ranked higher on the agenda. Numerous studies, commissions and panels debated the value of the bomber force in the post-Cold War era. The Defense Department's 1993 *Bottom Up Review* (BUR) reduced the size of the bomber force to 184 total aircraft, with only 100 deployable for combat operations.[1] The Air Force 1995 *Heavy Bomber Study* downplayed the bombers' role by identifying how a large fighter force would utilize strategic warning to deploy for a short-range theater conflict.[2] In contrast, other independent reports recommended expanding and/or upgrading the fleet based on trends in the security environment. For example, the 1997 *Independent Bomber Force Review Commission* advised fielding a third B-2 squadron.[3] Operation DESERT STORM air commander General Chuck Horner said, "I returned from the Gulf convinced that tomorrow's air commanders required—and would indeed have—a fleet of 60 or more long-range stealthy bombers."[4] Likewise, the *National Defense Panel* in 1997 called for more long-range, stealth, precision-weapon equipped aircraft and platforms.[5]

In response to these reports, and at the direction of Congress, the Air Force in 1999 published a "bomber roadmap" in a "White Paper on Long-Range Strike."[6] This document established 2037 as the initial operational capability (IOC) date for what became known as the Next Generation Long-Range Strike System (NGLRS).[7] In the meantime, the White Paper declared the Air Force would modernize the current bomber force to keep it relevant for the next forty years.[8] These investments included adding precision weapons, such as Joint Direct Attack Munition (JDAM), Joint Stand-Off Weapon (JSOW), Joint Air-to-Surface Stand-off Missile (JASSM) and the 250 pound Small Diameter Bomb (SDB). The White Paper also stipulated that other upgrades—such as the Link-16 command and control network data link and new low observable maintenance processes for the B-2—would ensure the force met future operational requirements.[9] Finally, the White Paper articulated three assumptions underpinning the finding that the current force could last 40 years:

- No significant changes in the air defense threats
- No unforeseen increases in sustainment costs

[1] Les Aspin, *Report on the Bottom Up Review*, Section IV: Building overall force structure, October 1993, available at http://www.fas.org/man/docs/bur/part04.htm

[2] Brent Scowcroft, Final Report of the Independent Bomber Force Review Commission, July 23, 1997, pp 17-18.

[3] Ibid. pp 2, 6.

[4] Rebecca Grant, *Return of the Bomber: The Future of Long-Range Strike*, Air Force Association Special Report, Feb 2007, page 11.

[5] Report of the National Defense Panel, *Transforming Defense National Security in the 21st Century*, December 1997.

[6] Grant, op.cit. page 8.

[7] HQ U.S. Air Force, *U.S. Air Force White Paper on Long-Range Bombers*, March 1999, pp 21-22.

[8] Grant, op.cit, page 11.

[9] *U.S. Air Force White Paper on Long-Range Bombers*, pp 10-11.

- No significant combat attrition[10]

If the lack of an increased threat was one factor contributing to delaying bomber modernization, so was the requirement for a more advanced system. Thus, in 2001, the opportunity to acquire a conventional variant of the B-2 bomber was set aside on the grounds that the "B-2C" did not offer enough new capability. The Air Force wanted an aircraft "...that is extremely stealthy, has extreme high-speed and extreme range, allowing us to conduct wholesale daytime operations. [We need to] reduce the link between when the target is spotted and identified, and it is attacked."[11]

A second reason the Air Force chose to postpone a new bomber was the priority it placed on modernizing its air superiority (F-22) force. The Air Force outlined several factors underpinning the F-22's urgency, including how the F-15C would reach its 8,000 hour airframe life by 2010.[12] In addition, the Air Force argued that Russian, French and Chinese fighters would surpass the F-15's capabilities early in the 21st Century—requiring a more capable fighter aircraft to ensure U.S. air dominance.[13] Given the primacy of that threat and constrained procurement budgets, the Air Force elected to push the F-22 program and hold to the 2037 timeline for the next advanced technology bomber.

Planners in the Office of the Secretary of Defense (OSD) evaluated the nation's air needs differently. In the 2006 Quadrennial Defense Review (QDR), DoD accelerated the planned fielding of the NGLRS from 2037 to 2018. This paper explores the rationale behind that decision and assesses the case for NGLRS acceleration.

- Given the Air Force previous decision to upgrade the existing bomber fleet and delay fielding of the NGLRS until 2037, what factors prompted the Office of the Secretary of Defense planners to move up the date?
- What enhanced capabilities will the NGLRS bring to the force to support its earlier fielding?
- Given Combatant and Component Commander requirements for the future fleet and the proposed capabilities identified for NGLRS, does a 2018 IOC make sense?

Reviewing the rationale to accelerate the NGLRS (also referred to as the Next Generation Bomber or NGB), is the focus of this paper. As the Chairman of the Joint Chiefs stated on his first day in that office, "The fighting in Iraq and Afghanistan will one day end. We must be ready for who—and what—comes next."[14] Supporting the current warfighter and achieving the nation's objectives today is critical—as is preparing the next potential fight. Regarding the next-generation long-range strike system, how soon should we be ready?

[10] Ibid., page 22.

[11] Vago Muradian, "Roche: Air Force Needs Stealthy, Fast, Long-Range Bomber, Not More B-2s," *Defense Daily International*, October 19, 2001.

[12] Bob Algarotti, "The F-15 Eagle: A Key Player in Network Centric Operations," *Journal of Boeing Integrated Defense Systems*, on-line journal, Vol I, No 6 at http://www.boeing.com/ids/allsystemsgo/issues/vol1/num6/story09.html

[13] HQ U.S.A.F. Air Force News Service, "Air Force separates F-22 facts from myths," August 4th, 1999.

[14] Admiral Michael Mullen, "CJCS Tribute/Hail/Farewell," October 1, 2007, at http://www.jcs.mil/chairman/speeches/CJCS_tribute_hail-farewell_1oct07.html

II. The Case for Accelerating the NGLRS

The nature of future conflict played a compelling role in why the 2006 QDR advanced the NGLRS schedule. Force planners recognized, as the new Chairman of the Joint Chiefs articulated, that the U.S. military must be ready for "what comes next." Three challenges underscore the factors that shape the need for fielding the NGLRS sooner:

- Air base availability
- Anti-access/area denial
- Targeting shortfalls

Air Base Availability

As the Cold War ended, U.S. security interests shifted away from Europe and toward the Middle East and Asia. In 2002, a Center for Strategic and Budgetary Analysis report surveyed the availability of bases in these different theaters. When U.S. force planners focused on Europe, CSBA identified that the U.S. had access to 388 airfields within the 7 million square mile area—an airfield density of 55 airfields per million square miles.

In contrast, U.S. military planners in the Persian Gulf and Asia-Pacific theaters had access to only 151 and 278 airfields in each area, respectively (excluding China and North Korea). CSBA calculated that the airfield density dropped to 37 airfields per million square miles in the Persian Gulf but only 15 in the Asia-Pacific rim. When including airfields with hardened shelters—vital for aircraft survivability—the density dropped to 14 airfields per million square miles in the Middle East and just three in Asia.[15] Thus, CSBA concluded that U.S. aviation forces, deprived of close-in secure bases, would operate over greater distances—in many cases—farther than 1,500 miles.

One way to manifest the significance of the greater distances is to examine a crisis in the Asian-Pacific theater over Taiwan. If during such a contingency, Korea and Japan denied U.S. access to their territory, Guam would be the closest operating base 1,700 miles away. Australia might provide a number of bases (up to 30), but at distances of 2,700 to 4,200 miles. The size of the tanker force to support fighter operations would be significant. For example, five KC-135Rs are required to support a four-ship of F-22s operating at a 2,000 radius from Guam. If the Raptors operated from Australia, an average of 3,500 mile range, eight tankers are needed. Using a JDAM-per-tanker metric, operations from Guam would have a 1.6 JDAM-per-tanker while those from Australia would have a 1.0 JDAM-per-tanker ratio. By comparison, a B-2 requires no tankers at either of these ranges to deliver sixteen 2,000 pound JDAMS or eighty 500 pound weapons.

This shortage in long-range strike is shown in Figure 1, depicting the number of U.S. combat aircraft as a function of strike distance from a refueling orbit. Beyond 500 miles, bombers provide the primary offensive capability. The U.S. has limited capacity in this area to meet the challenge of operating over greater distances.

[15] Christopher J. Bowie, *The Anti-Access Threat and Theater Bases*, Washington D.C., Center for Strategic and Budgetary Assessments, 2002, p.27.

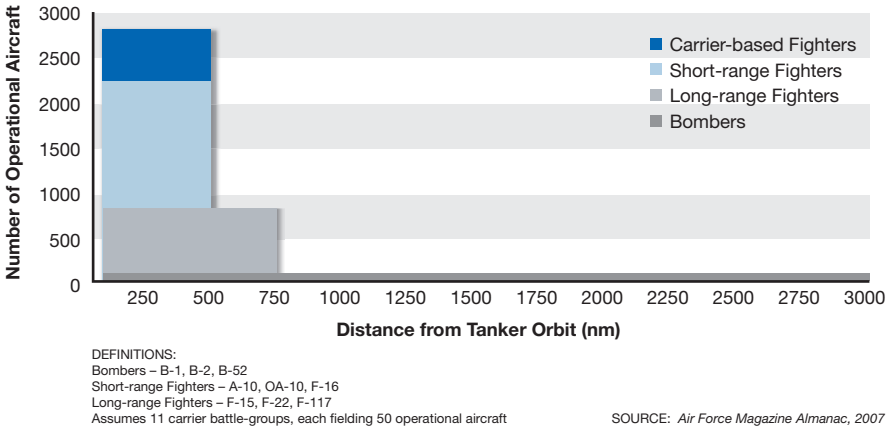

Figure 1: Strike assets versus range (Total U.S. combat aircraft inventory.)

The lack of secure regional bases in the region means that U.S. air power must rely on aerial refueling to extend the range of fighter aircraft. However, human performance and aircrew fatigue become major limiting factors for fighter aircrews to effectively sustain operations at mission distances of 1,500 or 2,000 miles (equivalent to a 10 hour sortie duration).[16] In addition, in the Middle East and Pacific theaters, relying on aerial refueling aircraft has a second order consequence of requiring a large contingent of support aircraft which will compete for ramp space. Table 1 depicts a notional deployed force to support major combat operations near Taiwan when bases in Korea or Japan are denied. Five hundred air-to-ground fighter aircraft would require nearly 300 tanker aircraft.

Table 1: Illustrative JFACC fighter and tanker forces to execute Taiwan MCO.

Aircraft	Employed	JDAM/AC	Total JDAM	Combat Radius	Tankers Required	Comment
F-35	200	2	400	1,000	54	CVBG
F-35	150	2	300	1,700	70	Guam
F-35	150	2	300	3,500	157	Australia
B-2	**16**	**16**	**256**	**3,500**	**8**	**Australia**
Total	**516**		**1256**	**-**	**289**	

Anti-Access/Area Denial

While operating over increased distances in the future, U.S. forces will also face more sophisticated and lethal defenses. Unlike the air defense system the U.S. Air Force defeated over Iraq in 2003, advanced air defenses are characterized by their networked radars and longer range anti-aircraft missiles and fighters. For example, Russia has developed the SA-20 Surface-to-Air Missile (SAM), featuring a phased-array radar employing sophisticated anti-jam software and multi-target track and engagement capability. These missile systems, along with other advanced "double digit" air defense missile batteries have greater mobility, higher speed, longer range (125 and 250 miles) and are far more maneuverable than earlier systems. Air Force leaders observed during Operation ALLIED FORCE that B-1Bs and other non-stealthy aircraft could not survive in the face of "double digit SAMs," even when employing advanced decoys and other countermeasures.[17]

These anti-aircraft missile systems are proliferating throughout the Middle East and Asia (Figure 2). China is purchasing 14 to 20 battalions of Russian S-300 SAMs, allowing that nation to field 700-1,000 missiles capable of denying air operations over the Taiwan Straits to non-stealthy aircraft.[18] More than eight nations also have the SA-10, a system similar to the SA-20 with a maximum range of 125 miles. Air defense missile systems with these ranges will push U.S. aircraft further away, reduce the effectiveness of

[16] Ibid., pp. 11-14.

[17] Adam J. Herbert, "Former ACC Chief Says U.S.A.F. Should Move to Larger, All B-2 Bomber Fleet," *InsideDefense.com*, (17 October 2001). See also David Bond, "Vulnerable Bomber," *Aviation Week and Space Technology*, (23 December 2002), p. 23.

[18] Ronald O'Rourke, *China Naval Modernization: Implications for U.S. Navy Capabilities — Background and Issues for Congress*, Washington, D.C., Congressional Research Service, October 2007.

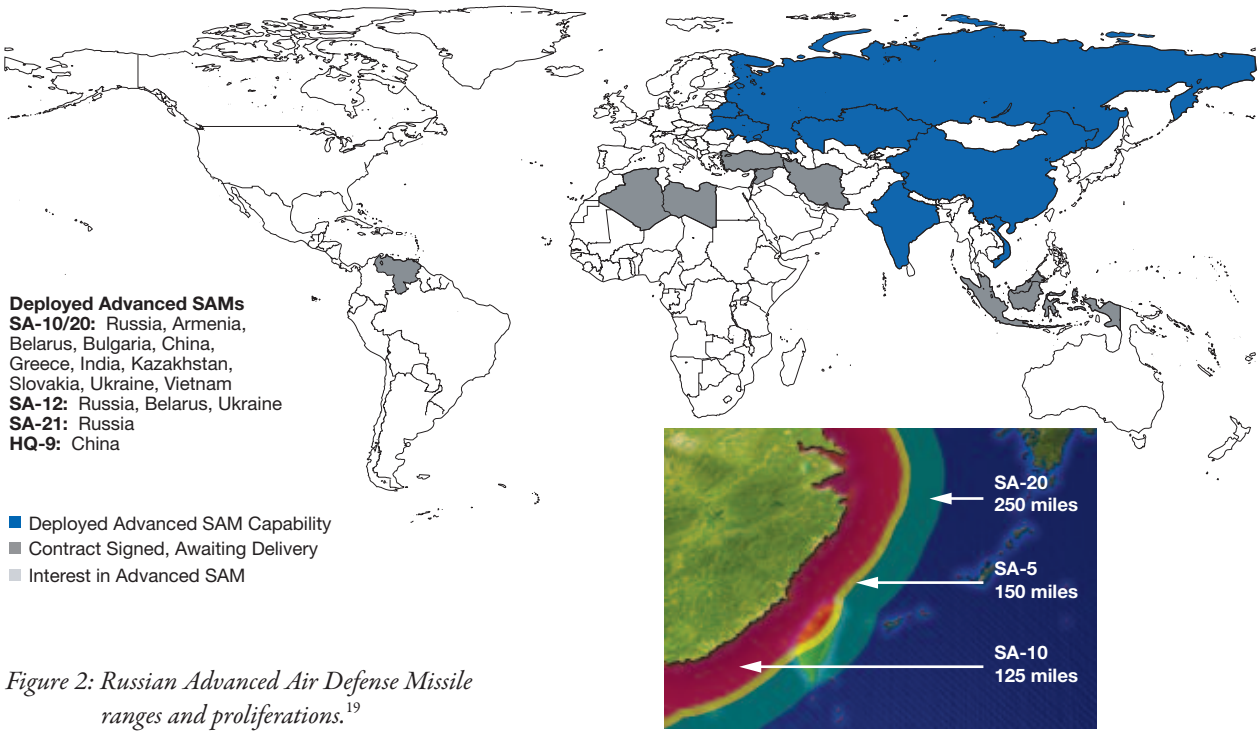

Figure 2: Russian Advanced Air Defense Missile ranges and proliferations.[19]

U.S. stand-off air launched cruise missiles and deny U.S. access to their air space.

In addition, more advanced air defense fighters are being fielded. Russian-made Su-27, Su-30 and Su-37 interceptors rival the capabilities of most of the U.S. fighter fleet. The Su-37, equipped with a phased array, multi-function radar and advanced countermeasures, will operate at a combat radius of nearly 1,000 miles and contest U.S. air supremacy. Russia and China are also developing the FA-PAK and J-XX aircraft series, designed to challenge the F-22's stealth, avionics and super-cruise capabilities and further deny the U.S. access in their airspace. If patterns of proliferation continue, these advanced aircraft will soon make their way into the inventories of other nations (Figure 3).

The proliferation of offensive ballistic missiles adds to the anti-access challenge. Equipped with satellite navigation systems, re-entry vehicle guidance systems, and advanced submunitions, ballistic missiles are more accurate and more lethal than previous versions. China, for example, has deployed almost 1,000 medium range ballistic missiles opposite Taiwan and is increasing the inventory by 100

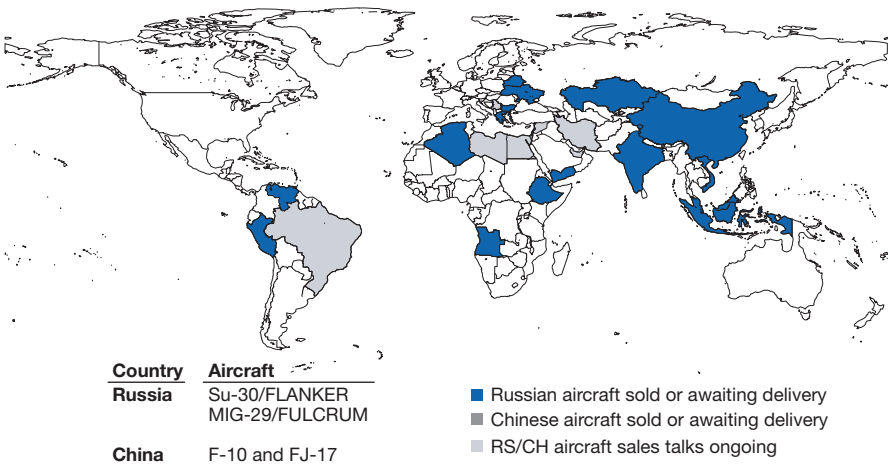

Figure 3: Advanced fighter aircraft proliferation.[20]

[19] Lieutenant General David Deptula, *Global Threat Awareness*, Washington, D.C.: Headquarters U.S. Air Force, January 2008.

[20] Ibid.

missiles per year. Future versions of these systems may feature maneuvering warheads capable of hitting aircraft shelters or moving ships at sea.[21]

Cruise missiles are also a threat with world-wide inventories containing about 75,000 anti-ship cruise missiles easily converted to a land-attack role. Nine countries manufacture land-attack cruise missiles with ranges of 60-500 nm.[22] During Operation IRAQI FREEDOM, Iraqi forces used a Chinese *Seersucker* anti-ship cruise missile to attack U.S. forces. Using a low-level ingress, it avoided the Patriot defenses enroute to its target.[23] Other nations have followed Iraq's example. India revealed that it had developed the mobile PJ-10 cruise missile (with a range of 175 nm) and is developing two other land-attack cruise missiles. One of these new systems, the *Lakshya*, can carry a 1,000-pound payload 300 miles.[24] Likewise, Iran is constructing a cruise missile production facility and working with North Korea on other cruise missile projects.[25] These relatively low cost weapons provide substantial range and payload, challenging U.S. military access to the Middle East and Asia.

These missile threats will drive U.S. forces to operate at increasingly greater ranges. Once the forces have transited the extended range that allows their bases to be more secure from offensive weapons and then penetrated the advanced air defense networks, U.S. forces will require updated targeting information. Following Operation DESERT STORM, the Air Force moved toward a net-centric concept of operation that allows command and control (C^2) networks to provide the strike forces with current target data. For example, during Operation IRAQI FREEDOM, 84 percent of the targets hit were given to aircrews while they were airborne.[26] The effect of the dynamic target concept of operations coupled with the increased ranges over which U.S. forces will operate means that future forces must have stealthy, survivable and long-range aircraft that are integrated into C^2 networks to ensure their relevancy and accuracy of attack.

While ballistic and cruise missile proliferation creates a significant barrier to entry, if armed with nuclear weapons they will raise that threshold by an order of magnitude. In the 1990s, India and Pakistan joined the "nuclear club" and more nations—notably North Korea and Iran—may be developing a similar capability. The anti-access and area denial complications of confronting a nuclear power are multi-faceted. Could an adversary threaten to use nuclear weapons to prevent allied nations from granting base access to U.S. forces? Would a U.S. President be willing to deploy short-legged forces within range of such a threat? Any conceivable nuclear weapons scenario drives up the premium placed on long-range strike, as well as on the ability of these assets to operate in a nuclear environment.

Targeting Shortfalls

Throughout most of the Cold War, the U.S. Air Force procured an average of 218 fighter aircraft per year. From 1997 on, it fielded just 21 fighters per year—over 90 percent less. As a result, from 2006 to 2018, roughly 200 fighters will disappear from Air Force ramps (Figure 4) as the Air Force downsizes its fighter inventory. In the past, Air Force leaders exploited the high reliability rate of the fighter fleet to generate 2-3 sorties per aircraft each day. Employed over a relatively short-range, this force generated a capability to attack up to 1,000 targets per day. Future commanders operating in an anti-access environment will be unable to generate such a high sortie rate due to the increased distances. Fewer sorties translate to fewer bombs on target, posing a severe challenge for the Joint Force Air Component Commander (JFACC).

If the JFACC needs the 2018 force to employ 500 to 1,000 pound bombs, the fighter inventory will deliver 11 percent fewer weapons (Figure 5). If the campaign calls for larger 2,000 pound joint direct attack munitions (JDAMs), the shortfall is staggering—64 percent fewer weapons would be available

[21] O'Rourke, op.cit.

[22] "Analyst Warns of Increasing Foreign Interest in Cruise Missiles," *Inside Missile Defense*, April 18, 2001.

[23] Michael R. Gordon and Bernard E. Trainor, *Cobra II*, (New York: Pantheon Books, 2006), page 178.

[24] "India Plans Broad Arms Deals With Russia, Worth $3 Billion," *Defense News*, October 22-28, 2001.

[25] "Analyst Warns of Increasing Foreign Interest in Cruise Missiles," *Inside Missile Defense*, April 18, 2001.

[26] Lt. General T. Michael Moseley, *Operation IRAQI FREEDOM By The Numbers*, HQ U.S. Central Command Air Forces, 30 April 2003.

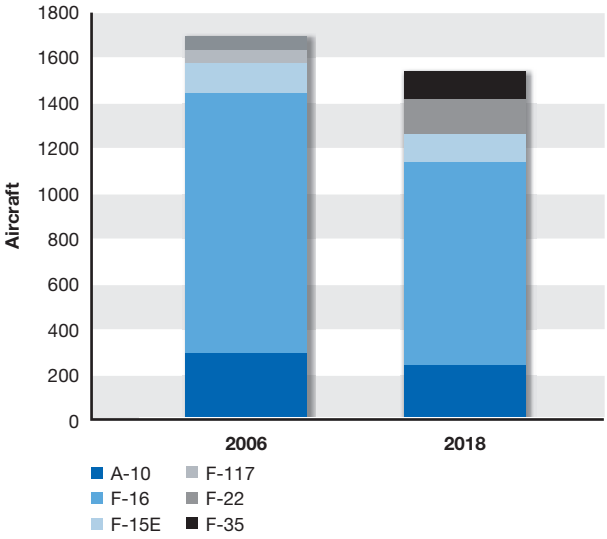

Figure 4: Projected U.S. fighter inventory.

(Figure 6). This shortfall could be even greater if budgetary pressures, reduced procurement rates and accelerated aircraft retirements cause Air Force fighter reductions to be greater than planned.

A planned reduction in the bomber fleet will also aggravate the targeting shortfall. The USAF has proposed retiring 38 B-52s by the end of fiscal year 2008 in order to save $680 million in operations and maintenance costs through 2011.[27] Given the fiscal pressures on the service and the cost of an aging fleet, additional force structure cuts are not out of the question. In terms of aimpoints, the proposed B-52 drawdown represents a loss of 638 targets that could be struck with JDAMs or 760 targets hit with air-launched cruise missiles.

Will this shortfall matter? During the six weeks of Operation DESERT STORM, U.S. forces attacked 40,000 targets.[28] During Operation IRAQI FREEDOM's three weeks of major combat operations, the air component engaged 19,000 targets.[29] These two campaigns reflect an average of 950 targets per day. Thus, the capacity appears to be sufficient for future potential requirements. Three factors, however, highlight the significance of the reduced ability to hit targets and why the total capacity may be insufficient. First, the U.S. deploys only half its combat air forces for a single campaign, with the rest of the force committed to other missions. Second, a number of the deployed F-22 and F-35s will be diverted from air-to-ground missions to gain air superiority. Finally, air campaign planners want to strike the most number of targets as quickly as possible to maximize the effects.

The targeting shortfall is exacerbated if stealth aircraft are the only platforms that can penetrate the hostile environment with a good chance of survival. Estimates for the U.S. Air Force 2018 combat inventory indicate 21 percent of the future force will

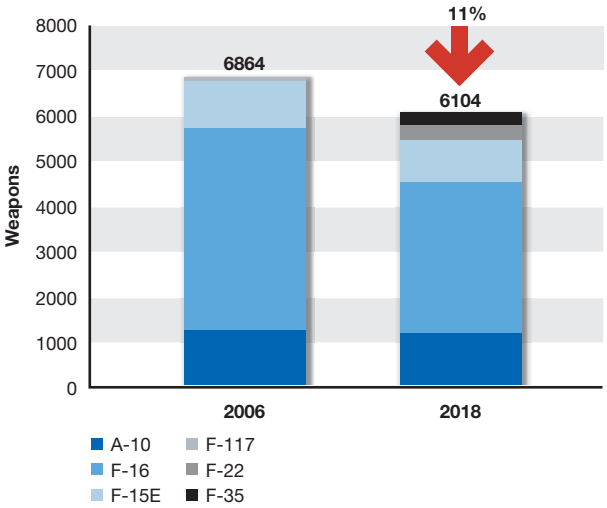

Figure 5: Targets with 500–1,000 lb weapons.

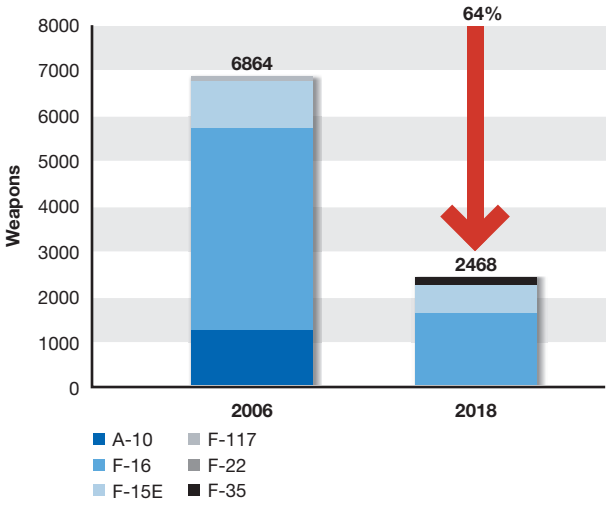

Figure 6: Targets with 2,000 lb weapons.

[27] Adam J. Herbert, "The 2018 Bomber and its Friends," *Air Force Magazine*, October 2006, page 26.

[28] Carl Conetta, *The Wages of War*, Project on Defense Alternative Monograph, 20 October 2003, at http://www.globalpolicy.org/security/issues//iraq/attack/consequences/2003.

[29] Moseley, op.cit.

have stealth technology—16 B-2s, 180 F-22s and 150 F-35s. If F-22s focus on neutralizing the air defense threat, future JFACCs will have just 10 percent of the air-to-ground force as stealthy penetrators. And if half the F-35 fleet is dedicated to defense suppression, only five percent of the total U.S. air inventory is available to attack priority targets.

A survivable, long-range strike platform will mitigate the targeting deficit. Historically, bombers have provided a significant striking power for theater commanders, which has increased over time (Figure 7).

While bombers have consistently flown a small percentage of total combat sorties, the integration of low cost, direct attack weapons such as JDAM enabled a large number of targets to be attacked on a single sortie. Against Serbia during Operation ALLIED FORCE in 1999, a handful of bombers delivered over 50 percent of the total number of weapons. The B-2, equipped with an early version of the JDAM, flew just three percent of the sorties while hitting 33 percent of the targets in the first eight weeks of operations.[30] In a similar manner, during the first six months of Operation ENDURING FREEDOM, bombers flew 10 percent of the missions against the Taliban and Al-Qaeda in Afghanistan, but employed 70 percent of all weapons—including 46 percent of all precision munitions. Likewise, during Operation IRAQI FREEDOM, bombers were a small percent of the sorties—just 3 percent—but employed nearly 55 percent of all Air Force weapons.[31]

Coupled with its payload, the bomber's long-range translates to providing the ability to wait for a target to emerge. A single bomber provides the presence and strike capability of a number of fighters. During recent operations over Iraq, commanders viewed bombers as a "roving linebacker"—able to flex to a variety of missions.[32] Thus, the nature of contemporary conflict demonstrated the value of long-range, long endurance, precise, flexible and survivable aircraft. A reduced inventory of strike assets, however, will jeopardize Time Sensitive Targeting (TST) concepts of operation that have become common to how U.S. air forces fight.[33] The most renowned TST incident was when coalition forces located Saddam Hussein in the Mansour district of Baghdad. The time from the first tip-off to bombs on target was 47 minutes—including 35 minutes for the coalition to decide to attack and then pinpoint the target's location. In this case, a B-1 on airborne alert employed its dash speed to execute the strike.[34] But with fewer aircraft and fewer munitions available, future commanders will have less capacity to execute TST successfully.

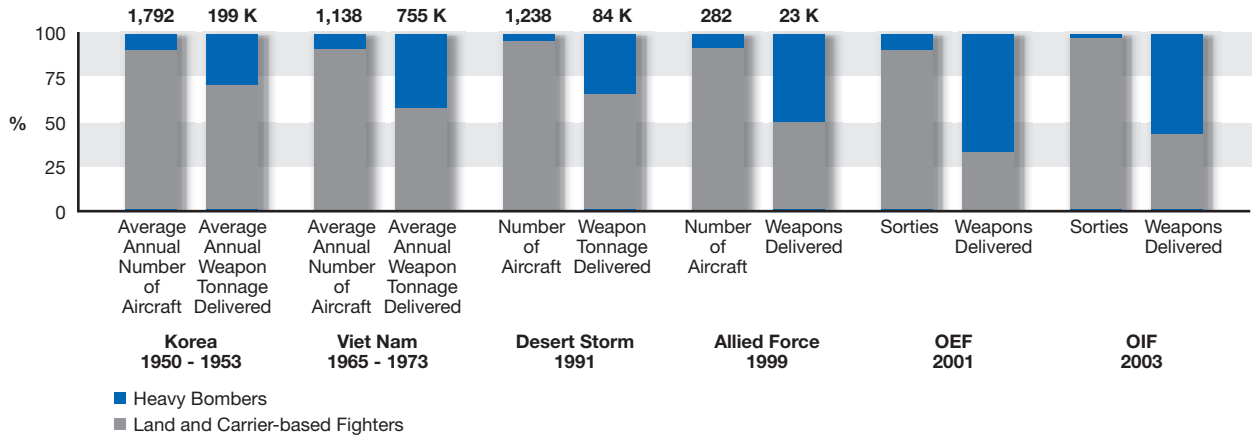

Figure 7: Bombers' contribution to conventional conflicts.

[30] Grant, op.cit., page 13.

[31] Ibid., pp 14-15.

[32] Adam Herbert, "The Long Reach of Heavy Bombers," *Air Force Magazine*, November 2003, pp 26-27.

[33] See Robert Haffa and Jasper Welch, *Command and Control Arrangements for the Attack of Time-Sensitive Targets*, Washington, D.C.: Northrop Grumman Analysis Center, November 2005.

[34] Barry M. Watts, *Long-Range Strike: Imperative, Urgency and Options*, Washington, D.C.: Center for Strategic and Budgetary Assessments, April 2005, pp 26-27.

The development of advanced air defense networks will also stress the future JFACC's ability to conduct TST missions without additional long-range, survivable strike assets. When target areas are located deep inside an advanced air defense network, stealth fighters will offer reduced persistence because they must refuel outside the threat ring with conventional tanker aircraft before transiting to their high threat orbit areas.[35] Nominally, a stealth fighter aircraft could penetrate 200 to 300 miles for a 30 minute orbit time before needing to egress for more fuel. Stealth bombers have much greater persistence and flexibility in this future environment.

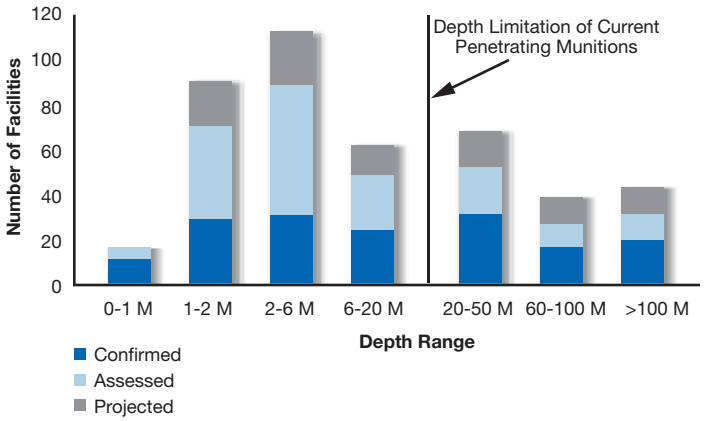

Figure 8: Hardened and deeply buried targets, circa 2002.

When operating deep or in close proximity to U.S. forces, bombers will not operate alone. Operations in 2003 over Iraq demonstrated the promise of linking command and control centers, ISR assets, bombers and ground units in a netted environment. The concentrated attack on Iraqi armor forces during a major sandstorm showed how bombers could exploit an E-8 Joint STARS moving target indicator radar to decimate a hostile ground force. Numerous other stories emerged from OIF to document this episode was not a singular event, but a common practice.[36]

Finally, the targeting dilemma is accentuated by adversaries investing in hardened and deeply buried facilities to protect key military infrastructure (such as command posts or weapons storage bunkers (see Figure 8).[37] Few aircraft can carry the weapons required to penetrate and destroy these targets. An F-15E can only carry a single large penetrator—the 5,000 lb GBU-28 capable of penetrating 100 feet of dirt or 20 feet of concrete.[38] The B-2 can carry eight GBU-28s. In addition, only the B-2 can carry the Massive Ordnance Penetrator (MOP) featuring eight times the explosive payload and three times the penetrating capability of the GBU-28.

Thus, in the near future, a JFACC will likely face a situation where the air component will have fewer assets that can survive deep in hostile airspace and limited options for engaging well-protected facilities. While the NGLRS may or may not carry weapons the size of MOP, its capabilities as a survivable, penetrating and long-range strike system will mitigate this shortfall.

In summary, these factors of declining base availability, anti-access challenges and targeting shortfalls provide strong arguments for accelerating a new long-range strike system. Declining base availability for U.S. forces will drive future forces to operate over increased distances. Force deployments may be pushed further from the objective area by the proliferation of ballistic and cruise missiles, which increasingly threaten regional U.S. and allied bases. In addition, U.S. aviation forces will face more sophisticated offensive and defensive air defense systems that will deny them access into an adversary's airspace. Given the extended ranges and more lethal defenses, the U.S. ability to strike targets and execute TST missions will require a new NGLRS. What might that 2018 bomber look like?

[35] Ibid., page 58.

[36] Ibid. pp 14-15.

[37] Rowan Scarborough, *Rumsfeld's War: The Untold Story of America's Anti-Terrorist Commander*, 2004.

[38] Grant, op. cit. page 22.

III. The 2018 Bomber

The 2006 QDR pulled the NGLRS forward nearly two decades. Considering that only a few years earlier the Air Force rejected a B-2 "C" option because it did not offer enough advanced technologies, what could a 2018 NGLRS offer?

The 2037 bomber sought by the Air Force was to provide long-range, supersonic cruise, a large payload and very low observability to survive in all environments—day and night. An examination of the "art of the possible" applied to an aircraft fielded twenty years sooner led to a shift in these requirements. The Air Force conducted an NGLRS Analysis of Alternatives (AoA) following the 2006 QDR directive, and in May 2007 declared the following properties for the 2018 bomber:

- Be a manned aircraft
- Carry 14,000 to 28,000 pounds of weapons
- Be subsonic
- Have a combat radius of 2,000 miles or greater
- Be highly survivable

Could these capabilities be achieved and fielded within the narrower time span? Some suggested that fielding a new bomber even with these relatively modest capabilities by 2018 is questionable. For example, a Center for Strategic and International Studies assessment concluded that the 2018 timeline was not feasible or supportable, basing their conclusions on the likelihood that the integration of the technology would prove too expensive and render the program "unaffordable."[39]

While any acquisition program can falter, a 2018 IOC for the NGLRS is feasible. Several factors suggest this is so. First, making the aircraft manned reduces the degree of difficulty for system integration. Although the Air Force is pursuing a manned aircraft both to make its employment more flexible in the dynamic battlefield environment[40] and to allow the NGLRS to fulfill a nuclear role,[41] its design and development will be far less challenging than an unmanned variant. Secondly, Air Force officials anticipate industry will use existing sensors, weapons, communication-navigation avionics and similar "off the shelf" technologies to exploit state-of-the-art capabilities, negating costly waits for the maturation of technologies. As a result, the new bomber will exploit mature technologies to keep the unit costs as low as possible and avoid schedule delays. Thus, if granted programmatic and budgetary priority, the NGLRS IOC of 2018 should be feasible as industry's challenge will be one of integration—not design and development of new capabilities. Third, the prime competitors for the NGLRS (at this writing, a Boeing/Lockheed team and Northrop Grumman) can build on their F-22 and F-35 systems integration experience, applying those approaches within a larger airframe, while obviating up-front non-recurring engineering costs. If the Air Force sets and holds to realistic requirements and develops a stable acquisition program of economic order quantities, the NGLRS should be affordable. Finally, the Air Force should also be able to leverage existing propulsion technology. As envisioned now, the aircraft would be subsonic because current engine technology does not support a long-range, supersonic capability with long loiter times in the battle area.

[39] Clark A. Murdock, *U.S. Air Force Bomber Modernization Plans: An Independent Assessment*, January 25, 2008, pp 7 and 12, at http://www.csis.org/index.php?option=com_csis_pubs&task=view&id=4301. See also "Young keeping a close eye on Air Force Next Generation Bomber plans," *Defense Daily*, June 5, 2008.

[40] General Mark Matthews, "Return of the Bomber", Eaker Institute Presentation, National Press Club, Washington D.C., May 1, 2007.

[41] Graham Warwick, "Speed bump," *Flight International*, June 12, 2007.

But building a state-of-the-art airplane does not imply that the aircraft will be obsolescent when fielded. At the September 2007 Air Force Association meeting, senior Air Force leaders outlined their expectations of the 2018 NGLRS as a basic aircraft that could be improved in subsequent block upgrades. The Commander of Air Combat Command stated: "This is going to be technology that we know or we know that we can get to. And then we will do block upgrades...so all of the fancy stuff will be in the [later] model."[42] The Air Force Chief of Staff also added that those upgrades might lead to supersonic and unmanned variants.[43]

Given this approach, will the 2018 NGLRS be able to meet the requirements that prompted the QDR decision to accelerate it? The answer to this question can be seen by examining how the NGLRS addresses the three factors influencing a need for a 2018 fielding date: air base availability, anti-access/area denial capability, and targeting shortfalls. And, there are additional capabilities that a 2018 bomber can provide that further strengthen the case for accelerating the NGLRS.

Increasing Range

Fewer overseas bases in the Middle East and Asia challenge U.S. forces to operate over greater distances. The current USAF fighter inventory includes the F-15E, which provides an unrefueled combat radius of 700 miles, and the F-22, which operates to a combat range of 410 miles with a 100 mile supercruise dash.[44] With a minimum combat radius of 2,000 miles, the NGLRS will provide an air attack asset with much greater range.

If fielded in sufficient numbers, the NGLRS will do much to make up for what is principally today a forward-deployed, short-range Air Force. The QDR specified that the USAF should increase its long-range strike capabilities by 50 percent, and current plans are to field 100 new NGLRS aircraft distributed over 5 squadrons, providing combatant commanders with between 80 to 90 operational aircraft.[45] If the Air Force retains about as many B-1Bs and B-52s,[46] a total bomber inventory of roughly 180 *operational* long-range strike aircraft would meet the QDR goal as indicated in Figure 9, providing future air commanders with a significantly greater capacity to operate over extended distances.

Overcoming Anti-Access/Area denial

The second obstacle that the NGLRS system must overcome is the growing anti-access capabilities of possible adversaries. Advanced air defense missile batteries and fifth generation interceptor aircraft present a real and lethal barrier to U.S. aerospace forces. This anti-access challenge is magnified by the need to operate over greater ranges—when U.S. forces are driven to distant bases to minimize the risk of ballistic and cruise missiles. Without additional long-range, survivable aircraft, only 16 B-2 aircraft would be available.

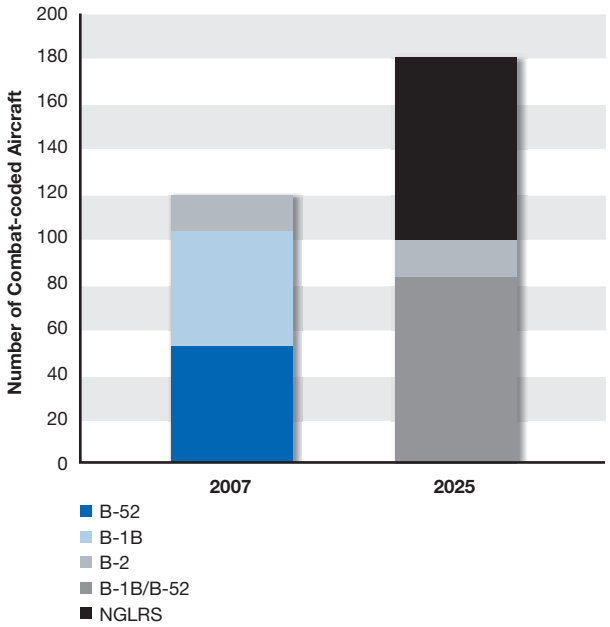

Figure 9: Current and future bomber force structures.

[42] "Senior Air Force Generals To Skeptics: We Can Field A New Bomber In 2018," *Defense Daily*, September 26, 2007.

[43] Caitlin Harrington, "USAF May Seek Supersonic and Unmanned Capabilities for Bomber," *Jane's Defense Weekly*, October 24, 2007.

[44] Lockheed Martin's F-22 Raptor, at http://www.f22-raptor.com/technology/data.html

[45] Harrington, op.cit.

[46] In terms of combat-coded aircraft, the Air Force currently fields 51 B-1Bs, 16 B-2s, and 54 B-52s for a total force of 121 aircraft. "Bomber inventory," *Air Force Magazine 2007*, pp.

The NGLRS fleet will provide a significant improvement in this capacity. Figure 10 depicts the increase in long-range, stealthy and survivable assets, a more than six-fold increase in capacity. Overcoming anti-access obstacles requires an improved combination of both range and survivability.

To enable persistence over hostile territory, the NGLRS system must be able to loiter and survive deep in enemy airspace. If the NGLRS has the minimum range outlined in the AoA and using standard pre- and post-orbit air refueling, an NGLRS platform operating at 2,000 nm will have an on-station time of 5 hours when penetrating 500 nm into hostile airspace. A platform with an additional 500 mile combat radius could loiter 7 hours.

When this capability is extrapolated to the stealth bomber fleet, the value of the NGLRS is evident. Given its current mission capable rates, the 16 operational B-2s could launch 4-5 aircraft per 24 hours and sustain 2 orbits.[47] The NGLRS with 80 operational aircraft could sustain at least 48 missions per day and at least 10 orbits for a platform with 2,000 nm combat radius or 14 orbits with a 2,500 nm combat radius. Table 2 compares the current B-2 capacity to the anticipated NGLRS capacity—showing a significant improvement to sustain a presence in an anti-access/area denial environment.

Fielding an NGLRS in 2018 will provide improved capacity to overcome an adversary's advanced air defenses and offensive ballistic or cruise missiles that push the beddown bases farther from their targets, while providing the survivability and persistence needed to assure U.S. military access. It also improves the nation's ability to leverage its war-fighting capabilities

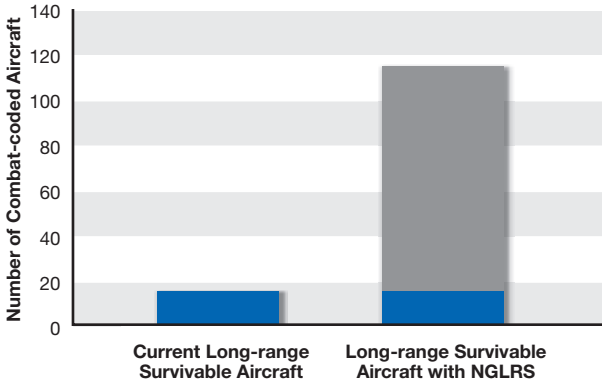

Figure 10: NGLRS increase in survivable long-range aircraft.

to link C2, ISR, airborne and ground forces in contested airspace—in the manner successfully demonstrated in uncontested airspace during OIF.

Offsetting Targeting Shortfalls

The NGLRS will provide enhanced capacity to mitigate the targeting deficit. Figure 11 compares the NGLRS increased contribution measured in terms of 2,000 pound JDAMs.[49] It will provide a 27 percent increase in long-range strike capacity—from an illustrative 2,452 JDAMs today to 3,126 in the future. Just as important, in an anti-access environment, the NGLRS will improve long-range, survivable strike capacity. Today, assuming one sortie per day, 16 stealth bombers could deliver 256 JDAMs—or just over 10 percent of the total

Table 2: On-Station time and orbit calculations for NGLRS with a 2,000 and 2,500 mile combat radius (4,000 or 5,000 mile total range.)[48]

	B-2	4,000 nm NGLRS	5,000 nm NGLRS
Maximum unrefueled flight time (hrs)	12	8	10
Inbound: Time from refueling track to armed orbit location (hrs)	1	1	1
Outbound: Time from armed orbit location to refueling track (hrs)	1	1	1
Reserve fuel time (hrs)	1	1	1
Total Time on Armed Orbit (hrs)	**9**	**5**	**7**
Total Orbits per day with inventory	**2**	**10**	**14**

[47] Rene Boston, *AFRL Engineer Receives Air Force Science and Engineering Award*, Wright Patterson AFB, OH press release, June 2006.

[48] Orbit calculations use the formula: (# of combat-coded aircraft × Sortie Rate × Loiter Time) ÷ 24 hours per day = average number of aircraft on orbit per hour.

[49] Data discussed here on weapons use the 2,000 lb JDAM as the baseline. Parallel discussions are possible using 500 lb JDAMs or SDB, but the increased ratios will be along similar lines.

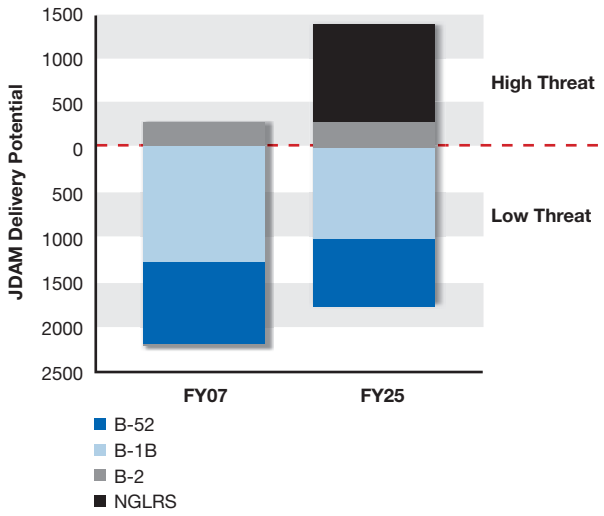

Figure 11: Comparing JDAM delivery assets for high and low threat environments.[50]

weapons that could be delivered in a high threat environment. In the future, the NGLRS platform will add 1,120 weapons to that mix—increasing the stealth-delivered JDAMs to 42 percent of the total capacity—a 330 percent increase in an advanced air defense network environment.

The NGLRS contribution to alleviating the targeting shortfall is doubly impressive when U.S. forces must operate over extended range. Table 3 displays again a notional deployed joint air component in 2025 and the associated tanker support needed in this Taiwan scenario. While fuel capacity of the NGLRS is unknown, the tables reflect a conservative estimate of one KC-135R needed per NGLRS operating from Australia.

Without NGLRS, F-35s operating from Guam could deliver only 4 JDAMs-per-tanker ratio while Australian-based F-35s would have a 2-to-1 ratio. With the NGLRS fleet factored in, the size of the air component's air-to-ground force is cut in half and its tanker requirement is reduced 60 percent while engaging the same number of targets. Also, the JDAM-per-tanker ratio for Australian based NGLRS would rise to 14-to-1.

Additional NGLRS Capabilities

Every new Air Force bomber provided a salient new capability that separated it from preceding aircraft. The B-52 was the first intercontinental bomber. The B-1 offered supersonic capability. The B-2 was the first stealth bomber and the first to employ direct attack munitions. What might the 2018 NGLRS bring?

Although it will be capable of nuclear operations, the NGLRS will be the first bomber since World War II designed primarily for conventional operations. As such, it will be expected to *generate more sorties per day and have a maintenance concept to support a high operational tempo*. The NGLRS will build on the B-2, F-22 and F-35 experience and offer

Table 3: Illustrative PACOM Major Combat Operation comparisons without and with NGLRS.

Aircraft	Employed	JDAM/AC	Total JDAM	Combat Radius	Tankers Required	Comment
F-35	200	2	400	1,000	54	CVBG
F-35	150	2	300	1,700	70	Guam
F-35	150	2	300	3,500	157	Australia
B-2	**16**	**16**	**256**	**3,500**	**8**	**Australia**
Total	**516**		**1256**	**-**	**289**	

Aircraft	Deployed	JDAM/AC	Total JDAM	Combat Radius	Tankers Required	Comment
F-35	100	2	200	1,000	27	CVBG
F-35	64	2	128	1,700	30	Guam
B-2	**16**	**16**	**256**	**3,500**	**8**	**Australia**
NGLRS	**48**	**14**	**672**	**3,500**	**48**	**Australia**
Total	**260**		**1256**		**113**	

[50] Assumes entire deployable force is available for operations and flies one sortie. NGLRS assumed to carry 14 JDAMs.

improvements in maintainability enabling a higher mission capable status. The NGLRS will also be built with an open system information technology architecture—enabling faster upgrade to avionics and communications systems.

Second, the NGLRS will be built with *flexibility to handle dynamic conventional requirements*—such as re-tasking in-flight needed to support TST operations. The NGLRS will be designed as part of a netted Command and Control, Intelligence, Surveillance, and Reconnaissance (C^2ISR) enterprise. Dynamic re-tasking has become the cornerstone of Air Force operations since the 1991 Gulf War, when adversaries began moving assets to reduce their vulnerability to U.S. aerial attack. To overcome this tactic, the U.S. has linked ISR assets in a network connecting command and control nodes with loitering attack aircraft capable of responding rapidly to time-sensitive targeting information.[51] The high percentage of OEF and OIF missions receiving targeting data in-flight confirms that TST is a fixture in U.S. warfighting doctrine.

Current bomber aircraft have added near-real-time targeting connectivity in an *ad hoc* manner with systems such as Combat Track II—a laptop with secure internet link for target and threat updates. The NGLRS will be designed to accommodate and integrate information from a networked information enterprise that includes downlinks from space systems when deep over hostile territory and beyond line-of-sight with surface-based C2 nodes. This netted architecture will also allow the NGLRS to send non-traditional ISR data to fighter aircraft and surface and sub-surface vessels as well as receive traditional targeting data from ISR platforms or other sources.[52] If equipped with an electro-optical and infrared (EO/IR) targeting system, it will have the ability to confirm many target locations prior to its or other platforms' engagement. As a netted weapon system, the NGLRS will improve the Air Force's ability to engage mobile and emerging targets as well as avoid and survive against advanced air defense threats. This capability will be critical to overcome the anti-access barriers created by advanced air defense networks.

Using aircraft to form an airborne netted architecture in this manner is not necessarily a new idea. The E-3 Airborne Warning and Control System (AWACS) serves as the distribution hub for the air picture. Likewise, the E-8 Joint Surveillance and Target Attack Radar System (Joint STARS) provides a similar service for the air-to-ground picture. Using a fighter or bomber aircraft in this capacity, however, is new. For example, in 2007, F-22s provided an equivalent of an airborne "local area network" during the NORTHERN EDGE exercise in Alaska.[53] The NGLRS, with its greater power capacity, can be employed over a larger area and create an airborne "wide area network" to expand the information flow to the joint warfighter.

Third, the 2018 bomber will have the size and electrical capacity to *provide options for non-kinetic, cyber operations*. While the Air Force is exploring the F-22 and F-35 potential to contribute non-lethal effects, NGLRS passive electromagnetic surveillance sensors will allow it to identify and locate signals. The F-22 or F-35's common integrated processor and phased-array radar can be adapted on the NGLRS, but the bomber's larger antenna and greater electrical power promise improved range and capability. Emerging Information Operations capabilities will also be integrated into the NGLRS non-lethal inventory of effects. Thus, the NGLRS not only provides lethal explosive power, but also offers a persistent means to sever improvised explosive device communication links, monitor an enemy's communications, or conduct similar electronic warfare operations.[54]

Fourth, the NGLRS will contribute significantly to joint operations. As a weapon system netted into a C^2ISR architecture, NGLRS will enable cooperative targeting with other elements of the Joint Force—air, land and maritime, such as the Navy's Unmanned

[51] Christopher J. Bowie, et al. *Future War: What Trends in America's Post-Cold War Conflicts Tell Us About Early 21st Century Warfare*, Northrop Grumman Analysis Center, 2003, p. 25.

[52] See Douglas Barrie and Amy Butler, "Double Duty, USAF Considers unmanned ISR Penetrator based on future bomber design," *Aviation Week*, April 28, 2008, pp. 24-25.

[53] Marine Lance Cpl. Ethan Hoaldridge, *Northern Edge Aims for Air, Sea Dominance*, Air Force News Service, Jun 9, 2006 as available at http://www.af.mil/news/story.asp?id=123021435.

[54] "Supersonic SIGINT: Will F-35, F-22 Also Play EW Role?" *Defense Industry Daily*, Oct 24, 2005.

Combat Air System (N-UCAS). While N-UCAS capabilities remain in development, the unmanned aircraft (supported by aerial refueling) is anticipated to provide long dwell reconnaissance and strike capabilities. It may eventually carry 12 SDBs while maintaining 4-5 hour on-station time when operating in an anti-access, advanced air defense environment.[55] There is a real opportunity for NGLRS and N-UCAS (or similar USAF UAVs) to operate in unison, collaboratively finding and fixing targets then sharing them to match the optimum ordnance. Once a weapons inventory is exhausted, the aircraft can continue to operate as a "hunter" to maintain a presence and exploit their netted connectivity. As such, the paired NGLRS—N-UCAS team could provide a lethal "hunter-killer" or "wolfpack" capability.

In a similar manner, the netted "wolfpack" could extend to non-airborne weapon systems, such as Army's Tactical Missile System (ATACMS) or maritime Tomahawk cruise missiles. For instance, the NGLRS could provide in-flight updates to a submarine-launched Tomahawk until just prior to weapon's impact. This "netting" of systems allows rapid transmission of intelligence and targeting data, reducing the kill chain.

Finally, the NGLRS will have a *unique and compelling role at the strategic level*. Long-range platforms, like the B-52 during the Cold War and B-2 today, provide a means to place at risk any target worldwide—weapons of mass destruction facilities, infrastructure and systems or global terror leaders and their cadre of planners. A long-range force capable of striking anywhere around the globe provides the United States with strategic agility and imposes costs on adversaries by forcing them to emphasize defensive capabilities as they seek to protect their assets. The stealthy, long-loiter capability of the NGLRS could add additional alternatives and options to the national search for a conventional prompt global strike system, while its nuclear capability could allow a forward deployed deterrent replacing retired theater nuclear weapons systems.

The NGLRS will enable sovereign and strategic options. The current U.S. long-range strike inventory is meeting today's operational missions. However, beyond 2018 the current bomber fleet will require significant modernization to keep its survivability margin over the future threat. Without the NGLRS, strategic options for the President will be increasingly limited, as sixteen operational B-2s do not present a robust capability in the face of sustained global operations.[56]

For illustrative purposes, if the President directed a continuous orbit over North Korea to deter, preempt or respond to a ballistic missile launch, the NGLRS would allow such an operation from the U.S. At a flying distance in excess of 7,000 miles from the continental U.S., a minimum of seven aircraft would be required, as shown in Figure 12.

A fleet of 80-100 NGLRS systems will provide a capability to support such sustained operations over a period of months, if needed. If U.S. forces were simultaneously engaged in a conventional theater conflict, such as ALLIED FORCE or ENDURING FREEDOM, the larger long-range strike inventory provides a strategic reserve—providing the President options not available with the current inventory.

In addition to providing global reach, the NGLRS can be expected to deliver an array of weapons—from lethal weapons ranging from potentially the massive ordnance penetrator to 250 pound discrete SDB—to non-lethal/non-kinetic cyber warfare tools. A top priority of the Joint Chiefs of Staff is

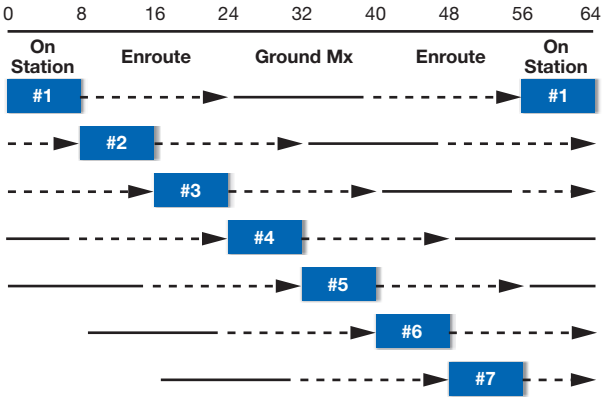

Figure 12: Aircraft required to sustain presence at 8,000 miles.

[55] Thomas Ehrhard and Robert Work, *The Combat Air System Carrier Demonstration Program: A New Dawn for Naval Aviation?* Washington, D.C.: Center For Strategic and Budgetary Analysis Backgrounder, May 10, 2007, page 32.

[56] Watts, op.cit., page 47.

to develop and field a conventional force providing strategic options below the nuclear threshold, recognizing the need to offer the President options to hold at risk adversaries, their leadership, key infrastructure and WMD without requiring the use of nuclear weapons.[57] A sizable NGLRS fleet will give the nation's leadership the quantity to consider various courses of action as well as a quality of weapons to provide a variety of options.

The options and capabilities provided with a larger long-range strike fleet ensure the U.S. leadership can turn to a tangible asset on short notice as a contribution to tailored dissuasion and deterrence.[58] Adversaries threatening the U.S. will be forced to either accept the risk of U.S. attack or invest in means to defend against the U.S. striking power. As such, a robust and capable long-range global strike capability imposes a cost on U.S. adversaries.[59]

Bombers are offensive weapon systems that give the U.S. leadership the initiative and the ability to choose the axes of attack. Their range and combat power forces adversaries to consider them as potential threats—regardless of where the adversary or the U.S. bomber fleet is located. The assets required to defend against a survivable bomber like the NGLRS—particularly when considering that multiple nations will each have to develop their own individual defenses—will cost many times more than the United States will spend to deploy it. Few—if any—other weapon systems offer this kind of strategic leverage for the long-term.

The Case for the 2018 Bomber

The decision to accelerate the next generation long-range strike system from 2037 to 2018 is prudent and plausible. The NGLRS will provide many of the desired capabilities of a long-range strike system as well as meet the stated goals of the 2006 QDR to improve U.S. long-range strike capability.

- The 2018 bomber will operate over the increased distances that U.S. forces will confront as they shift from favorable basing arrangements in Europe to the Middle East and Asia, mitigating the challenge of airbase availability
- In the face of adversaries adopting an anti-access strategy, the NGLRS will assure access into any airspace
- Operating over extended ranges and within these environments, the NGLRS will provide increased capacity to deliver ordnance and effects, alone or as part of a "wolfpack" of netted weapon systems that swarm over hostile targets at will

The 2018 bomber will bring other needed capabilities.

- It will operate at a higher operational tempo demanded in conventional theater operations
- It will be integrated into a netted C^{2}ISR enterprise that will allow it to receive and send targeting data from space assets, other airborne systems, surface and even sub-surface platforms. It will offer an open architecture for rapid upgrades and modifications. As such, it will be distinguished by its ability to conduct netted cyber operations that range from monitoring, intercepting and attacking enemy information nodes in addition to augmenting the theater commander's capacity to deliver highly survivable lethal effects
- It will also provide a critical enabling capability for the nation's leadership. The NGLRS will ensure the U.S. can hold at risk any hostile leadership, infrastructure, forces, resources—with a prompt, precise, man-in-the-loop global strike capability

The decision to accelerate the nation's next generation long-range strike system makes sense. The case for the 2018 bomber is strong. The time to implement that decision is now.

[57] Elaine M. Grossman, *Senior U.S. General Sees High Nuclear Threshold*, Globalsecuritynewswire.org, October 22, 2007.

[58] Watts, op.cit., page 38.

[59] The United States has pursued a cost-imposing strategy in the past. During World War II, Nazi Germany shifted manpower and resources to air defense in order to counter the allied bomber offensive. If Germany had been able to apply these resources to reinforce its coastal defenses in France or to build thousands of tanks that could have been used during the Battle of the Bulge, the cost in terms of Allied soldiers lives alone would have been tremendous. In a similar manner, the Soviet Union expended more than $400 billion over 40 years to maintain 2,000 interceptors, 8,000 surface-to-air missile launchers, early warning radars, communication networks, and 500,000 military personnel to defend against the U.S. bomber force. The stealthy B-2 made that system obsolescent.

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