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The B-2 Bomber: A Strategic Assessment

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ABSTRACT

TITLE: The B-2 Bomber: A Strategic Assessment

Author: David L. Eggers

Purpose: To discuss the various issues surrounding the need for the manned bomber - specifically, the B-2 bomber.

Intended Readership: Those who have an interest in the B-2 bomber and why we need it.

Brief Summary: This paper takes a look at all the varied aspects of the manned strategic bomber and how the B-2 can play a part. A brief history of the strategic bomber is given along with a description of the Triad concept. The threat we are presented with today is discussed. The nuclear and conventional mission of the B-2 is analyzed and how its stealth technology works. The costs of the B-2 program including research and development are presented. Finally, what happens if the B-2 program is stopped? The options are discussed.

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INTRODUCTION

> It is time that we move this debate from the question of simple cost to one of the strategic value. I fully support this program because the country needs it. The B-2 will be the cornerstone in our overall strategic deterrence well into the next century. 1

Aerial warfare and its value and contribution to modern military campaigns has been the subject of great discussion since the first aircraft was procured by a military activity. The World War I Italian military aviator Giulio Douhet wrote, "The airplane has complete freedom of action and direction; it can fly to and from any point of the compass in the shortest time - in a straight line - by any route deemed expedient." 2

Since those initial days, the sophistication of the airplane and its ordnance delivery capability has increased in an exponential fashion. Today, aircraft can carry literally tons of explosive capacity and can deliver it with such a degree of accuracy that we can now truly call it "strategic" or "pinpoint" bombing. 3

Specifically, my paper is going to tell the story of the consumate strategic bomber - the B-2. I will tell the B-2's story from a strategic assessment viewpoint. Why do we still need bombers in light of the current world

situation? What can the B-2 do to help protect our deterrent posture that other aircraft can't do?

After a thorough discussion of those questions and many others, I will conclude with some comments on what the repercussions are, if the United States should limit B-2 production to 15 aircraft. How much should the U.S. invest in further research and development of these modern weapons, and do science and technology have a role to play in keeping the United States a superpower?

THE HISTORY OF THE STRATEGIC BOMBER

Bombers appeared in the First World War, but the relative immaturity of aviation technology and the small numbers of such aircraft did not permit exploitation of their capabilities until the Second World War. In that conflict, both Allied and Axis powers employed the bombers to conduct maritime patrol and attack missions; provide the key support for troops during land battles; furnish strategic reconnaissance, electronic countermeasures, and electronic intelligence; and launch cruise missiles and guided weapons at shipping and industrial targets. Allied bombers devastated German and Japanese cities, industries, transportation grids, and energy networks. Finally, American B-29's dropped two atomic bombs on Japanese cities,

shattering their will-to-resist that could have cost millions of American, Japanese, and allied casualties during an anticipated invasion of the Home Islands in 1946. 4

After 1945, the United States, the Soviet Union, Great Britain, and France embarked upon the development of atomic-armed bombers. For almost ten years, the bomber was the only intercontinental weapon. The intercontinental ballisitic missile (ICBM) and various cruise missiles (both ground and air-launched) complemented the bomber force in the 1950s, followed by the submarine-launched ballistic missle (SLBM) in the 1960s. 5

While the Advanced Strategic Penetrating Aircraft (ASPA) later called the Advanced Technology Bomber (ATB), finally named the B-2, was being developed under extreme secrecy. Soviet nuclear forces had the capability to destroy our nation. They continued to modernize and further deploy these weapons. The U.S.S.R. deployed four new ICBMs (the SS-18 Mod 5, silo and rail based variants of the SS-24, and the road mobile SS-25), strategic nuclear submarines and associated SLBMs, and three types of bombers (Blackjack, Backfire, and Bear H). In 1989, the Soviets deployed 140 new ICBMs; the United States produced 12. We had a reason to be worried because of this awesome threat and felt the need to develop new weapon systems like the B-2. 6

DEVELOPMENT OF THE TRIAD

Deterrence of a nuclear attack is the cornerstone of U.S. national security. To deter an attack, the United States developed highly respected forces known as the Triad of air, land, and sea-based nuclear forces. These forces can retaliate, even after absorbing a first strike, to devastate an attacking nation. The Triad has provided an effective deterrent for over 30 years and its success has led to a broad national consensus that we should maintain, at least for the time being, a balanced Triad composed of modernized, effective individual "legs." 7

Each leg of the Triad possesses certain unique and complementary characteristics which, synergistically working together with the other legs, provide a retaliatory capability that no adversary could hope to successfully overcome. The individual elements of the Triad work in combination to confound an adversary's offensive and defensive strategies. The diversity of basing modes and penetration profiles posed by the different legs dramatically complicate the problems facing the enemy. Fast flying ballistic missiles pose one set of problems while slow flying air-breathers another. The Triad also provides a high confidence barrier against system failures, communication problems, technological breakthroughs, and

unforeseen events that inevitably occur in the heat of combat.

The bomber leg, composed of both penetrating bombers and cruise missile carriers, provides unparalleled flexibility to the Triad. No other Triad system offers the flexibility and adaptibility of the bomber. ICBMs and SLBMs are dedicated solely to nuclear deterrence. The bomber force can provide nuclear deterrence and conduct conventional operations. Understanding the flexibility of long-range bombers in both nuclear and conventional operations is the key to understanding their utility in supporting U.S. national security objectives across the spectrum of potential conflict. The rapid changes in the global security environment have added unprecedented uncertainty to our security planning and have increased the importance of flexibility and adaptibility when developing weapons systems and force structure. 8

The fundamental goal of the United States, in shaping the nuclear balance among all nations, is to increase stability. Stability will reduce incentives for any country to launch an attack in either peace or crisis. The bomber is the most stabilizing element of the Triad. Its capability to send a variety of unmistakable messages to an adversary provides our decision-makers with additional options to help defuse and stabilize crises. The bomber's

high survivability ensures devastating retaliatory capability and its slow speed, compared to ballistic missiles, makes it unsuitable as a first strike system. Together, these attributes enhance the stability of the nuclear balance. 9

The bomber force can be rapidly generated, dispersed, and/or launched under positive control and subsequently be recalled or redirected. These capabilities give U.S. leaders a variety of additional options to help cool off a crisis. This versatility allows the United States to demonstrate resolve by a controlled means of escalation short of actual conflict, thereby decreasing the chances of a nuclear war.

> Despite the fact that no U.S. bombers are currently on alert, the force can be generated to alert status very rapidly significantly increasing the total number of warheads on alert. This rapid increase in retaliatory potential sends a clear signal of national resolve - a basic component of deterrence - that cannot be matched by the other legs of the Triad. 10

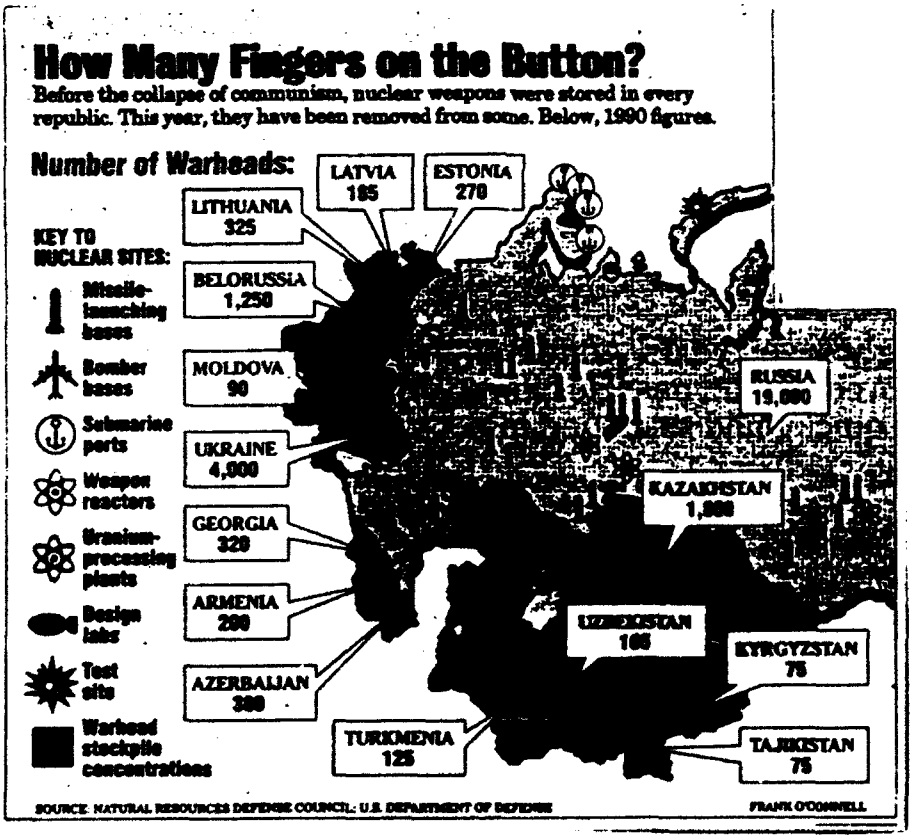
THE THREAT TODAY

There are, without a doubt, significant changes in the nature of the threat today compared to the threat that our defenses were built to defend against during the Cold War.

The world is by no means, however, a safer place today, as some would argue, than it was then.

The Soviet threat has changed significantly. Today, aggression by the Soviet Union is highly unlikely. Nevertheless, the USSR remains a major military power with the capacity to destroy U.S. society. Soviet policies could change overnight. Internal turmoil in the Soviet Union raises new uncertainties. These are facts the United States cannot ignore in its planning. 11

As the world watched the Soviet Union self-destruct, a major question was who would be in control of their 27,000 nuclear warheads? The problem is that about 12,000 long-range weapons are based in only four of the original republics: Russia, Belorussia, Kazakhstan and Ukraine. "Shorter-range tactical weapons are more likely to become loose nukes. The Soviet arsenal contains about 15,000 of them, including missiles, bombs, mines, and artillery shells." 12



With the shift from a predominantly bipolar to a more multipolar world, U.S. security policy has a new geographic focus on potential conflicts beyond Europe and a new strategic concern with the proliferation of advanced technologies - nuclear and non-nuclear. The Persian Gulf conflict has had a major short-term impact on U.S. defense planning and priorities, shifting resources from Europe to the Gulf and delaying planned force reductions. The war also dramatized the risks inherent in the proliferation of ballistic missiles in the Middle East and elsewhere.

> By the year 2000, it is estimated that at least 15 developing nations will have the ability to build ballistic missiles - eight of which either have or are near to acquiring nuclear capabilities. Thirty countries will have chemical weapons, and ten will be able to deploy biological weapons as well. 13

The erosion of NATO's role and influence is another major area of concern for the United States. This trend seems likely to proceed further. Absence of a perceived threat from the Soviet Union weakens the rationale for NATO. Military issues have declined sharply in Europe. At the same time, economic frictions have become more prominent and tend to divide the United States from Europe. Strong pressures in the United States are demanding reduced defense spending and major cuts in the U.S. force posture in Europe.

Another example of the changing threat, is the growing disparity between the North and the South, the developed and developing countries of the world. The South has watched the North fight three great internecine wars in this century: the two world wars and the Cold War. Fueled by latent industrial, transportation, and communication revolutions, the Southern nations are ready to become forces in their own right. American strategic vision must acknowledge these rising expectations. 14

Equally important are threats imposed by an increasingly interdependent world. There is growing recognition that separate events - ranging from destruction of rain forests to depletion of the ozone layer - may be the ultimate threats to national security.

Finally, maybe most troubling, is the declining public support in the United States for defense programs in general and for nuclear weapons in particular. People strongly believe that the end of the Cold War should produce a peace dividend. The current environment, marked by a flat economy and budget pressures, make the defense budget a target for cuts. The public desire to eliminate the nuclear threat generates pressure to cut strategic forces and to get nuclear weapons out of Europe and everywhere else around the world.

WEAPONS THREATS

Since 1965, the Soviets have invested over $400 billion to create a formidable integrated air defense system. It numbers 10,000 radars, more than 8,000 surface-to-air missile (SAMs) launchers, over 3,000 airborne interceptors and fighters, and growing numbers of tankers and airborne warning and control aircraft. Despite military cutbacks, by 1995 the Soviet homeland defense force will consist primarily of look-down shoot-down systems such as the MIG-31 Foxhound and the SU-27 Flanker aircaft. These aircraft are capable of detecting and engaging aircraft flying at low levels. New SAMs are set to replace older ones, giving the Soviets potential coverage from sea level to the fringes of the atmosphere against current U.S. systems. 15

Traditionally, the major nations - notably the Soviet Union, United States, France, Great Britain, and more recently, the People's Republic of China - have exported weaponry, at best only slightly less sophisticated than that fielded by their own military forces to Third World nations. During 1980-1988, for example, the U.S.S.R. delivered over 32,000 SAMs and associated equipment to nations in the Americas, Asia, Africa, Europe, and the Middle East. Such exports will continue to increase as Russia and the Commonwealth of Independent States seek additional hard

currency to bolster their faltering economy. Many of these developing nations have also produced quite sophisticated weapons of their own. 16

Modern fighter aircraft are also increasing in number and capability throughout the world. Even when excluding the United States, the Soviet Union, China, and the nations of Western and Eastern Europe, a count reveals over 9000 tactical fighters deployed around the world. The bulk of these fighters are from previous generations, but many have been upgraded with the new avionics, radars and weapons. Many nations, responding to regional tensions and threats, are modernizing with the latest generation equipment. MiG-29s, for example, are currently found in five Third World nations: Cuba, India, Iraq, North Korea, and Syria. Several others such as Nigeria, Iran, Libya, Algeria, Peru, and Zimbabwe have expressed strong interest in purchasing this aircraft. Other relatively potent radar-equipped fighters are also found in the developing world - MiG 25s, Toronados, Mirage F-1Cs, Mirage 2000s, F-4s, and front-line U.S. equipment. 17

The United States' future bomber force must be capable of operating in the face of these and other developing systems in both nuclear and conventional operations. The B-52 is already so constrained by advances in air defense technology that it is losing its viability as a penetrating

bomber for the deep strike missions. When flown over North Vietnam in 1972, B-52s operating at high altitude required concerted defense suppression to reduce their vulnerability to first-generation SAMs such as the SA-2. The B-1, whose design dates to the mid-1960s, will continue as a useful system for years to come. However, it too will be increasingly constrained by the evolving air defense threat environment, particularly in the post-2000 time period. Hence the reason for the development of the B-2 bomber. 18

B-2 CHARACTERISTICS

The B-2 is a lot bigger than it looks in photographs (see appendix page 1). It has a wing span of 172 feet, overall length of 69 feet, overall height of 17 feet, and a wheel track of 40 feet. It has an empty weight of 170,000 pounds with a weapons payload capacity of 40,000 pounds. If 160,000 pounds of fuel is added, the B-2 will have a takeoff weight of approximately 376,000 pounds.

The B-2's design is a tailless, all-flying wing with smooth surface contours, unbroken outer surface lines and extensive use of composites. The engines are recessed with top-of-the-wing inlets and exhaust. It is an aerodynamically clean design with a large wing area resulting in wing loading second only to the U-2/TR-1 and

greater range per pound of fuel than other bombers. The B-2 will require 40-50% fewer tankers than the B-1B or B-52 on similar missions.

Armament is stored in two side by side weapons bays. Boeing built the advanced applications rotary launcher in each bay for nuclear weapons. Conversion to conventional weapons bomb racks in each bay can be done. The nuclear payload could include a choice of 16 B-61 gravity bombs, or 16 B-83 gravity bombs, or 16 AGM-131 SRAM II nuclear missiles (See appendix page 1). In the conventional category the B-2 can load 80 Mk-82 500 pound General Purpose (GP) bombs, or 36 CBU-87 1000 pound CBU (cluster bomb units) dispensers, or 36 M-117 750 pound GP bombs. 19

THE NUCLEAR MISSION

The manned penetrating bomber is the most efficient, flexible, and effective system in the Triad against the large number of diverse targets which must be held at risk to ensure deterrence. The key to the penetrating bomber's warfighting versatility and efficient weapon delivery is the presence of a person in the cockpit capable of reacting to situations and making decisions. The penetrating bomber is the only nuclear system that can react if an adversary does something unexpected. The unexpected is the scenario of

choice in today's planning rooms. Penetrating bombers are particularly deterring because they make any potential adversary realize that no area of the world exists to hide his most valued elements of power. 20

The presence of a person in the loop makes the penetrating bomber the most efficient employer of nuclear weapons. The bomber crew can check key targets, such as naval bases, ground force dispersal locations, and airfields for occupancy using infra-red, visual, or radar sensors. Modern radar systems offer extremely high resolutions from great distances.

The penetrating bomber offers the best combination of accuracy and weapon yield compared to any current or projected Triad system. This provides important advantages when dealing with very hard targets (such as command and control facilities) and area targets (such as ground force dispersal sites). Planners would have to expend multiple SLBM, ICBM, or cruise missile warheads to achieve the same level of damage as that provided by a single bomb from a penetrating bomber. 21

Penetrating bombers, such as the B-2, still offer the best potential for defeating mobile relocatable targets. These types of targets are the fastest growing component of the still lethal Soviet target base.

THE CONVENTIONAL MISSION

As already stated, a prominent characteristic of the emerging global environment is uncertainty and instability. The likelihood that U.S. forces will be called upon again at some time and place to defend U.S. interests is high. The time and place, however, are difficult to predict. As numbers of our overseas bases and forward-based forces decline, global power projection capabilities will become increasingly important. The United States must place greater emphasis on systems that can operate from fewer locations, and at longer ranges. A flexible long-range bomber force, capable of rapidly and precisely delivering conventional ordnance against an enemy's most valued assets anywhere on the globe, can help prevent or delay potential escalation and achieve our national objectives over a wide range of conflict levels (See appendix page 2). 22

CHRONOLOGY OF THE B-2

1977 - DOD officially initiates R+D on a stealthy, penetrating strategic bomber after President Carter cancelled B-1A program. 23

1980 - SECDEF Harold Brown announces stealth bomber program.

1981 - Air Force selects Northrop Corp. as prime contractor.

1983 - Northrop opens ASD in Pico Rivera, CA.

1985 - 24,000 hours in wind tunnel tests, 44,000 hours on

avionics tests, 6,000 hours on flight control tests.

1986 - DOD releases ATB (Advanced Technology Bomber) related information.

1987 - ATB named B-2.

1988 - Nov - B-2 rolls out of hangar in Palmdale, CA.

1989 - One year delay to study aircraft status.

1990 - FY 91 budget calls for R+D and five B-2s
Cost: $4.7 Billion.

1990 - Secretary Cheney announces buydown from 132 to 75 aircraft.

1991 - JAN - Low observable study by Defense Science Board.
FEB - FY 92 budget calls for $4.8 Billion. 24
FEB - Congressional testimony by Chief of Staff and SECDEF reconfirm stealth success in Gulf.
SEP - B-2 fails one radar evasion test.
SEP - Failed Soviet coup - USSR implodes - Congress calls for reduction in B-2 funding.
NOV - House votes for building only one plane in 1992 rather than the requested four. Bill provided $1.8 billion to keep production line open. Included was 1 billion for next B-2 in 1992 if Senate and Congress vote in 1992 to release the money.

1992 - JAN 28 - President Bush in State of the Union address announces his proposal to stop B-2 production at 20 aircraft. 25

STEALTH TECHNOLOGY

The B-2, incorporates stealth technologies to reduce its signature in a wide array of spectra. But, does Stealth technology work?

> One of the lessons that I think has been amply demonstrated in our operations in the Gulf is the value of stealth technology. The F-117 fighter has been the backbone of

> our efforts in the Gulf. Out of all the missions flown by the F-117 to date, not one of them has been touched by enemy anti-aircraft fire. Every single one of them had returned to base safely, without a scratch on it, because of that technology. 26

In the case of the B-2 and other stealthy aircraft, we have a dramatic lead in this particular set of technologies and the potential to sustain that lead for many years.

"Stealth" is a popular name more precisely termed "low observables." They involve efforts to actively reduce the observable signatures of an aircraft in the electromagnetic, optical, thermal, and acoustic environments. The term stealth, however, had come to be associated primarily with radar cross-section (RCS) reduction. First applied to the Lockheed SR-71 strategic reconnaissance aircraft, "stealth" has grown steadily more sophisticated through the years. Its origins date to the early years of the Second World War, when British radar technicians first examined the potentiality of "radar camouflaging" aircraft to evade detection. German engineers applied primitive radar-absorbent coatings to submarine schnorkel breathing tubes so that Allied search radars could not detect them. Stealth as a concept is nearly 50 years old. The emergence of the Lockheed F-117 fighter demonstrated that aerospace technology finally succeeded in creating a military aircraft

that had a truly profound reduction in radar crosssection and aircraft signature. 27

Stealth not only protects an aircraft's defensive posture, but greatly enhances the aircraft's likelihood of a successful offensive strike. It enables the attacker to slip around the most critical defenses of an opponent, and get so close to a target before finally being detected that there is little chance of stopping the attack. It reduces the effective range of an adversary's defenses to the point where they are essentially nullified. 28

During the Gulf war, the F-117 flew over 2000 sorties and put 3000 weapons very precisely on target with no losses. Stealthy aircraft, while individually costly, are actually a bargain because of their effectiveness. The F-117A program unit cost in 1992 dollars, is $144 million per aircraft. A B-2 costs five to six times as much but can fly six times farther with four, six, or ten times the payload (see appendix pages 3, 4 and 5).

Without an aircraft like the B-2, the bomber fleet will atrophy and bomber penetration capabilities will decline. Together, these events will lead to eventual disintegration of the balanced Triad concept mentioned early in this paper. By the year 2000, for example, the force would deteriorate to less than 200 B-1 and B-52H bombers: the B-1s will be 14

years old; the B-52s will be at least 40 years old. (See appendix page 6). By that time it will have been 55 years since Air Force planners first envisioned the B-52, and almost 40 years since they envisioned the B-1. Eventually the force would shrink to only the B-1, thus effectively ending the era of the balanced Triad, particularly as the B-1's capability to penetrate sophisticated air defenses is eroded (see appendix page 7). Our deterrent capability would degrade as U.S. forces lose the penetrating bomber's flexibility and efficiency in delivering nuclear and conventional weapons. Reliance solely on non-stealthy cruise missile carriers would degrade effectiveness and open new vulnerabilities. 29

The B-2 enjoys important advantages over existing bombers, which stem from a revolutionary blending of stealth technologies in a large aircraft with high aerodynamic efficiency and large payload capability. The B-2's higher survivability enables it to fly at higher altitudes to provide a better field of view for the crew and the aircraft sensor suite. Its low observability allows more flexible routing which is driven by mission requirements rather than the threat. Other types of bombers will be restricted to operating at low altitudes with limited sensor field of view under strict routing restrictions and stringent fuel limits. In combination, the B-2's enhanced survivability and high

aerodynamic efficiency for greater range and search time will provide the baseline aircraft with greater capabilities against a wider variety of targets than existing bombers. Built-in potential for improvements can provide even greater capability in the future. 30

Unlike the B-52, which was first produced to be a high altitude bomber, the B-2 has always had a penetrating mission attached to it.

> Mission: The ASPA (Advanced Strategic Penetrating Bomber) shall provide the capability to conduct missions across the spectrum of conflict, including general nuclear war and the post-Single Integrated Operations Plan (SIOP) period, nuclear engagements less than general war, conventional conflict, and peacetime/ crisis situations. 31

As a viable penetrator, the B-2 will work synergistically to improve the capabilities of the air-breathing force as a whole. As the B-2 attacks the most heavily defended targets, the B-1 will be able to concentrate on penetrating to less heavily defended targets, and the B-52 force, equipped with ALCMs and the ACMs, can conduct standoff attacks. This employment of the bomber force, in which each type of bomber attacks the most suitable targets, enhances the survivability and effectiveness of the bomber force as a whole to reinforce our deterrent potential.

B-2 COST

Critics of the B-2 program invariably look at the cost, without examining cost in the context of value. There is no doubt that the B-2 is an expensive airplane. But two factors stand out. First, the value of the B-2 in terms of its nuclear deterrent capability, its contributions to arms control, the conventional capabilities, and its revolutionary stealth technology is enormous. Secondly, B-2 costs measure up favorably using many indices. 32

The B-2 will absorb a lower percentage of the defense budget during its three peak procurement years than the B-52 and other bombers did at their peak. In the three peak investment years, the B-2 consumes fewer dollars than the B-1 and the Minuteman ICBM.

The total program cost to build 75 B-2s was estimated by the DOD at $64.8 billion (including military construction) in "then year" dollars. Then year dollars is money as it is appropriated, not adjusted to a constant "base" year. "Congress has approved $33 billion for the production of only 15 production models and a single version for testing purposes. Congress also approved the purchase of major components for an additional five B-2s." 33

The Air Force had estimated it would cost an additional $22 billion to build 60 more B-2s. Ending production after 20 planes would make the aircraft by far the most expensive ever built, driving the cost of each plane, including the program's development, to more than $2 billion. 34

RESEARCH AND DEVELOPMENT

The production of 15 B-2s at a cost of approximately $39 billion bought a lot more than just an airplane. American scientists, along with Northrop and the many sub-contractors, pioneered the total integration of computer aided design, engineering, manufacturing, and logistic support. These processes are referred to as CAD/CAM and concurrent engineering.

Over 900 new materials and manufacturing processes were developed. Many of these advancements are directly applicable to other fields. Some of these advances include:

New tools and manufacturing techniques
High-speed machining of magnesium, aluminum and titanium parts
Drilling multi-material laminates
New drills that automatically adjust to changes in material hardness
Ion-gas "dusting" for cleaning machine honeycombed parts
High-speed ultrasonic knives for cutting composites
Robotics developed for drilling, inspection, fastening and coating parts
Computer driven optics used in tools alignment

These advances were necessary to provide the precision of shape and dimension necessary to meet the B-2's low observable design. These technologies will be incorporated in all future stealth aircraft. Commercial aircraft will apply the composite technology to their designs. Composite materials are significantly lighter than other structural materials. Lighter weight means better gas mileage for airliners and lower costs for everyone. 34

The foundation has been laid for a large composite technology market. The U.S. Department of Commerce estimates that by the year 2000, the advanced materials market will approximate $150 billion annually.

IMPACT ON NORTHROP IF PROGRAM STOPPED AT 15 AIRCRAFT

There is no doubt that these are trying times for Northrop Corporation. The looming cutbacks in the program will mean huge new aerospace layoffs much sooner than expected in Southern California. The company has about 9,000 employees on the program in Pico Rivera, 3,000 in Palmdale and about 800 at Edwards Air Force Base, where the bombers are tested. Nationwide, the B-2 program directly employs 40,000 workers at 4,000 companies. 35

Chairman Kent Kresa has stated that stopping B-2 production at 15 aircraft will cut the company's size in

half. Revenue would be reduced from about $5.5 billion per year to about $3 billion, although profit margins would be higher.

Financial analysts say that an estimated $1 billion termination fee will be paid to Northrop by the Air Force if production is stopped at 15 aircraft. That could easily wipe out the company's $830 million debt. They would be in a much better position, however, if they were to accept lower profits near-term and keep the B-2 program alive. This way, Northrop could retain their status as a prime contractor and be able to compete with giants such as McDonnell Douglas Corporation and Lockheed Corporation.

Northrop is vying for a subcontract on the Navy's AX stealth attack jet. Some of the shock could be absorbed by this project if the B-2 program gets cancelled.

FUTURE IMPLICATIONS

The United States is at a crossroads of where it wants to go with the manned bomber. All signs are pointing to the conclusion that the B-2 could be the last bomber we will build. The questions are, how many do we need, and how will we use them?

By next year, our bomber inventory will be down to 200 aircraft. One-half of these aircraft will be over 30 years old. By 2010, the B-52G will be retired, the B-52H will be over 50 years old, and the B-1B will be over 23 years old. It's obvious that without the B-2, the bomber leg of the Triad will be very weak. Is this what we want?

Air Force acquisition experts say that 15 B-2s are clearly not enough. Two of these aircraft would be in constant test and weapons fit programs at Edwards AFB, California. Four or more aircraft would be having maintenance performed on them, and two would be mission spares. This would leave no more than seven aircraft in mission-ready status. Not considered are possible aircraft losses due to accidents or combat. To think that this small amount of aircraft could somehow replace our aging fleet of bombers is ludicrous.

The costs to operate and maintain such a small amount of aircraft could become prohibitive. Some studies show that eventually, as the number of B-2s shrink, each might cost as much to operate as a whole wing of F-117s. It would no longer be rational to keep the remaining B-2s flying.

A small fleet of B-2s could be used similarly to the way the F-117 was used during Desert Storm. This "silver bullet" role would use the B-2 to attack targets too well

defended for B-52s and too distant for F-117s without tanker support. A second role could be as the leading edge of a larger attack, so other bombers could penetrate enemy territory.

The Congress is only looking at the cost of these planes. They have committed $33.2 billion of the total program cost of $60.8 billion. We have contracted for 15 aircraft, but $33.2 billion will not be enough to build 15 and stop production. It would cost another $6 billion to complete those 15 for a total of $39.2 billion--65 percent of the total program cost in FY 91 dollars. Building the remaining 60 aircraft would cost another $21.6 billion over the cost to build 15 and stop. The bottom line is that we can buy the last 60 aircraft for less money than was spent on the first 10 aircraft!

CONCLUSIONS/RECOMMENDATIONS

My paper has gone to great length explaining the need for deterrence in both nuclear and conventional roles. I don't believe it is time yet, based on the uncertainty of the threat, to put deterrence on the shelf in the name of saving money. We should keep the B-2 production line going with the intention of building all 75 aircraft. We should also make every effort to maintain and modernize the B-52H

aircraft so we can keep a cruise missile carrier in our inventory. The B-1B's ECM suite should be finished on all aircraft and conventional bombing capability should be incorporated as soon as possible.

The B-2 can be in our inventory for the next [illegible] years if we build 75 aircraft. If we stop production at 15, we will only have the aircraft for a maximum of seven years because of the excessive operations and maintenance costs and possible accident loss.

Congress needs to rethink their opinions of the B-2 program when the issue comes up on the floor again next year. They need to remember that the key is long-term deterrence. The U.S. has to prepare now for the threats likely to emerge over the next 5-15 years and beyond. Continued investment in research and development now, keeps us competitive because of the years involved in testing and manufacturing before a weapons system is mission capable. The B-2's stealth technology gives us a 20 year advantage over any other country.

Our lawmakers need to look at the total picture of what can be gained from a 75 B-2 program. What price should we pay for the world-wide security and stability we can ensure by being able to provide the world with strategic deterrence?

ENDNOTES

1. B-2 Stealth Bomber Fact Book, B-2 Background Information Paper, 1 March 1991, page 1.

2. Douhet, Giulio, The Command of the Air, 1942, page 9.

3. Air Force Association Science and Technology Advisory Group, Why the B-2?, May 1991, page 2.

4. B-2 Stealth Bomber Fact Book, Tab 9, The Case for the B-2: An Air Force Perspective, June 1990, page 1.

5. Ibid.

6. Ibid.

7. Ibid, page 2.

8. Ibid.

9. Ibid, page 3.

10. Ibid.

11. Sloss, Leon, U.S. Strategic Forces After the Cold War: Policies and Strategies, The Washington Quarterly, Autumn 1991, page 145.

12. Watson, Russell, Nukes on the Loose, Newsweek, 16 December 1991, page 32.

13. Secretary Cheney's Statement Before the Senate Armed Services Committee in Connection with the FY 1992-1993 Budget for the Department of Defense, Washington D.C., 21 February 1991.

14. Jablonsky, David, Strategic Vision and Presidential Authority in the Post-Cold War Era, Parameters, Winter 1991-1992, pages 12 and 13.

15. The Case for the B-2: An Air Force Perspective, June 1990, page 8.

16. Ibid, page 9.

17. Ibid.

18. Ibid, page 10.

19. B-2 Update, B-2 Stealth Bomber Fact Book, Volume 2, Number 1, 8 February 1991, page 4.

20. The Case for the B-2: An Air Force Perspective, June 1990, page 4.

21. Ibid, page 5.

22. Ibid, page 7.

23. B-2 Update, B-2 Stealth Bomber Fact Book, Volume 2, Number 2, Northrop Corporation, March 1991, page 4.

24. Britt, Russ, History of the B-2, Los Angeles Daily News, 27 October 1991, page B-1.

25. Bush, George, State of the Union Address, 28 January 1992.

26. Cheney, Richard, Testimony to the House Armed Services Committee, 7 February 1991.

27. The Case for the B-2: An Air Force Perspective, June 1990, page 11.

28. Ibid.

29. Ibid, page 10.

30. Ibid.

31. B-2 Update, B-2 Stealth Bomber Fact Book, Volume 2, Number 2, Northrop Corporation, March 1991, page 3.

32. Air Force Association Science and Technology Advisory Group, Why the B-2?, May 1991, page 15.

33. Healy, Melissa, Bush Expected to Scuttle B-2 Program, Baltimore Sun, 8 January 1992, page 1.

34. B-2 Stealth Bomber Briefing, Global Reach-Global Power for the 21st Century, page 37.

35. Vartabedian, Ralph, Northrop, Taxpayers Big Losers in B-2 Program Cuts, Los Angeles Times, 9 January 1992, page 1.

BIBLIOGRAPHY

Air Force Association Science & Technology Advisory Group, Why the B-2?, May 1991

"B-2 Update," B-2 Stealth Bomber Fact Book, Volume 2, Number 1, Northrop Corporation, March 1991

"B-2 Update," B-2 Stealth Bomber Fact Book, Volume 2, Number 2, Northrop Corporation, March 1991

"B-2 Information Paper," B-2 Stealth Bomber Fact Book, Northrop Corporation, 1 March 1991

Britt, Russ, "History of the B-2," Los Angeles Daily News, 27 October 1991

Bush, George, "State of the Union Address," Washington D.C., 28 January 1992

Douhet, Giulio, The Command of the Air, Coward-McCann, Inc., New York, NY, 1942

"Global Reach - Global Power for the 21st Century," B-2 Stealth Bomber Briefing Book, Department of the Air Force, June 1991

Healy, Melissa, "Bush Expected to Scuttle B-2 Program," Baltimore Sun, 8 January 1992

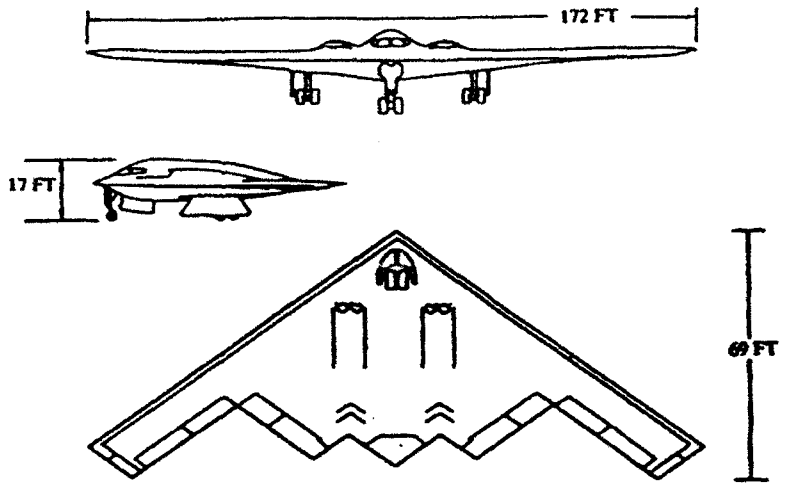
Jablonsky, David, "Strategic Vision and Presidential Authority in the Post-Cold Era," Parameters, Winter 1991-1992

Sloss, Leon, "U.S. Strategic Forces After the Cold War: Policies and Strategies," The Washington Quarterly, Autumn 1991

"The Case for the B-2: An Air Force Perspective," B-2 Stealth Bomber Fact Book, Department of the Air Force, June 1990

Vartabedian, Ralph, "Northrop, Taxpayers Big Losers in B-2 Program Cuts," Los Angeles Times, 9 January 1992

U.S.A.F. B-2 Bomber



WEIGHT:
Empty: < 170,000 lbs
Payload: 40,000 lbs
Fuel capacity: > 160,000 lbs
Takeoff weight: 376,000 lbs

PERFORMANCE:
Penetration Speed: 0.75 Mach
Altitude: Low altitude to 50,000 ft
Range: 6,700 nm all high altitude, unrefueled

ARMAMENT:

Two (2) side by side weapons bays
Boeing Advanced Applications Rotary Launcher in each bay, or conventional weapons bomb racks in each bay

NUCLEAR:
B-61 gravity bomb (16)
B-83 gravity bomb (16)
AGM-131A SRAM II missile (16)

CONVENTIONAL:
Mk-82: 500-lb GP bomb (80)
CBU-87: 1,000-lb CBU Dispenser (36)
M-117: 750-lb GP bomb (36)

RANGE/PAYLOAD COMPARISONS:

Aircraft	Weapons Load	----RANGE (NM)---- All High	HI-LO-HI
B-2	(80 Mk-82s) 40,000 lbs	6,700	4,740
B-52H	(51 Mk-82s) 25,500 lbs	5,800	4,200
B-52G	(51 Mk-82s) 25,500 lbs	4,840	3,200
B-2	(8 SRAMs + 8 B-83s) 37,300 lbs	6,300	4,400
B-1B	(8 SRAMs + 8 B-83s) 37,300 lbs	5,500	4,000

DESIGN:

- Tailless, all-flying wing design with smooth surface contours, unbroken outer surface lines and extensive use of composites. Recessed engines with top-of-wing inlets and exhaust.

- Aerodynamically clean design and large wing area result in wing loading second only to U-2/TR-1 and greater range per pound of fuel than other bombers (e.g., uses 40-50% fewer tankers than B-1B/B-52 for similar missions).

- B-2 flights show it handles like a fighter in agility, responsiveness and precision, in part because composites give it more rigidity than large aircraft like the B-52.

- Thirty year operational life.

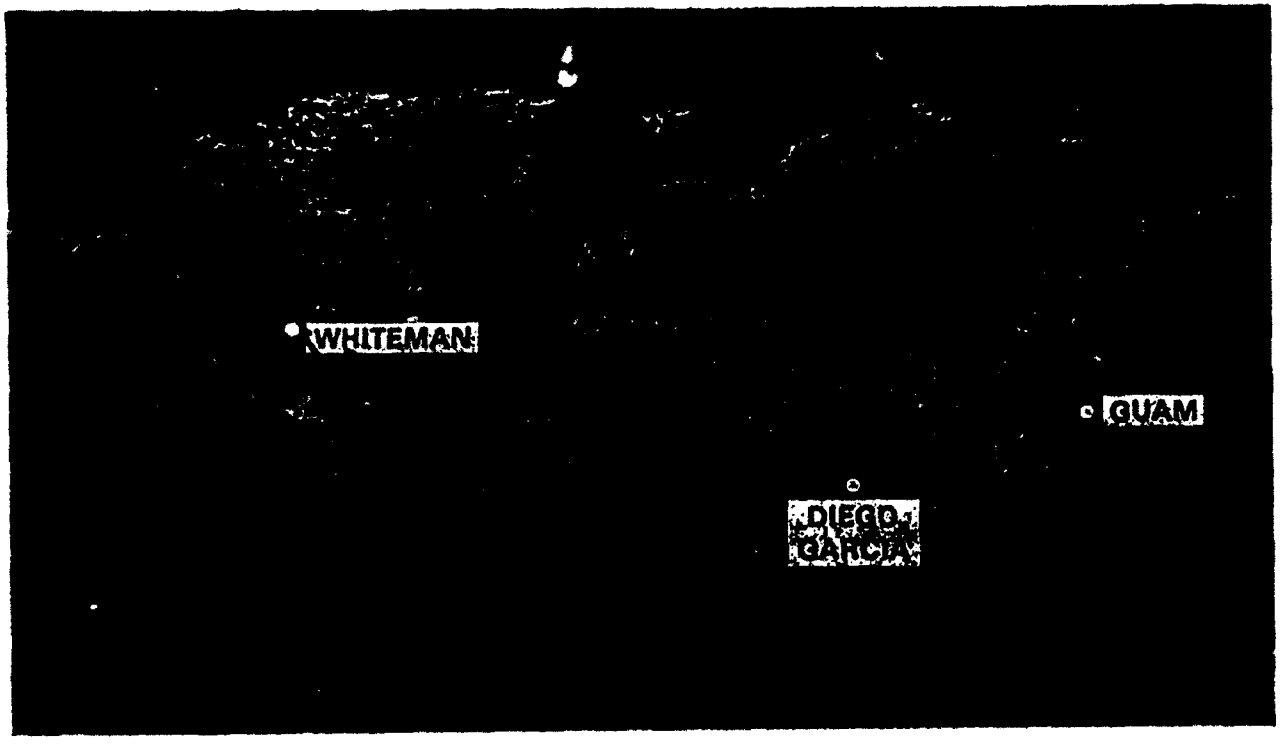
- Built on production hard tooling versus standard hand building of prototypes. Exacting standards and use of composites required precision tooling, fabrication, and manufacturing capabilities not existing in industry at the outset of the B-2 program. Producibility had to be proven along with aircraft capability.

- Most extensively tested aircraft in history before first flight: over 550,000 hours on systems and components.

B-2 Conventional Capability
Worldwide Force Projection Capability

B-2 Stealth Bomber

- 40,000 LB PAYLOAD + ONE REFUELING COVERS GLOBAL LANDMASS



B-2 CAN HOLD VIRTUALLY EVERY TARGET IN THE WORLD AT RISK WITHIN 24 HOURS

'STEALTH IS A BARGAIN'

Air Force Secretary Rice in February testimony used the chart presented below to illustrate how stealth aircraft significantly cut operational costs by reducing support requirements.

The standard force package depicted, representing one actually flown during Desert Storm operations, is composed of about 75 aircraft, only 32 of which would be planned to put bombs on the target. The rest of the package consists of air superiority escorts, electronic countermeasures aircraft, defense suppression fighters and all the tankers necessary to get the 75-aircraft force to the target and back to base. When precision and stealth are added, the same mission could be performed by only eight stealth fighters and two refuelers.

In drawing this contrast, Secretary Rice stated: "Stealth allows us to operate with far less support forces. Even though the planes are individually expensive, they are clearly a bargain when you look at all the resources."

Using stealth:

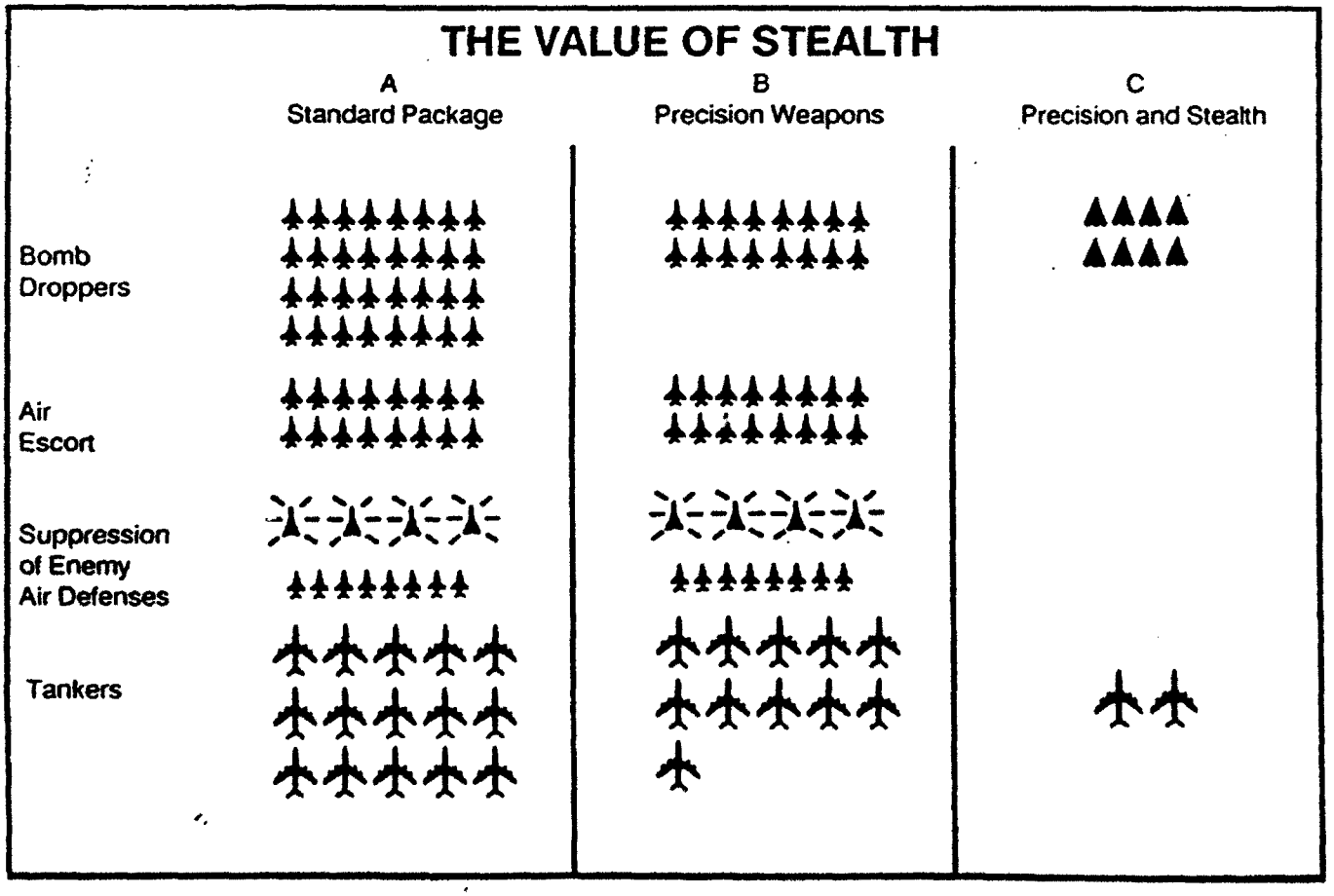
--reduces "air-to-air superiority coverage."

--reduces "the numbers of defense suppression assets."

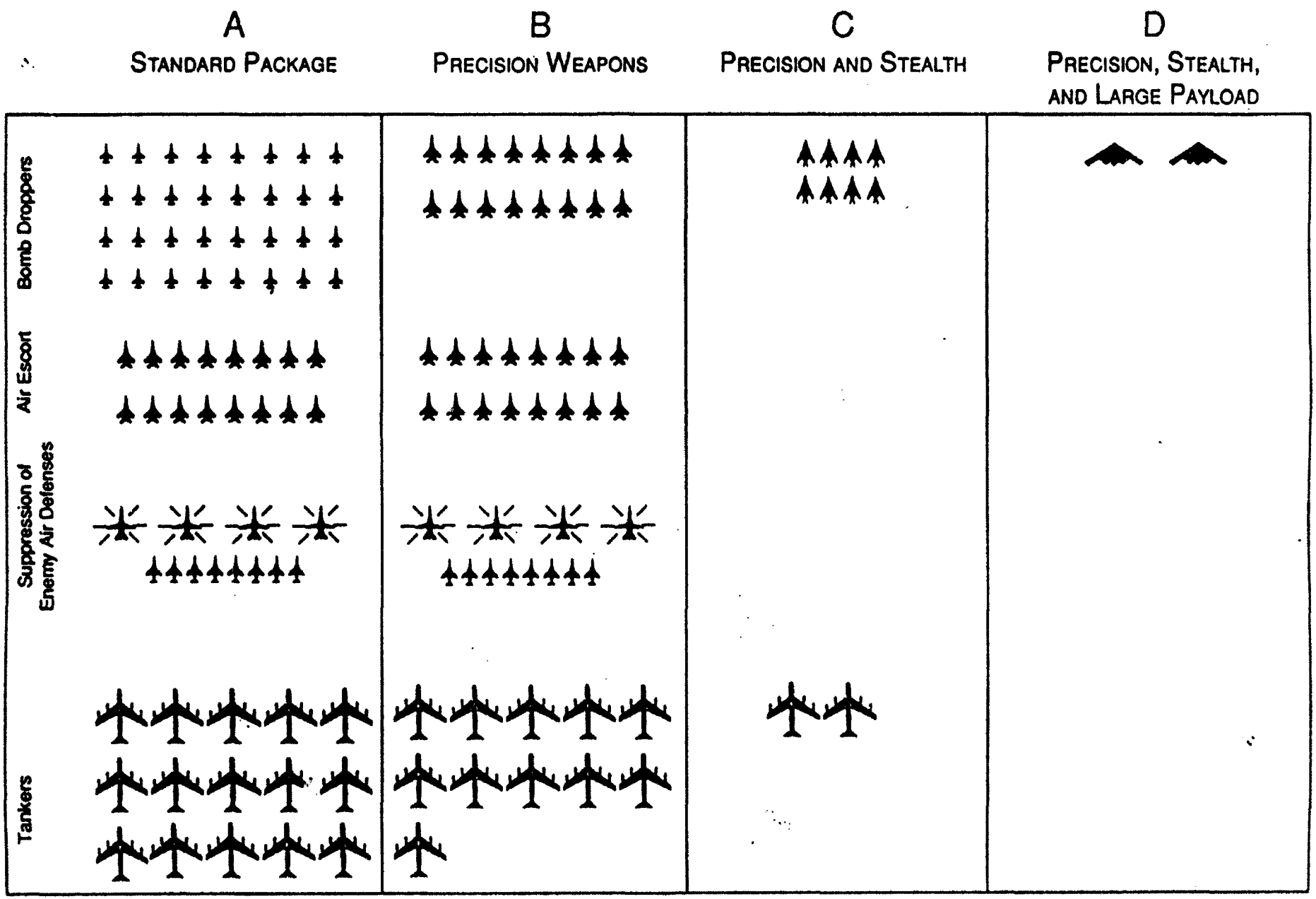
--reduces "the numbers of tankers."

Additionally, stated Rice, "[W]e really do believe that when you look at how stealth is used in actual operations, one has to conclude that even though the aircraft are individually expensive, stealth is in fact a bargain. You put far fewer assets at risk. You have to commit smaller portions of the actual force to go do a job, and it saves lives. No two ways about it.

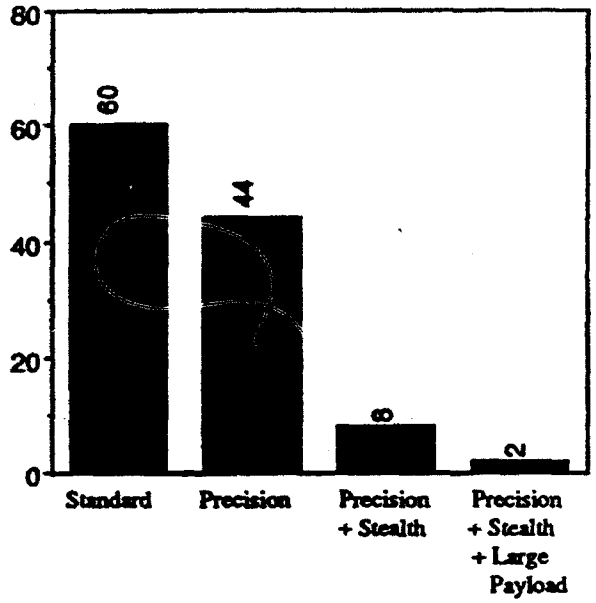
"You are putting many fewer lives at risk in the process of carrying out the campaign, and because they deliver precise weapons, and they do that more effectively because they are not paying so much attention to avoiding the defenses that may be thrown up against them, they actually do a better job...and, so, you get more bang for the buck, too."



THE VALUE OF STEALTH

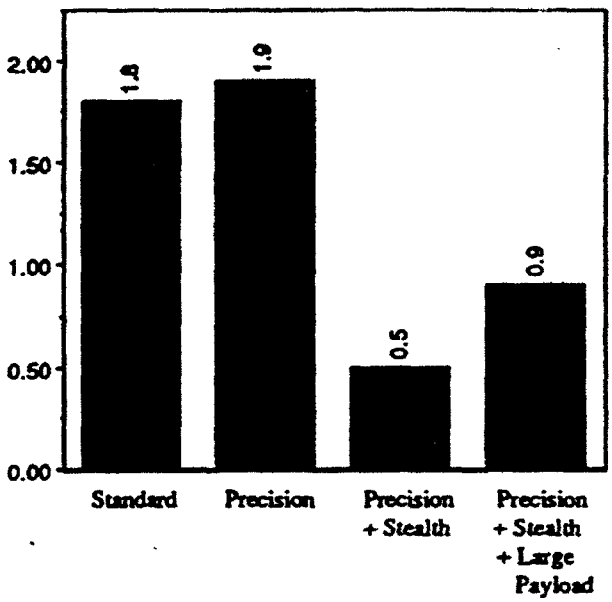


Stealth Saves Lives and Saves Money



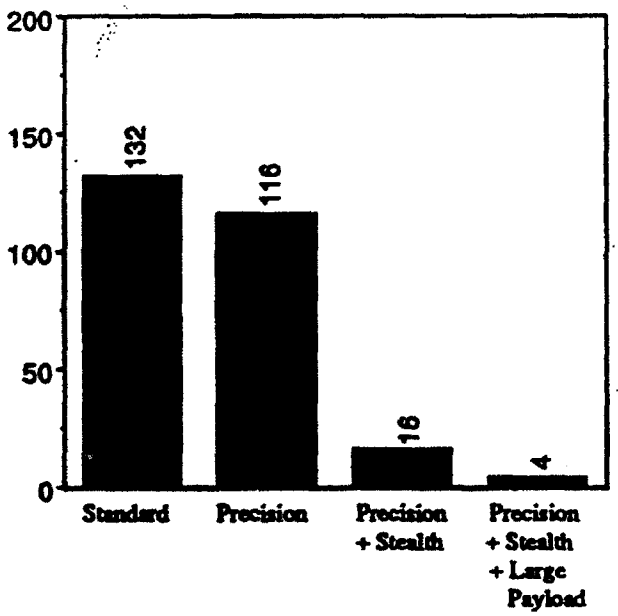
Aircraft At Risk

Figure 2



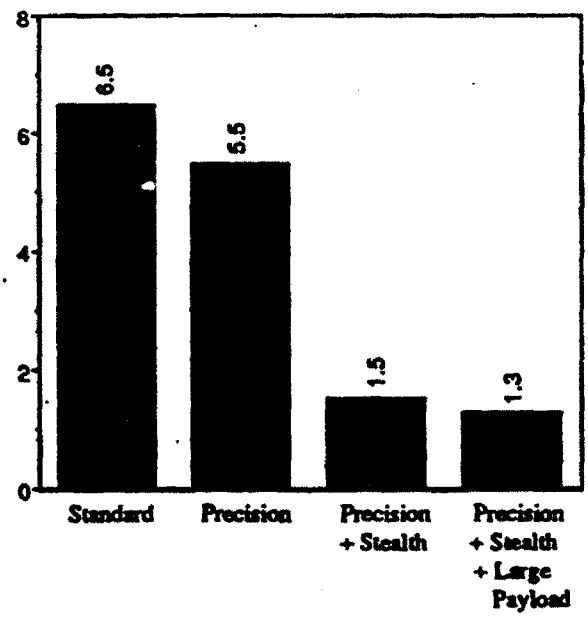
Flyaway Cost
(FY91$ Billions)

Figure 3



Aircrew at Risk

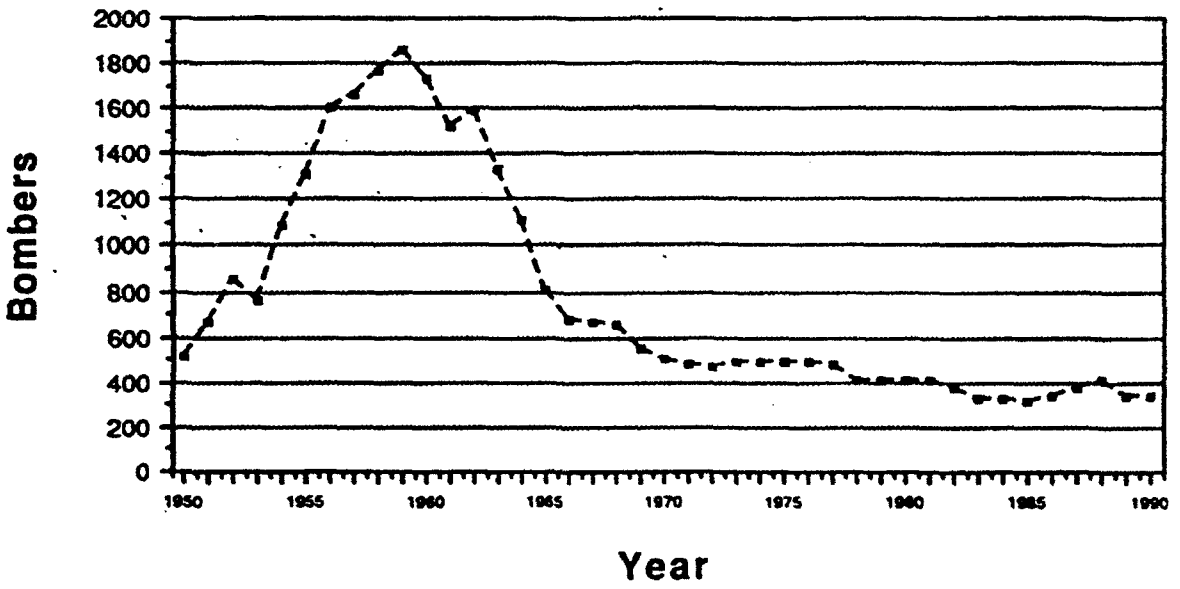
Figure 4



Procurement Cost Plus 20 Year O&S
(FY91$ Billions)

Figure 5

Bomber Inventories Over Time



The Balanced Triad

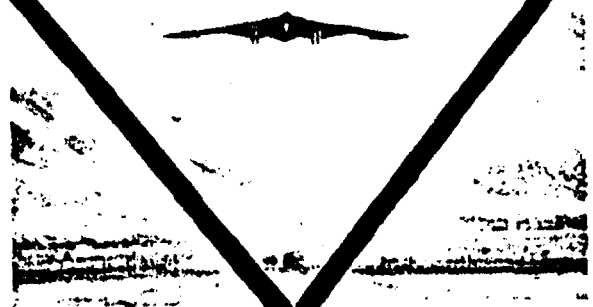
B-2 Stealth Bomber

STRATEGIC TRIAD

ICBMs

- Use when deterrence fails
- Low O&S cost
- High day-to-day alert
- Prompt response
- No recall
- No recycle
- No conventional use

BOMBERS



- Demonstrates resolve in crisis before deterrence fails
  - — Most stabilizing
- Relieves decision time pressure
- Man-in-loop
- Most efficient weapon delivery
- Survivable
- Recallable
- Reuseable
- Rapid global conventional capability
- Proven in combat

SLBMs

- Use when deterrence fails
- Survivable
- Low cost/warhead
- Prompt response
- No recall
- No recycle
- No conventional use

Each President Has Requested More Options