



Chapter

5

AVIATION: FROM THE COLD WAR TO DESERT STORM



Objectives

Discuss the political situation at the end of World War II.

Define the “Cold War.”

Identify why the United States reduced its military forces after World War II.

Identify the date the United States Air Force was formed.

Discuss the first primary mission of the United States Air Force.

Identify several aviation advances that were made during World War II.

Identify the so-called German “vengeance” weapons that were used to terrorize Europe.

Discuss the use of helicopters during World War II.

Discuss air power’s role in keeping Berlin from becoming a part of East Germany.

Discuss how ready the United States air power was for a war in Korea.

Discuss air power’s role in stopping the North Korean army outside of Pusan.

Identify the reason American fighter pilots were able to defeat the MiG-15.

Discuss the air power’s lessons learned from the Korean War.

Identify why the DC-4 was initially one of the most popular commercial airliners after WWII.

Identify the first “pure” jet commercial airliner.

Identify the “big three” in general aviation manufacturing.

Identify the problems encountered when attempting to break the sound barrier.

Define Mach 3.

Discuss the advantages of variable swept-back wings.

Discuss the potential impact new missile technology had on aircrews.

Identify the primary reason the B-52 bomber was built.

Discuss the impact television had on the Vietnam War.

Discuss the results of the Tet Offensive.

Discuss the impact technology has on air power, looking at the Thanh Hoa Bridge example.

Discuss the difference in how air power was applied during Operation ROLLING THUNDER and Operation LINEBACKER.

Identify aircraft built specifically for Strategic Air Command during the Cold War.

Discuss Strategic Air Command’s mission during the Cold War.

Identify the contribution the Civil Reserve Air Fleet made to Operation Desert Shield.

Identify the “key” air power capability that allows US air power to be a “global striking force.”

Identify several of the lessons learned from previous air wars that were used to help develop the Desert Storm air campaign plan.

Discuss why Iraq’s command and control was attacked first during the war.

Discuss air power’s contribution to the defeat of Iraq’s counterattack into Saudi Arabia.

Discuss air power’s contribution to the “100 Hour War.”

Discuss the impact new technology had on the “War in the Desert.”



Setting the Stage: The Political Situation

The postwar years (after World War II) were called the “Cold War.” The Soviet Union (Russia) tried to increase her influence in the world, and the United States tried to prevent the spread of the communist influence.

Although the Soviet Union and the United States were Allies during World War II, they did not share the same ideas on freedom, economics and government. The Soviet Union (Russia) had been hurt terribly by World War II and by previous wars. They wanted to ensure that never happened again. They also desired all the countries that were near them to be friendly towards them. So they directly influenced these nations’ fate after World War II and beyond.

The countries the Soviet Union had liberated during World War II (Hungary, Czechoslovakia, Romania, Yugoslavia, Poland, East Germany, etc.) were shaped in the image of the Soviet Union. The Soviet Union installed governments that restricted people’s freedoms, created socialist economies, and unrepresentative governments. All of these were exactly what the United States did not favor. The United States believed in freedom of speech, freedom to choose your religion, freedom to choose who represents you in government, and the freedom to choose what you want to do in life.

The United States and the Soviet Union clearly did not believe in the same things. This led to their antagonistic relationship. This relationship was known as the “Cold War” because their objective was not to get into a “hot” war. They both wanted to influence what happened in the world, but they didn’t want to go to war. If they went to war, leaders feared it would be the last world war. The destruction would be too great. The two sides were clearly marked off. The Soviet Union and her new socialist friends, and the United States and her Allies.

Each side was trying to influence as many countries as possible into believing in its system of government and economics. The Cold War was so influential it shaped many of the developments in the world including the development of aviation.



The Douglas JD-1 served in WWII, then again during the Cold War.

Military Developments

Just like after World War I, the United States immediately rushed to “return to normal.” The Army Air Forces had 2,125,000 men in uniform in September 1945, and by January 1946, there were less



than 900,000. By 1947, this figure was cut to 300,000. America was certain its monopoly on the atomic bomb provided all the security it needed. No one would dare attack the United States or her Allies for fear of massive strikes like the ones the Japanese experienced at Hiroshima and Nagasaki. Therefore, there was no need to maintain a large military force.



The RB-36D was one of the largest bombers ever built. It was a mainstay of the Strategic Air Command in the 1950s.

A Separate Air Force: Designed to Defend the Nation

The lessons learned from World War II seemed to indicate that air power and the atom bomb could provide for the security of the United States. However, General Billy Mitchell was right, the United States needed a separate but equal Air Force. This would ensure a strong and powerful Air Force, like the Army and the Navy. If the Air Force was going to carry the bulk of the load for the defense of the United States, it had to be separated from the Army. This would allow the Air Force to grow without interference from the Army and, more importantly, give the Air Force its very own budget.

With the passage of the National Security Act, on July 26, 1947, the Army Air Forces of World War II became the United States Air Force (USAF). The first Secretary of the Air Force was Stuart Symington, and General Carl Spaatz became the first Chief of Staff of the United States Air Force.

This newly formed United States Air Force's primary mission was deterrence. The Air Force needed to be strong enough that no nation would dare attack the United States. The United States Air Force could destroy a nation with atomic bombs. This mission was given to the Strategic Air Command (SAC). At that time, SAC had nothing but a handful of B-29s, an improved offshoot called the B-50, and just a few atom bombs.

The new, giant B-36 started service in 1948. At this point in history, this bomber was the largest bomber ever built. It was designed in 1941 when it looked like England might lose the Battle of Britain to the Germans. If England had lost, bases would not have been available for the bombing of Germany. This is why the B-36 was designed to carry 10,000 pounds of bombs 10,000 miles. This huge plane weighed six times as much as the B-17 and was powered by six pusher propellers (later, four jet engines were added).

Wartime Advances

The huge B-36 bomber was just one of many developments during World War II. There were also advances in aircraft design, instrumentation, navigation, electronic systems, engines, and armor



protection. Bombers grew in size, speed, and bomb load, showing little similarity to their prewar ancestors. The B-29 carried three times the bomb load and had three times the range of the B-17. In addition, the B-29 was the first bomber to have a pressurized crew compartment, which allowed it to fly at much higher altitudes. It also had a central fire control system for aiming and firing its guns by remote control.

The P-51 *Mustang* is often called the best fighter of World War II. A comparison of the P-51D and the Curtiss P-40C shows the advancements made in fighter aircraft during the war.

	<u>P-51D</u>	<u>P-40C</u>
Maximum weight	11,600 lb.	8,058 lb.
Maximum speed	437 mph	345 mph
Maximum range	2,300 mi	945 mi
Service ceiling	41,000 ft	29,500 ft
Rate of climb (ft/min)	3,500	2,690

War seems to bring out the survival instinct in many of us, and this instinct has led to many revolutionary developments that completely replaced previous technology. One case in particular is the jet aircraft, which rapidly made the piston-engine aircraft obsolete. Advances like these paved the way for even more development after the war.

Jet Propulsion

Before the war, Frank Whittle, an Englishman, designed the world's first turbojet engine for use in an airplane. He tested the engine for the first time in April of 1937. It was not until May 15, 1941, however, that England flew her first jet aircraft. By this time, Germany had already flown several jet aircraft. The first jet in the world to fly was Germany's Heinkel HE-178, which was first flown on August 22, 1939.

The United States flew its first jet aircraft, the Bell XP-59 *Airacomet*, on October 1, 1942. The P-59, however, was not much better than the piston engine P-51 *Mustang* and was never put into production. The first U.S.-produced jet fighter was the Lockheed F-40 (originally designated the P-80A) *Shooting Star*, which flew for the first time in January 1944. The *Shooting Star* was far superior to any fighter aircraft in the world (jet- or propeller-driven), but it came too late to be used in World War II.



The Bell Aircraft Company produced America's first jet fighter, the P-59A.

Both the British and the Germans produced jets that saw combat in World War II. In fact, before World War II ended, Germany had produced 22 different models of jet aircraft, including some with sweptback wings, delta wings, afterburners, ramjets, and even variable-swept wings. England produced two aircraft, the Gloster Meteor I and the DeHavilland Vampire, which were operational before the war ended.



The most famous jet of World War II was the Messerschmitt ME-262A. It could have possibly changed the outcome of the war if it had come a little earlier and in greater numbers. Fourteen hundred of these twin-engine German jets were produced during the war, but only about 100 ever saw operation as fighters. An additional 200 were used as tactical fighter bombers. The ME-262 was a very good aircraft. It carried four 30-mm cannons and was capable of a speed of 550 mph. Unfortunately for the Germans, it came too late.



The Messerschmitt ME-262 was the first, fully operational jet fighter.

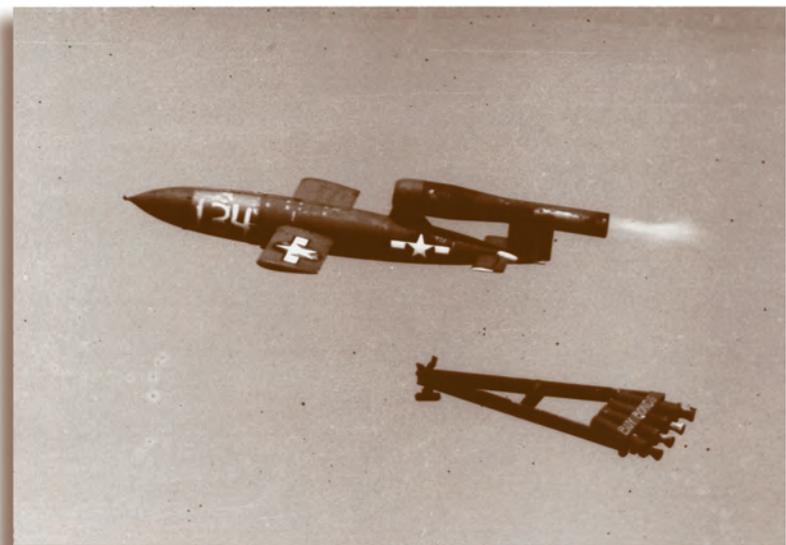
"Vengeance" Weapons

During the World War II European Campaign, two new German "vengeance" weapons were used. The first was a small, 26-foot-long unmanned flying bomb called the V-1. The V-1 weighed 3,000 pounds and carried 1,800 pounds of high explosives. Powered by a pulsejet engine mounted in a "stovepipe" above the fuselage, this type of engine

produced a unique sound, giving the V-1 its nickname, the "buzz bomb." Between June 1944 and March 1945, over 10,500 "buzz bombs" were launched against England, and 12,000 more against targets in Europe. Most of the V-1s were launched from ground ramps, but about 1,900 of those launched against England were air-launched from HE-111 bombers.

Flying at about 400 mph, the V-1 had a range of about 200 miles. It was not very accurate but served its purpose of terrorizing the enemy. Since the rockets were so large and noisy, they were fairly easy to locate. This made the V-1 vulnerable to fighter aircraft and ground fire. As a result, nearly 4,000 were shot down over England.

The other "vengeance" weapon was the rocket-propelled V-2 ballistic missile. It was the forerunner of the space age. It was the product of a brilliant rocket scientist named Wernher von Braun and was the first liquid-fuel missile ever built. Unlike the V-1, it was impossible to defend



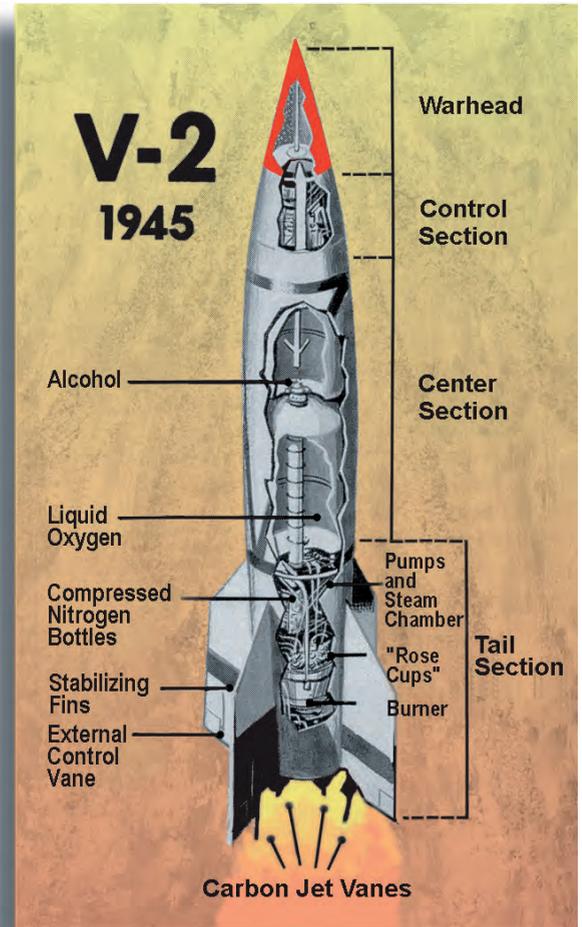
The German V-1 "buzz bomb" terrorized Europe. It is shown with American markings.



The Messerschmitt ME-163 Rocket Interceptor

against the V-2. It carried a 2,000-pound warhead at speeds of about 3,600 mph and had a range of about 220 miles. The high, arching flight of the V-2 carried it to an altitude of about 100 miles from which it fell at speeds faster than the speed of sound, landing before any warning could be given. Altogether, about 4,300 V-2s were launched between September 1944 and March 1945.

Records show that approximately 1,050 actually fell on England. Again, it was fortunate for the Allies that this effort occurred late in the war. If Germany had been able to develop and launch great numbers of V-2s, the tide of the war might have been changed.



The German V-2 ballistic missile started the race to space.

Helicopters

Another World War II aviation development was the Sikorsky R-4. It was the first successful military helicopter. In 1942, the R-4 went into service with the Army Air Forces. Before the war ended, 400 of them were used in Europe, the Pacific and in the United States.

Most importantly, on April 23, 1944, the R-4 was used to rescue a downed pilot from behind enemy lines for the first time. This event developed a role for the helicopter that still exists today. Helicopters are extremely good tools for search and rescue. After this first rescue, the helicopter became an integral part of the Army Air Forces, but it was not until the Korean War, some 5 years later, that the helicopter really demonstrated its value.



The Sikorsky R-4 was the first successful military rescue helicopter.



The “Cold War” Heats Up

The Berlin Airlift

The peace treaty ending World War II divided Berlin into four sectors, each controlled by one of the Allied Nations (United States, Britain, France and the Soviet Union). Additionally, Germany was divided into two parts – West Germany, controlled by Britain, France and the United States; and East Germany, controlled by the Soviet Union.

In June 1948, the Soviet Union decided to test the will of the other three Allied Nations by initiating the Berlin blockade. The blockade prevented any surface transportation into or out of Berlin.

Berlin was located in East Germany. This meant that all supplies for the sectors of Berlin controlled by Britain, France, and the United States had to travel through East Germany, which was controlled by the Soviet Union.

The Soviet Union decided to block the supplies going into Berlin so that the Allies would leave Berlin. Russia wanted to take over all of Berlin and, unless the blockade could be broken, the strategy would work. The answer to the blockade was the Berlin Airlift. Air power would be used to fly over the roadblocks and into the city of Berlin.

This was a massive undertaking. It was estimated that Berlin required 4,500 tons of supplies a day just to survive. Not only were there not be enough aircraft, but also the effort had to overcome the poor weather and other problems. At the start, there were only 105 C-47 aircraft for the effort. Each C-47 was capable of carrying three and one-half tons of cargo. There were also 54 C-54 aircraft that were able to carry 10 tons of cargo.



The C-54 was the most widely used transport during the Berlin Airlift.

Within five months, the effort had grown to 319 C-54 aircraft (the C-47s had been phased out) and 150 British planes of various sizes. During the winter, the problem got worse. The airlift now had to include heating fuel (mostly coal) as well as other cold weather supplies. Amazingly, the Berliners made it through the winter with the supplies.

By April 1949, life was a little better as the airlift had grown to the point that 12,940 tons were delivered by 1,398 flights in one day. This record-setting effort was nearly three times what was estimated for Berlin’s daily survival. The Berlin Airlift had clearly come a long way.

In May 1949, almost 1 year after they began, the Russians conceded that they could not isolate Berlin. They lifted the blockade. With great effort, the United States and her Allies had supplied a city for almost an entire year. In all, 1,750,000 tons of supplies were carried in the world’s greatest demonstration of carrying cargo by air. Air power, once again, had won a big victory.



The Korean War

On June 25, 1950, shortly after the Berlin Airlift, North Korea, an Ally of the Soviet Union, invaded South Korea. Like Germany, after WWII, Korea was divided into two parts. When the Japanese surrendered, the Soviet Union was in North Korea and the United States in South Korea. North Korea, like the Soviet Union, became a communist country, and South Korea, like the United States, became a republic.

Once again, in the context of the Cold War, the United States and the Soviet Union were at war. They did not actually fight each other, they fought with each other's Allies. This became a favorite tactic of the Soviet Union. The Soviets would supply and support a communist nation in the takeover of another nation. They would do this without becoming directly involved in the fighting themselves. This time, the United States and her Allies fought a Soviet supplied communist North Korean Army for control of the Korean peninsula.

North Korea's invasion forced the United Nations to act. This was the first test of the United Nations (UN), which was formed after World War II to ensure world peace. On June 27, 1950, the United Nations resolved (the Soviet Union was absent on the day of the vote) that its members would provide assistance to South Korea. Sixteen nations provided armed forces, and five more provided medical assistance. The United States, with its powerful armed forces, took the lead.

Shortly after the United Nations' resolution was passed, President Truman authorized the use of United States armed forces. On June 30, he ordered General Douglas MacArthur to command the US effort. He subsequently became the UN forces commander as well.



The Lockheed F-80 *Shooting Star* became America's first operational jet fighter.

The first priority was to stop the advance of the much stronger North Korean Army. In little over a month, the communist forces had driven the United Nations' forces almost off of the Korean peninsula. The UN forces occupied only a very small perimeter around the port city of Pusan at the far Southeastern edge of Korea.

Like World War II, the Korean War was an air war. All of Korea was within range of naval aircraft operating off the US naval aircraft carriers of the Seventh Fleet, or US Air Force aircraft operating from bases in Japan and South Korea.

Since there were very few industrial targets in Korea for the B-29s based in Japan, they were used to bomb bridges, roads and supply areas. Most of the targets during the Korean War were really tactical in nature. This means that most of the air war consisted of UN fighter aircraft bombing and strafing enemy troops, supply lines, transportation systems and communications.

This is exactly what happened at Pusan. US tactical aircraft were able to bomb and strafe North Korean troops, and more importantly, cut their supply and transportation lines. This slowed down the



North Korean advance just enough so that the UN forces could be resupplied and hold their defensive positions. To accomplish this, the Air Force used the F-80 *Shooting Star*, the F-51 and the F-84 *Thunderjet*. The Navy carriers were equipped with the F-9F *Pantherjet* fighters, AD *Skyraiders* and F-4U Corsair propeller-driven attack aircraft. Soon thereafter, the UN forces had achieved air superiority over a small North Korean Air Force that consisted of about 120 obsolete Russian aircraft.



The F-84F was one of America's first jet aircraft to see combat in the skies over Korea.

to the forces engaged in the fighting and hammered North Korean supply routes.

South Korea's territory had been recaptured in a rout of North Korean forces. With the North Korean Army on the run, General MacArthur calculated the entire Korean peninsula could be swept clean of communist forces with a simple mopping-up operation. The UN and President Truman agreed that the original objectives of the Korean War allowed for the elimination of the communist force that would hinder a completely reunified Korean peninsula.

The communist Chinese, who had been supporting the North Korean war effort, did not take General MacArthur's threats lightly. They threatened that if UN forces moved past Seoul and the original border of North and South Korea (the 38th parallel), they would attack.

On November 25, 1950, after moving all the way up to the Chinese border with little North Korean resistance, the war changed completely around. The communist Chinese entered the war with 850,000 troops and the best fighter aircraft in the world. The Chinese were using the Russian-built MiG-15 fighter jet.

A new air war had started in the skies over Korea, and part of this air war was very new and different. It was an all-jet battle. The best Russian built jets versus the best that the Americans could build. The

In September 1950, the UN forces landed at Inchon. This amphibious operation placed the UN forces behind the enemy lines and was timed to coincide with the Eighth Army breakout at Pusan. The plan was so successful that within 10 days the North Koreans had been pushed back nearly 200 miles to the former South Korean capital of Seoul. During the push north, UN air power provided close air support



The Chinese MiG-15 proved to be a formidable opponent in the Korean War. (EAA)



first all-jet air battle in history was won by an American F-80 piloted by Lieutenant Russell J. Brown against a Chinese piloted, Russian-built MiG-15. Meanwhile, the Chinese pushed the UN troops back across the 38th parallel and captured the South Korean capital of Seoul again.

The Chinese had about 1,000 MiG-15s when they entered the Korean War. The Russian built aircraft were smaller, faster and more maneuverable. They could climb faster and higher, and they possessed more firepower than the F-80 and the Navy F-9F fighters. In fact, the MiG-15 even had the edge, at high altitude, over the F-86 *Sabrejets*, which were the best aircraft the United States had during the Korean War.



The F-86 *Sabrejet* proved to be one of America's greatest jet fighters. (EAA)

Although the Russian-built MiGs out performed the American made jets, more MiGs were shot down than American jets. The biggest reason for this was that the United States had better trained pilots. The result was nine MiGs shot down for every one United States aircraft lost during the war.

When the Chinese invaded in November, the United Nations' aircraft provided air cover for the retreat and kept the UN forces from being completely overwhelmed. They used two weapons that proved to be the best weapons used in Korea. One was a new weapon, and the other was very

similar to what was used on Japan during World War II. The new weapon was rockets delivered by airplanes. The rockets carried the destructive force of a 105-mm cannon shell and could be delivered with great accuracy by the fighter-bombers. The other weapon was a bomb just like what General Kenney used during World War II, a firebomb. These new bombs were called Napalm bombs, and were made of 110-gallon tanks of jelled gasoline, which when dropped, would explode and burn an area some 250 feet long and 80 feet wide. Postwar interviews showed that Korean and Chinese troops greatly feared these weapons.

Once the Chinese advance was stopped, UN troops recaptured Seoul and advanced as far as the 38th parallel. From this point, the war neutralized into a stalemate. By the middle of 1953, United States' close air support for the ground troops developed into a very precise art. Just like the end of World War II, the Air Force had become very good at supporting the fight on the ground. It became clear, however, that the enemy could not win the war, and neither could we.

On July 27, 1953, a cease-fire treaty was signed, the fighting stopped, and Korea was almost precise-

KOREAN WAR AMERICAN ACES

The top five American aces of the Korean War were:

Captain Joseph McConnell, Jr.	16
Major James Jabara	15
Captain Manuel J. Fernandez	14.5
Major George A. Davis, Jr.	14
Colonel Royal N. Baker	13



ly where it had been in 1950. Although neither side finished the war as an outright victor, the original objectives of the United Nations were accomplished. South Korea was once again an independent nation.

In retrospect, the Korean War was a limited or political war; the first of several for the United States. The overall controlling strategy of the war was to ensure that it did not enlarge into World War III. This meant the war had to be limited, and political leaders, rather than military leaders, were in charge of the strategy. This restricted the military leadership. Certain targets were placed off-limits. For example, the Chinese airfields that were located north of the Korean border in Manchuria were off-limits. American planes were not allowed to bomb targets north of the Yalu River, which marked the Korean-Manchurian border. In fact, US aircraft could not even pursue communist aircraft across the border. This meant that the communists could take off from their safe air bases in China, cross the Yalu River to fight, and then return back across the Yalu to safety. This type of fighting was like boxing with one hand tied behind your back.

Lessons Learned

Looking back, there were quite a few lessons to be learned by the Korean War. One was that US atomic arsenal alone is not enough to prevent involvement in war. Another was that the United States was not prepared for the Korean War. After World War II, the United States drew down its forces and invested in an Air Force focused on delivering the atom bomb.

This meant that the Air Force organized, trained and equipped to fight a war with atom bombs. To do

this, they created a large Strategic Air Command with plenty of bombers and atom bombs. They did not invest in fighter aircraft, fighter tactics or fighter personnel. As a result, the US Air Force was not prepared to support a ground war, and the United States paid for that mistake by giving up ground, and losing men and equipment to the enemy.

Lastly, the military leaders forgot the lesson they had learned during the North African Air Campaign during World War II. They forgot the benefits of having centralized control and decentralized execution. They forgot the benefits of having one person in charge of the air effort. During the Korean War, air assets were again divided with the Navy working in one area and the Air Force in the other. As a result, coordination and timely execution was poor.

Despite all the problems experienced during the Korean War, the United States still felt that the atom bomb could deter war. A comment by the Secretary of the Air Force, 1950 - 1953, Thomas K. Finletter, summarizes the philosophy at this time, "The Korean War was a special case and air power



The McDonnell F-101 B Voodoo was developed as an interceptor during the '50s and later served in a reconnaissance role in Vietnam.



can learn little from there about its future role in the US foreign policy in the East.” Put simply, they thought there was nothing to learn from the Korean War. Military strategy was going to continue to be based on the United States’ ability to use the atom bomb.

Aviation Continues to Develop: An Ongoing Process

Meanwhile, interest in aviation continued to grow and there were many developments in the expanding world of aviation. Air power’s huge contribution to World War II had made the world aviation-conscious.

Civil Aviation Developments

Another reason for aviation’s expanding popularity rested on the more than 2 million Americans involved in building aircraft in World War II. In addition, more than 16 million Americans served in uniform and witnessed air power first hand. Hundreds of thousands of servicemen and service women flew for the first time during the war, either as a crew member or as a passenger. Millions of people had been exposed to aviation and were now aviation enthusiasts.

Many of the military veterans knew what aviation could do, and many that played important roles in the war continued to publicize the merits of aviation. Some wrote or lectured, and some continued flying. They all recognized the importance of aviation as a transportation system and this created an immediate demand for commercial airline travel.

They also recognized that this demand would create the possibility to make money. Commercial aviation companies set out to take advantage of this opportunity and started competing for the potential profits of the commercial aviation travel industry.

Commercial Airlines

There were remarkable developments in aircraft design during the war. This led to better instrumentation, better navigation and increased safety. There were also larger and better airports available because of wartime requirements. Radar, which improved navigation and safety, had been developed. There were more and better pilots available than prior to World War II. Weather forecasting and the ability to fly through weather had improved. In addition, there were a large number of surplus airplanes available at a very good price.



DC-4



Immediately after the war, the most widely used aircraft was the Douglas DC-3. More than 10,000 of these were built during World War II for the Army who designated them the C-47. The C-47s were modified for commercial use to carry 21 passengers, and they worked fine for short flights.

For longer routes where traffic was heavier, two other aircraft developed for the Army Air Forces were available. These were the four-engine Douglas DC-4 and the Lockheed *Constellation*. The DC-4 had been built for the military as the C-54 and the *Constellation* as the C-69. The *Constellation* had two advantages over the DC-4. One was that it was pressurized, which allowed passengers to be taken comfortably higher in the air, and it was about 100 mph faster.

The DC-4, however, won the first round against the *Constellation* as a commercial airliner because there were many more DC-4s available to use. There were about 1,100 DC-4s built during the war whereas only a few hundred C-69s were built.

Eventually, the DC-4 was used by nearly every large airline, including foreign carriers. When the supply of “cheap” surplus DC-4s ran out and the airlines had to start buying new airplanes, the *Constellation* became the top-selling airliner. This resulted in both Douglas and Lockheed developing several versions of their aircraft, each bigger and better than the last. The DC-4 was followed by the DC-6, DC-6B, DC-7, DC-7B and DC-7C. Meanwhile, Lockheed countered with the *Super Constellation* and the *Starliner*.

During the competition, the Douglas aircraft grew from 44 seats (DC-4) to 105 seats (DC-7C),



The Lockheed *Constellation* was a “flying work of art.” (EAA)

and the *Constellation* grew from 44 seats to 99 seats (*Starliner*). Both the DC-7 and the *Starliner* were fast (300 mph) and long-range carriers. Both aircraft offered nonstop transcontinental service in about 8 to 9 hours and transatlantic service (New York to London). In all, about 800 DC-6s and DC-7s were built and about 650 *Constellations*. They were the airliners of the 1940s and 1950s and were the biggest, fastest, safest and most comfortable piston-engine airliners ever built.

Another result of the increase in speed and range of the DC-7s and *Super Constellations* was the death of flying boats. The large clippers had been developed in the 1930s when nonstop flight across the oceans was impossible. The flying boats were used briefly after the war, but they were made obsolete by the much faster Douglas and Lockheed aircraft.

In the short- and medium-length route market, the DC-3 was challenged by the Martin 2-O-2 and the Convair 240 in 1947-48. Both were faster, pressurized and offered the same comfort to the short-haul passenger that the DC-6s and *Constellations* offered the long-haul passenger. The 40-passenger Convair 240 was enlarged to become the 44-seat Convair 340 in 1952, and in 1956, it grew into the 56



seat Convair 440. There were more than 1,000 of these Convair aircraft built for civilian and military use, and later more than 200 were equipped with turboprop engines.

It was right after the war that the first all-cargo airlines came into existence. They were also used in World War II C-47s and C-69s, but they carried air cargo rather than passengers. There were many of these all-cargo airlines (such as Riddle, Resort, Slick, Flying Tiger, etc.) formed, but of this list only Flying Tiger survives today.



The Boeing Stratocruiser (EAA)

Commercial Airlines Adopt Jet Engines

With the military converting to jet fighters and bombers, it was inevitable that jet aircraft would also be developed for airline use. When this did occur, the first jets were British-built, not American, which is rather surprising since United States aircraft had dominated the airlines since World War II.

There are two types of jet propulsion: turboprop and “pure” jet. Both types use a gas turbine engine, the difference being that in a turboprop the gas turbine is fastened to a propeller that is used to propel the aircraft. There is some thrust provided by the jet exhaust, but the propeller provides most of the power. In a “pure” jet, all of the thrust is provided by the jet exhaust.

The British developed both the first turboprop and the first turbojet airliners. The Vickers *Viscount*, powered by four Rolls-Royce Dart turboprop engines, was the world’s first turboprop airliner. The *Viscount* first flew in July 1948 and went into commercial service in 1953. There was a total of 444 *Viscounts* produced in three series. The first series carried 47 passengers. This was increased to 75 in later models. The *Viscount* had a cruising speed of about 350 mph and a range of about 1,700 miles.

The DeHavilland *Comet* 1 was the world’s first “pure” jet airliner and entered service in May 1952. The *Comet* revolutionized commercial travel by increasing air speed to 500 mph. Also, it flew at a higher altitude (25,000 - 30,000 feet), which put it above most of the weather and made for a much smoother ride.

In 1954, two *Comets* had fatal accidents caused by structural failure. Flying at extremely high altitudes, a pressurized aircraft has a tremendous amount of pressure on the inside. In the case of the *Comet*, the aircraft could not withstand the pressure difference and explosive decompression occurred. This caused the aircraft to disintegrate in flight. This was a serious setback to the British aviation industry, but as a result, all later jets were safer because of the knowledge gained from the *Comet* 1 disasters.

In 1940, the year before we entered World War II, our nation’s airlines carried about 3 million passengers. By the end of the war in 1945, this figure was about the same due to wartime travel



The DeHavilland Comet 1

restrictions. By 1950, however, it had increased 600 percent to 17 million. By 1958, the year the first commercial jets were introduced, this figure had grown to about 30 million.

Thousands of military veterans found work in the commercial airline industry and many did very well in their new line of work. Discrimination, however, held many of the black aviators back. The established airlines did not hire any blacks, despite the fact that hundreds of ex-World War II military black pilots were very good pilots and eager to fly commercial planes. Refused employment in the airlines, these black pilots had to turn to other occupations and fly in their spare time.

In 1948, however, James O. Plinton broke the trend and established an inter-island air service, flying the Boeing 247-Ds. This air service linked the islands of Jamaica, Port-au-Prince (Haiti), Grand Turk and Caicos. It was probably the first commercial air service begun and operated by a black pilot.

In summary, the commercial aviation business boomed after World War II and did not decrease during the Korean War as it had during World War II. This occurred because the national war effort was

not as intense during the Korean War, and because we had enough large transport planes to serve both the military and civilian needs. This was true worldwide as well. Airline traffic increased from 3 million in 1938 to 18 million in 1946, and then to 24 million in 1948. The “Aviation Age” had arrived.



The Boeing 707 was America’s first operational jet airliner. (Boeing photo)

General Aviation

Meanwhile, general aviation also fared well after World War

II. There were thousands of pilots in America who had flown during World War II. Thousands more earned their pilot licenses using the GI Bill after the war. The Civil Aeronautics Administration (forerunner of FAA) predicted there would be 500,000 aircraft in service by 1950. This prediction failed to materialize, but there was a great demand for general aviation aircraft after the war. Surplus airplanes



Taylorcraft BC-12D

The 120 led directly to the Cessna 150/152 while the 140 was the direct ancestor of the Cessna 172. By the end of the 1950s, Cessna had grown to the number one general aviation manufacturer.

Piper Aircraft also resumed production of general aviation aircraft right after the war. Here, too, they initiated a change that has become a Piper trademark through the years. Their first new postwar aircraft was called the *Skysedan*. It was a four-place, all-metal, low-wing monoplane. Prior to World War II, all Piper aircraft were high-wing, fabric-and-wood aircraft. The *Skysedan* can be considered the direct ancestor of the *Cherokee* series of Piper aircraft.

Of course, Piper also left World War II with the most famous light aircraft of all time. The J-3 *Cub* was the traditional high-wing, fabric-covered aircraft. After the war, Piper continued production of the *Cub*, producing the Piper PA-28 *Super Cub* that had a high wing and was fabric-covered.

During the war, the general aviation manufacturers had been involved in building training, observation and liaison aircraft for the military. After World War II, they began immediately to convert over to building aircraft for civilian use. Generally, the initial aircraft they built were the same types they had been manufacturing for the military with whatever changes were required to get them licenses for civil use.

On December 7, 1945, just 16 weeks after the war ended, Beech Aircraft received a certificate for their Beech 18 executive aircraft. Beech had produced more than 5,000 Model 18s during the war and now began delivering the civilian model at the rate of two airplanes per day.

In 1947, Beech first offered an airplane that would become a classic. The Model 35 Bonanza was an all-metal, low-wing

filled some of this demand, but the manufacturers also began building new civilian airplanes immediately after the war.

In 1946, Cessna Aircraft brought out its first postwar aircraft called the C-120 and the C-140. Both of them were all-metal, high-wing monoplanes. The 120 was a two-place aircraft and the 140 a four-place. Prior to World War II, all Cessna aircraft were wood and fabric, but the new technology that developed during the war killed fabric aircraft. Both of these aircraft were very successful.



Cessna 140 (EAA)



retractable-gear aircraft that could fly at almost 200 mph. It was equipped with a two-way radio and all navigational gear required to fly at night and in all types of weather. This was the closest thing the public could get to a “fighter” and was so attractive that they had 500 on order before it made its first flight.

Cessna, Piper and Beech made themselves into the “big three” of general aviation manufacturers. Others,

such as Mooney, Rockwell, Maule, also made very good names for themselves in general aviation manufacturing. General aviation aircraft were clearly popular and there were profits to be made in the business.



Piper Cherokee 140 (EAA)

Aviation Research and Development

Much of the post World War II progress in aviation is directly related to the research and development done for the war. During the war, large-scale advances in research and development (R&D) occurred.

During the war, the National Advisory Committee on Aeronautics (NACA), which was founded in 1915 to do government-funded research in aeronautics, opened two more research centers. One was the Ames Research Center at Moffett Field, California, and the other was the Lewis Research Center in Cleveland, Ohio.

The aviation manufacturers also did a great deal of their own research, and many, such as Boeing and Lockheed, developed research facilities. They rivaled those of NACA, but most often industry research was done in support of the war. Generally, they contracted on a particular aircraft and not on researching basic questions about flight.

The research was mostly done by NACA or by a college or university under government contract. Many colleges and universities had departments of aeronautics and possessed wind tunnels to do research to support their graduate programs. Universities such as Purdue, Miami of Ohio, and Auburn are examples of schools involved in basic research in aeronautics.

During the war, a team effort between the NACA scientists and engineers, and their counterparts in industry and the universities led to some great developments. One example was the P-51 *Mustang*. A



need existed for a fast, long-range fighter escort in Europe. The requirements were known, so a team from North American Aviation, the Royal Air Force (RAF), and the Ames Research Center went to work. The result was the P-51, which was designed, built and flown in only 120 days. This aircraft was equipped with a revolutionary new wing design called the laminar-flow wing.

After the war, there was a need to continue this type of aviation R&D. Many problems needed solving and questions needed answering. This was particularly true in the realm of high-speed flight. The new jet fighters, and some of the most modern propeller-driven ones, began to approach the speed of sound. They encountered many strange things. When approaching the “sound barrier,” they would experience severe vibrations, or control reversal where the controls of the aircraft would function opposite to how they should function. In some cases, the aircraft did not make it through the experience and broke apart.

Research and development was so important that the Air Force formed a new command in 1950 called the Air Research and Development Command (ARDC) to lead the Air Force research effort. Part of the mission of ARDC was to do laboratory research and flight-testing. R&D is still very important and represents a massive on-going effort in the United States Air Force.

Airborne Research and Development

While some questions can be solved in the laboratory, eventually research aircraft must be built to test the laboratory theories. A number of experimental research aircraft were built and tested to solve complex aeronautical problems. Research findings from these aircraft have led to many supersonic and innovative aircraft.

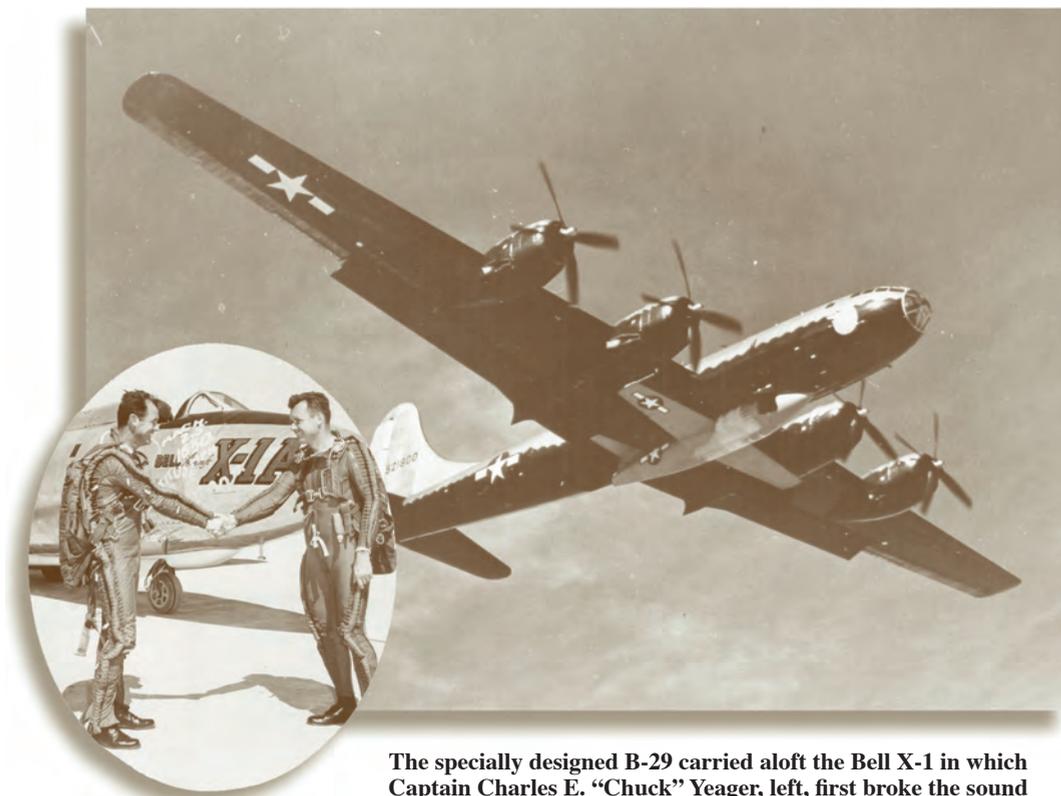
Some of the post World War II efforts include Republic company’s XF-91 two turbojet rocket engine in 1946, and the French ramjet aircraft called the *Leduc* 0.10. It was carried aloft by a Languedoc 161 transport and then released for its test flight.

Besides conventional airplanes, vertical-takeoff-and-landing (VTOL) aircraft also got their start during the 1950s. These experiments were attempts to lift off straight up as soon as the power to weight ratio of the turbojet was sufficient to lift an aircraft vertically on the jet thrust alone. One of these experiments was conducted by Rolls Royce in 1954. Their craft, called the *Flying Bedstead* was successfully flown straight up into the air. Also in the same year, the Convair XFY-1 *Tailsitter* took off vertically by means of a propeller mounted at the tail.

Breaking the Sound Barrier

One of the most famous tales today is the story of breaking the sound barrier. Several books and movies describe the events in some detail. The effort started in February 1945; the Army Air Forces and NACA decided to jointly develop a research aircraft to fly faster than the speed of sound. First, a contract was let to the Bell Aircraft Company to build a research aircraft to explore the problems of high-speed flight. This aircraft, called the X-1, made its first flight in January 1946.

There were actually six X-1 aircraft built for the flight tests. They were shaped like bullets, with short, very thin, nonswept wings, and were propelled by a rocket engine. Because their rocket engines consumed fuel at an extremely high rate, they could not take off from the ground. They would have



The specially designed B-29 carried aloft the Bell X-1 in which Captain Charles E. “Chuck” Yeager, left, first broke the sound barrier. Congratulating him is Major Arthur Murray who broke the altitude record of 90,000 feet in the Bell X-1A.

run out of fuel before they ever reached their operating altitude. The X-1 was carried to an altitude of 25,000 feet by a specially designed B-29 aircraft. The first flight tests were not powered and were designed to test its handling characteristics. They tested the X-1 by letting it glide to a landing on the dry lakebeds at Edwards Air Force Base, California.

Powered flights began on December 9, 1946, with the aircraft being flown a little faster on each flight. They experienced several problems as they approached the speed of sound. The aircraft would vibrate and become hard to control. Previous tests that tried to break the sound barrier had resulted in the aircraft breaking apart. Undaunted, the experiments pressed on, and on October 14, 1947, with Air Force Captain Charles “Chuck” Yeager at the controls, the X-1 penetrated the “sound barrier” and man first flew faster than the speed of sound. The speed the X-1 reached on that historic day was 670 mph at 42,000 feet.

Some of the other test pilots working with NACA were: Scott Crossfield, Pete Everest, Marion Carl, Bill Bridgeman, Kit Murray, Ivan Kincheloe and Mel Apt.

Flight tests continued with the X-1 and other aircraft too. These aircraft were pushed to higher and higher speeds. One of the most amazing discoveries was that once the aircraft passed the speed of sound, flight smoothed out and no further vibration problems existed.

In November 1953, Scott Crossfield reached the aviation milestone of Mach 2 (twice the speed of sound) or more than 1,320 mph. Although Crossfield had several hours in the X-1, he accomplished Mach 2 in the D-558-II *Skyrocket*.



In June of 1954, Yeager pushed the X-1A to a speed of 2.42 times the speed of sound (1,650 mph). Testing with the X-1 aircraft continued until 1956.

One test included having the X-1B outfitted specifically to test the effects of frictional heating on an airplane at very high speeds. This led to more tests with another experimental aircraft called the X-2.

This X-2 was designed to study heating in flight at three times the speed of sound. It was similar to the X-1, but had swept-back wings and a stainless steel airframe. Two of these aircraft were produced and, unfortunately, both were destroyed in accidents during the test program.

During its final flight on September 27, 1956, the X-2 flew three times the speed of sound. It had reached its design goal of Mach 3, but shortly thereafter, the X-2 disintegrated in flight killing the test pilot, Captain Mel Apt. Captain Apt's speed record of 2,094 mph, was not again approached until 1961.

The X-1 and X-2 series of aircraft were rocket powered. The next tests were done with the X-3, which was a jet powered aircraft designed to break Mach 3, three times the speed of sound. The X-3 was built of titanium alloy to protect it from frictional heating. Originally, there were three prototypes ordered from Douglas Aircraft, but only one was completed. The X-3 flew for the first time on October 20, 1952. It made more than 20 experimental flights. Unfortunately, however, the X-3 never flew Mach 3 because the jet engine did not have enough power.



The Douglas X-3 *Stiletto* was designed for aerodynamics, structural and other flight research in the Mach 2 range.

At the end of World War II, the United States captured the plans for the German Messerschmitt P-1101. The Bell X-5 was based on these designs and was the world's first aircraft with variable-angle wings.



Swept-back wings of a jet aircraft are very important. They are more efficient at high speeds and, in fact, are almost a requirement for supersonic flight. They do have one problem, however. The swept-back wings do not produce enough lift at low speeds to keep the aircraft flying. This means that the takeoff and landing speeds of the swept-wing jet are much higher than ones with straight wings. One solution to this problem is to be able to change the wing of the aircraft from straight wings for takeoff and landing to swept-back wings for high-speed flight. The X-5 was built to test this theory and provide the answers necessary to build variable-wing aircraft.

Two models of the X-5 were built, and the first flight was on June 20, 1951. The first prototype crashed in 1953, killing the test pilot Major Raymond Y. Popson. The second aircraft flew for several years and provided the knowledge necessary to build swept-wing aircraft like the F-111, F-14, and the B-1.

In summary, research and development made some outstanding contributions to air power and continues to do so today. The testing conducted in the 1950s led to many superior aircraft that eventually became operational aircraft that met the ultimate test, combat.

One example is the F-100 series of aircraft. In 1953, the F-100 *Super Sabre* flew for the first time at Edwards Air Force Base, California. This aircraft was the first in a line of superior aircraft, and was the world's first production supersonic fighter.

F-100 SERIES OF SUPERSONIC FIGHTERS

<u>Name</u>	<u>Date</u>
F-100 <i>Super Sabre</i>	1953
F-101 <i>Voodoo</i>	1953
F-102 <i>Delta Dagger</i>	1953
F-104 <i>Starfighter</i>	1954
F-105 <i>Thunderchief</i>	1955
F-106 <i>Delta Dart</i>	1956

F-106 *Delta Dart*



Lockheed F-104 *Starfighter*



Bomber Developments

Manufacturing companies also worked on developing better bombers for the military. President Truman and then President Eisenhower decided that US foreign policy would be backed by the strength of the atom bomb. So, America needed the best bombers to deliver the atom bomb.

In theory, no country would challenge the United States' powerful atomic threat. So, the United States Air Force needed more bombers and requested bids from the manufacturers for a high-performance, all-jet bomber.

As a result, the aircraft companies built three prototypes: the North American XB-45, the Convair XB-46 and the Boeing XB-47. All three had straight wings. The Boeing engineers, however, were not satisfied with their initial creation.

They studied the captured German reports on sweptback wings and decided to try them on their aircraft. The result was the XB-47, and it became the United States Air Force's first all-jet bomber. The XB-47 flew for the first time on December 17, 1947, and more than 1,600 of these aircraft eventually entered service with the Strategic Air Command.

The B-47 had one shortcoming and that was its range. Unrefueled, its range was only about 3,000 miles. Because of this, the Air Force decided it needed another bomber; larger with longer range than

the B-47. The result was another Boeing aircraft, the B-52. It flew for the first time on April 15, 1952. The B-52 is twice the size of the B-47 and has an unrefueled range of 10,000 miles.

During this time, the first supersonic strategic bomber, the B-58, was designed and built. It was a remarkable technical accomplishment, but very expensive to operate. Although the B-58 was faster than most fighter aircraft of its time, it was not that much better than the B-52. After a few years, the B-58 was retired.



The B-47 *Stratojet* was introduced in 1951. It was faster than many fighters during its time.

Smart Bombs: Advances in Guided Missile Research

During this same period, research on missiles also progressed, leading to some remarkable results in the 1950s. One of the first developments was a drone called the Northrup SM62 *Snark*. It was a jet-propelled, tailless, pilotless airplane that flew 6,300 miles at Mach 0.94. It was small and hard to shoot down. The *Snark* had inertial and stellar guidance systems. So, it could guide itself much better than a pure dumb bomb that fell like a rock. Inertial and stellar guidance gave it some navigational capability and it was therefore smart.



As technology got better, systems got smaller. This allowed the developers to put the technology they used in the *Snark* drone, into a smaller missile. Whereas the *Snark* was a pilotless airplane, the next system, the GAM 63 *Rascal*, was a small, rocket-propelled, supersonic winged bomb. In 1957, B-47 bomber squadrons carried it and launched it 100 miles away from the target. Once launched, the bomber crew guided it by radar to the target.

These changes in technology were significant. These new rocket systems allowed the bomber aircrews to stay farther and farther away from the target. By keeping their distance from the target, enemy fire would be less effective. In the long run, these new weapons would save lives.



The B-58 *Hustler* was America's first operational supersonic bomber.

The Vietnam Conflict

While all these advances were happening in the world of aviation, the United States became more and more involved in Vietnam. America's involvement in Vietnam can be broken down into four fairly distinct phases that cover a period of about 25 years.

Phase I, July 1950 - July 1954

In February 1950, France requested military and economic aid from the United States for its war with communist separatists in Vietnam. At the time, Vietnam was a French colony. President Truman responded by granting \$15 million in assistance in July 1950. He did so because he wanted to help the French stop the spread of communism in Vietnam.

To do this he established a US Military Assistance Advisor Group (MAAG). This unit initially consisted of 342 military advisors who advised the French Expeditionary Corps in its war against the



communists. This 4-year period was really a normal operation for the United States. As a part of US foreign policy, military advisors are often stationed in many countries around the world to help them set up their own defense forces, and also to help with other civil and humanitarian efforts.

Phase II, July 1954 - August 1964

During the next 10 years, US involvement grew from helping the French and the South Vietnamese, to fighting along side the South Vietnamese. It all started with the defeat of the French at Dien Bein Phu by General Giap and his Viet Minh forces. The Viet Minh were Vietnamese communist separatists who started the separatist movement.

Shortly after this defeat, the French agreed to pull out of their colonies in Southeast Asia. Vietnam, Cambodia and Laos were then recognized as independent countries at an international conference held in Geneva, Switzerland, in July 1954.

One of the agreements signed at the conference was an agreement for French forces to withdraw slowly and be completely out by 1957. At this point Vietnam was temporarily divided, at the 17th parallel, into two parts. This would continue until elections could be held to let the people elect their choice of governments.

The two choices were the communists who dominated the north and wanted to control all of Vietnam and a western representative type of government who dominated the South. No Vietnamese wanted to see a permanently divided Vietnam, and an election was scheduled to take place in July 1956. Unfortunately, it never happened, as both sides feared that they would lose. The result was exactly what the people of Vietnam did not want, and that was a divided nation. The stage was set for a civil war.

After the division of Vietnam, the newly formed government of South Vietnam requested assistance



MiG-17

from the United States. President Eisenhower authorized a military training mission to help reorganize the South Vietnamese military into a strong fighting force. At this point, US troops were not fighting in the civil war, they were helping South Vietnam organize, train and equip themselves.

The South Vietnamese struggled with the Civil War and by 1961 President Kennedy expanded the commitment of the United States. The goal was to prop-up the South Vietnamese military until they were able to conduct the war by

themselves. To do this, President Kennedy sent in US Special Forces, Air Force T-28s and B-26 bombers. By February 1962, over 11,000 US forces were in Vietnam and participating in actual combat.

Despite US participation, the civil war continued to go poorly for the South Vietnamese. Although several advisors to President Kennedy agreed that success in Vietnam was not likely, he decided to



increase US involvement. By the end of the Kennedy Administration, the U.S. had over 17,000 troops in Southeast Asia, and over 100 killed in a war not yet authorized by the Congress of the United States (only Congress can declare war).

Phase III, August 1964 - June 1969

On August 2, 1964, the destroyer USS *Maddox* was patrolling in international waters off the coast of North Vietnam and was attacked by North Vietnamese torpedo boats. President Johnson then ordered retaliatory naval air strikes against North Vietnamese coastal torpedo boat bases and an oil storage depot on August 5th. On August 7th, Congress passed the Tonkin Gulf Resolution, which allowed President Johnson to “take all necessary measures to repel an armed attack against the forces of the United States and to prevent further aggression.” This was the beginning of what was to become known as the “Vietnam War.” Although war was never declared by Congress, President Johnson used the Tonkin Gulf Resolution to justify the start of the “Vietnam War.”

In October and December of 1964 and in February 1965, the Viet Cong (North Vietnamese) launched several attacks, one against the US support base at Bien Hoa and another against Pleiku Air Base. Four Americans and two Vietnamese were killed and over 15 others were wounded. Several American and Vietnamese aircraft and helicopters were also destroyed.

The North Vietnamese were not giving in to continued American pressure. In response, President Johnson ordered systematic air strikes on selected targets in the southern panhandle of North Vietnam. In response, the communists increased their terrorist activity and sabotage of US bases. In March 1965, President Johnson called in the US Marines to protect US air bases, and thus slowly escalated US involvement in Vietnam’s Civil War.

By mid-1965 and despite President Johnson’s addition of 7 more US Army ground battalions, the war was still not going well for the South Vietnamese. In order to prevent a South Vietnamese defeat, President Johnson ordered B-52 bomber strikes on known communist bases.



One of the greatest bombers of all time is the Boeing B-52.



Operation Rolling Thunder: 1965-1968

The “tit-for-tat” air strikes were intended to warn of heavier punishment to come if the communists continued with the war. Unfortunately, President Johnson did not trust his military advisors, so he and his Secretary of Defense personally ran the Vietnam conflict. Unlike World War II where the objective was unconditional surrender of Germany, Italy and Japan, the objective of the Vietnam conflict was not so clear. In World War II, the military experts developed a strategy, ran it by the President for his approval and then conducted the war. In Vietnam, President Johnson called all the shots. He even picked out targets for the air strikes.

President Johnson’s objective was to raise the morale of the nearly defeated South Vietnamese Army, and to demonstrate to North Vietnam that if they did not start negotiations for peace, the bombings would continue. In the background, there was also another objective.

President Johnson did not want either the Soviet Union or the Chinese to enter the conflict and thus start a world war. This is why Operation ROLLING THUNDER was another gradual escalation of the conflict. This is also why President Johnson and Secretary of Defense MacNamara ignored the advice of their military experts, and



F-100F Wild Weasel Also Known as the Super Sabre

personally went through the maps of Vietnam and selected targets to be hit. This way they ensured the targets that were sensitive to either the Soviet Union or the Chinese were not hit. For example, surface-to-air missile sites were not targeted because there might be Soviet advisors at the sites. These kinds of rules made it seem like America was fighting with one hand tied behind its back.

The conduct of the war so frustrated the Army Chief of Staff, General Harold K. Johnson, that he later said, “I remember the day I was ready to go over to the Oval Office and give my four stars to the President and tell him, ‘You have refused to tell the country they cannot fight a war without mobilization; you have required me to send men into battle with little hope of their ultimate victory; and you have forced us in the military to violate almost every one of the principles of war in Vietnam. Therefore, I resign and will hold a press conference after I walk out your door.’”

The war continued. Operation ROLLING THUNDER lasted for 3 years and is the longest operation of its kind in history. It severely disrupted North Vietnam’s war effort and severely destroyed many ammunition depots, oil storage facilities, power plants and railroad yards. But, it did not destroy North Vietnam’s will to resist. The piecemeal attacks allowed the enemy to repair vital needs. Every time President Johnson ordered a stop in the bombing to see if North Vietnam would negotiate, the communists repaired and resupplied.

Success was hard to measure and it was being assessed every night during the five o’clock news. Television was now an affordable luxury for almost every American family and, as a result, families



nationwide saw the ugliness of war. President Johnson now had over 300,000 American soldiers in the area, and many were not coming home. As a result, the war became the most unpopular war in American history. Americans did not understand why Vietnam was worth the terrible cost in American lives, and they began to protest in mass.

The bombing during Operation Rolling Thunder was carried out by US Air Force B-52s and F-105s, while F-4s beat back North Vietnamese MiG-15, MiG-17 and MiG-21 fighters. The F-105 had a tough time because it was originally designed to deliver tactical atom bombs on large targets in a World War III-like scenario against the Soviet Union. It was not an all-weather, nighttime fighter-bomber. American airmen, however, made it work.

One technological advantage was putting “eyes into the skies.” The Air Force put an early warning radar on top of a cargo plane to look for enemy MiG fighters taking off from their airfields. As soon as they were spotted, the Air Force EC-121 directed Air Force and Navy aircraft where to engage the enemy.

The North Vietnamese countered this with Soviet-built technology called surface-to-air missiles (SAMs). Combined with anti-aircraft artillery (AAA) fire, the SAMs and the AAA created a good defensive curtain against US air power. It was not undefeatable however. Tactics were developed to counter the threat.

One such tactic was to use the EC-66 aircraft to confuse enemy radar. This was a large cargo aircraft equipped with high technology equipment. The EC-66 sent out electronic signals that confused the enemy’s radar so that they could not see US aircraft coming towards them.



The UH-1 *Huey* Helicopter became a *symbol* of the Vietnam War.
(EAA)

Placing radar-detecting equipment on board a fighter aircraft created another tactic. The first of these aircraft were F-100Fs, called *Wild Weasels*. The *Wild Weasels* could find enemy radar and then use a new radar homing missile to destroy them. The new missile called the AGM-45 *Shrike* had a radar receiver in it. The AGM-45 *Shrike* used the receiver to find the enemy’s radar. When the enemy had their radar on, the receiver would find it and then follow it all the way to it. Then it exploded and destroyed the enemy’s radar.

Another development was the US Navy’s A-6 bomber. Launched from the Navy’s aircraft carriers off the coast of Vietnam, these small fighter-bombers were all-weather capable because of the sophisticated radar that they used to distinguish large targets, such as an airfield, from the surrounding area.

The Navy also used a television-guided glide bomb. This bomb was called the Walleye. This was

AMERICAN TROOPS IN VIETNAM

31 Dec 65	184,000
31 Dec 66	385,300
31 Dec 67	485,600
31 Dec 68	536,100
30 Apr 69	543,400



another step toward “smart” weapons. “Smart” weapons were preferred because pilots could launch them far away from the targets and thus stay away from enemy defensive weapons.

Meanwhile, the war progressed and US involvement increased. In mid-1966, US troops launched their first prolonged offensive aimed at destroying communist units and bases. Reports coming back to the United States via television sounded good as President Johnson trumpeted the news.

Unfortunately, what was really happening was that the enemy was running from the conventional fight and resorting to guerrilla warfare. This way they did not have to fight a superior US force head-on. Instead they used hit-and-run tactics, then disappeared into the dark jungle to hide. This worked until 1968.



The Deadly MiG-21

The Tet Offensive

In January 1968, the communists launched a large-scale surprise conventional attack on US and South Vietnamese forces. Abandoning small guerrilla warfare attacks, the North Vietnamese attacked during a holiday cease-fire. Simultaneous attacks were carried out all over South Vietnam. Hoping that the South Vietnamese would give-in, the North Vietnamese attacked 36 of the 44 provincial capitals in South Vietnam. They attacked 23 airfields and five of the six principle cities, including the capital of South Vietnam, Saigon. Fighting went block to block in the cities. Enemy soldiers even entered the American Embassy in Saigon. Americans watching on television were shocked.

Air power did everything expected of it during the attacks. In fact, with the enemy now out in the open and not hiding in the jungles, air power worked even better. Close air support missions leveled enemy troops engaged with US and South Vietnamese forces. Enemy supply lines were cut and, probably the worst thing for the enemy, US troops were airlifted quickly thereby reinforcing, then



The F-105F, *Thunderchief*, was used extensively during the Vietnam War.



overwhelming communist forces.

At one point, more than 12,000 troops were moved within hours from southern military regions to northern areas under attack. US C-130s moved men, ammunition and supplies quickly and effectively. Meanwhile, 6,000 US Marines needed help as they were barely hanging on at Khe Sanh. Unlike when the communists defeated the French by surrounding them at Dien Bien Phu, the US Marines were going to win because of air power.

The battle for the Marine base at Khe Sanh lasted over 2 months. More than 20,000 air attacks destroyed over 3,000 communist trucks that were supplying North Vietnamese forces. Another 25,000 sorties dropped over 110,000 tons of bombs on the enemy. Air Force cargo planes air-dropped over 12,000 tons of supplies into Khe Sanh while under constant enemy



The incredible A-1H Skyraider was capable of carrying a bomb load with as much destructive power as a WWII bomber.

fire. In the end, some 6,000 US Marines, previously surrounded at Khe Sanh, won the battle, and over 10,000 communist troops were killed.

All total, the North Vietnamese communists lost over 50,000 in the Tet Offensive battles. They were turned back and out of South Vietnam. But the battle changed the political and social climate in the United States. The Tet offensive was brought into America's living rooms every night. There were now over 500,000 American forces fighting an undeclared war in Vietnam. American soldiers were dying in a war they were told that we were winning. The American public did not understand what was going on or why.

Shortly after the Tet offensive, President Johnson surrendered to the public's protests about the war and decided not to run for a second term. The next President would win the presidential race by calling for a US withdrawal from Vietnam.

Phase IV, June 1969 - April 1975

On January 22, 1969, Richard Nixon replaced Lyndon Johnson as President of the United States. Nixon campaigned on the promise to "end the war and win the peace."

The plan to end America's involvement in the war was called Vietnamization. The basic idea was to gradually turn the fighting over to the South Vietnamese after building up their supplies and fighting abilities. The plan was implemented and, by the end of 1971, it appeared that South Vietnam might be able to win the war.

As President Nixon had promised, American forces began to leave Vietnam. Nearly 545,000 troops were there in 1969, and President Nixon's goal was for that number to be down to less than 70,000 by May 1972. While the Americans were leaving, however, the North Vietnamese were building up along



the demilitarized zone between North and South Vietnam. The US Air Force responded with over 1,000 sorties bombing SAM and AAA sites.

Unfortunately, the attacks only delayed the impending North Vietnamese attack. While the United States was withdrawing troops from Vietnam, the Soviet Union was arming the North Vietnamese with new guns, SAMs, tanks, and MiG-15, MiG-17, MiG-19 and MiG-21 fighter aircraft.

On Good Friday, March 30, 1972, 120,000 North Vietnamese Army troops invaded South Vietnam again. President Nixon reacted with B-52 strikes, the first since 1968. This campaign, named Operation LINEBACKER, was different from President Johnson's Operation ROLLING THUNDER. President Nixon trusted his military advisors and let them run the campaign. Unlike President Johnson, who selected targets while having lunch on Tuesday afternoons, President Nixon let the military experts run the campaign. At the same time, Henry Kissinger, the President's National Security Advisor, talked to the Chinese and the Soviets about the war. Even with the Soviet's help, North Vietnam did not want to negotiate.

With US troops still leaving Vietnam as scheduled, the South Vietnamese troops fought hard to defend their country. Support came from the US Air Force, Navy, and the relatively new Royal Vietnam Air Force. Together they prevented the North Vietnamese from overrunning the country. The war was

now in the hands of the South Vietnamese Army and they had stopped the invasion with the help of US air power.

Since the North Vietnamese still did not want to negotiate, President Nixon launched massive air attacks. Operation LINEBACKER was designed to not only bomb the Vietnamese to the negotiating table, it was designed to cut off North Vietnam from Chinese and Soviet supplies, and destroy their ability to make war.

Operation LINEBACKER was conducted without as much worry about Chinese and Soviet reactions to the war.



F-4 Phantom was the workhorse of the Vietnam War.

North Vietnam's harbors were mined so that Soviet supplies could not enter the country, and railroad lines heading from China into Vietnam were destroyed. In addition, SAM sites were no longer off limits.

The result was an all out air war between Soviet built MiG fighters and the US F-4s, and between American bombers and Soviet built SAMs and AAA. The fighting was intense. Each side gained a short-lived advantage over the other by changing tactics and procedures, or by developing a technological counter to the threat.



The Versatile F-4 Was a Workhorse During Vietnam

One such example was the continuing development of precision guided munitions or smart bombs. The Thanh Hoa Bridge survived hundreds of missions by Air Force and Navy bombers. It seemed like nothing could destroy that bridge. After losing dozens of pilots and planes to that bridge, one mission consisting of 14 F-4s, armed with new laser guided bombs, destroyed the bridge. Technology had found a way to get the job done, and more importantly to save lives in the process.

By October of 1972, US ground forces had withdrawn from Vietnam and the bombing of North Vietnam had resulted in negotiations. The negotiations did not proceed well, however, and President Nixon ordered more bombing on December 18th. This operation, dubbed LINEBACKER II, was aimed at driving the North Vietnamese back to the negotiating table.

US Air Force B-52 bombers were lined up in long waves. It was reminiscent of World War II. It looked like the waves of B-17 and B-24 bombing attacks on Germany during World War II. For 11 days, B-52 bombers attacked 34 targets in North Vietnam dropping over 15,000 tons of bombs.

It was a very large team effort. Escort duties were handled by Air Force F-4s. Meanwhile, Navy EA-6 and EA-3 aircraft jammed North Vietnamese radar, and Air Force F-105s and Navy A-7Es attacked SAMs. Even though the enemy was able to get off over 900 SAMs at the B-52s, only 15 bombers were lost.

ACES IN VIETNAM

Captain Charles de Bellevue, USAF	6
Captain Steve Ritchie, USAF	5
Captain Jeffrey Feinstein, USAF	5
Lieutenant Randy Cunningham, USN	5
Lieutenant J. G. Willie Driscoll, USN	5
Colonel Tomb, North Vietnamese Air Force	13

NOTE: The war produced five American aces and one known North Vietnamese ace.



The A7D Corsair II saw duty in Vietnam and later in many Air National Guard units.



Air Power in Vietnam

In summary, the United States used air power as a foreign policy tool during the Vietnam War. President Johnson's initial objective for air power was to raise the morale of the South Vietnamese Armed Forces and to contain the military advances of the communists.

As America became more deeply involved in the conflict, the doctrine of gradualism restricted the use of air power. President Johnson did not really want to get involved in an all out war. He therefore decided to use small portions of military power to influence enemies. This is why he did not set forth on an all out war against North Vietnam. Air power was used to support ground troops, deny the communists areas of sanctuary, punish the North Vietnamese, limit the flow of enemy troops and supplies, and coerce the communists to negotiate.

Comparative American War Costs

The President's gradualism policy and his personal hands-on day-to-day control of its use restricted air power's proper use in Vietnam. These policies took away many fundamental principles of success in war. Under this policy, the politicians committed American air assets piecemeal, restricted certain targets from attack, dictated the frequency and level of attacks, and even limited certain types of tactics. As a result, this allowed North Vietnam to study American strategy, weapons and tactics. The government in Hanoi was able to build up its air defenses and disperse its people, supplies and industries, and force the United States to lose billions of dollars and thousands of lives.

In contrast, the employment of air power changed drastically under President Nixon. Gradualism was discarded and military leaders were allowed to plan and execute what they believed were the best plans to obtain the President's objectives. President Nixon authorized senior field commanders to make day-to-day decisions, and he lifted restrictions on many targets that had been off-limits. This time when the North Vietnamese invaded, President Nixon's reaction, Operation Linebacker, cut off North Vietnam from external supply sources, and stopped the communist advance.

In mid-December 1972, when peace talks in Paris broke down, President Nixon decided to punish North Vietnam and drive them back to the negotiating table. Operation LINEBACKER II was the only true strategic bombing campaign of the war, and 12 days after its start, North Vietnam was negotiating a cease-fire. This time air power was swiftly and massively applied to the heart of North Vietnam. Although it is not known for sure, this proper application of air power may have shortened the war.

	COSTS	
	Battle Death	(In Billion \$)
World War I	53,500	\$ 22.6
World War II	292,100	\$ 310.4
Korea	33,600	\$ 18.0
Vietnam	47,200	\$ 138.9



Meanwhile: The Cold War Continues



The F-14 *Tomcat* was a frontline fighter for the US Navy used at the end of the Vietnam War.

It is debatable whether both the Korean War and the Vietnam War could have been avoided if the end of World War II had been handled better. At the end of World War II, the Japanese were defeated and a power vacuum was created. In the case of both Korea and Vietnam, the communists filled that vacuum and the countries were split in two. Conflict was nearly inevitable.

The Soviet Union was pushing the spread of Communism while the United States tried to contain it. Both had the capability to use the atom bomb and were, therefore, feared by many. However, most of all, the world feared a war between the two.

As a result, both countries created large defenses designed to deter the other from attacking with atomic weapons. The large defenses consisted of early warning systems and interceptor type aircraft. Unfortunately, as defensive systems got better, offensive systems were developed to overcome them. The result was an arms race.

Research and development expanded as both nations strived to develop the ultimate weapon. In charge of most of this effort in the United States was the Air Force's Strategic Air Command (SAC). SAC grew into a very large command whose primary mission was to defend the United States from atomic (later called nuclear) attack.

To perform their mission, SAC bought hundreds of B-52 bombers and KC-135 tankers. The tankers refueled the bombers in the air, thereby allowing the bombers to fly farther. The bombers and tankers were stationed throughout the United States and in some overseas areas as well.

As the arms race continued, some analysts feared that the only way to win a war would be to preempt the enemy from using his bombs. In other words, if you launched a surprise attack, you could destroy most of the enemy's weapons before he had a chance to use them. This way you could win



and, hopefully, only endure a little damage. As this thinking spread, reconnaissance, surveillance and command and control became more important.

Reconnaissance aircraft, like the U-2, flew over the Soviet Union to locate where the Soviets were hiding their missiles. As missile technology and space power improved, both the Soviet Union and the United States created missiles that could fly across the world and deliver a nuclear weapon. Missile fields soon spread across the United States and the Soviet Union.

This placed an even greater emphasis on space power. Satellites were needed to constantly watch over the enemy's missile fields so that they could not launch a surprise attack. The information from the satellites had to be monitored constantly. This resulted in the creation of hardened underground command posts; hardened to withstand a nuclear attack. Once the command post survived the initial attack, they could launch a retaliatory strike.

As the arms race continued, missiles could go farther and became more accurate. Command posts were, therefore, vulnerable and a new system had to be developed. The new system was a mobile airborne command post designed to mirror the capabilities of the now vulnerable underground command post. SAC called their airborne command post "Looking Glass" for this very reason. It could do everything the underground post could do, including launching the nuclear missiles. To do their mission, Looking Glass aircraft flew constantly to ensure that no one could launch a surprise attack and destroy US command and control capability. In fact, for over 29 years SAC had at least one Looking Glass aircraft airborne over the United States every minute of the day.

The arms race produced faster and better aircraft, missiles, radar and satellites. Some weapons became smarter as precision guided munitions developed further, and some weapons even appeared to



AWACS—the Air Forces' *Eyes in the Sky*



get smaller. Becoming smaller was important because radar had become better. Radar could detect and identify aircraft miles away, which therefore made them vulnerable to attack. What was needed was a way to hide from radar. This new dramatic development was not a function of speed, nor was it really about size. It was radar cross section.

Earlier, this text discussed the Battle of Britain and the British use of radar. They used the radar to see when the Germans were coming across the English Channel. This gave them increased warning time and allowed them to get their fighters in the air and defend England from attack. The radar worked by sending out an electronic pulse. When the pulses bounced back, there was something there. Large targets bounced back pulses that could be seen by radar very easily. This was because they had a large radar cross section.



B-2 Spirit (Boeing photo)

What was needed was a way to avoid detection, and the experts in research and development did it. They did it by making an aircraft from material that absorbs some of the electronic pulse and deflects the rest of it. This way only a small portion of the radar's electronic pulse is bounced back. The blip on the radar screen is so small, and the radar cross section is so small, it can not be distinguished as a plane. This is what led to the development of the B-2 Bomber: a stealth (hard to see by radar) bomber designed to fly through Soviet air defense systems.

End of the Cold War

The Cold War and the arms race that came with it started right after World War II and ended in 1989 with the fall of the Berlin Wall and the collapse of the Soviet Union. Many conflicts were fought and billions of dollars were spent. In the final analysis, the lack of dollars may be why the Soviet Union collapsed.

Between World War II and 1989, the Soviet Union faced off against the United States and its Allies over a dozen times. Wars in Korea and Vietnam were fought between the United States and enemies backed by the communist Chinese and the Soviet Union. Middle Eastern conflicts between Israel and



her Arab neighbors were also backed by both the Soviet Union and the United States. Almost every continent in the world was affected by the Cold War.

Every US president since the end of World War II had to deal with the Soviet Union, and all of them share in the ultimate US victory. President Eisenhower fought the communist expansion in Korea. President Kennedy stood fast when the Soviets tried to place medium-range missiles in Cuba. President Carter objected to Soviet expansion into Afghanistan, and President Reagan outspent them.

The best aspect of the Cold War is that an all-out war between the Soviet Union and the United States never occurred. Great restraint was exercised many times by many leaders and many soldiers, sailors and airmen. Although dozens of soldiers, sailors and airmen lost their lives on spying missions, an all-out war never happened.

Although there is some debate, most agree that the key element of the Cold War was economics. The United States simply outspent the Soviets. When President Reagan decided to build a strong military to counter the Soviet threat, the Soviet Union reacted. Bigger tanks led to more tanks, better airplanes led to even better airplanes, and better missiles led to better missile defense. Missile defense was probably the straw that broke the camel's back. President Reagan's missile defense system, called "Star Wars" by some and the Strategic Defense Initiative officially, was a huge undertaking and a great expense.

The Soviet Union's economy simply could not sustain the pace. The communist central planning system was plagued with problems that resulted in labor and food shortages and, in turn, hurt industrial productivity. With the economic problems at home and the constant military struggles overseas, the Soviet Union was overextended.

The wall that separated East and West Berlin came down, and the Soviet Union separated into independent states.



The Lockheed TR-1A spy plane could operate at altitudes well above 90,000 feet.



War in the Desert

With the end of the Cold War, the stage was set for the most dominating display of air power the world had ever seen. On August 2, 1990, Iraq invaded Kuwait over a dispute concerning oil and outstanding Iraqi loans. The Emir of Kuwait fled and the Iraqis were in complete control by August 4th.



The F-117 Nighthawk has the radar signature of an insect.



F-15E Strike Eagle is considered by many aviation authorities to be the finest jet fighter in the world. (Boeing)

Operation Desert Shield

Fearing an advance into the Kingdom of Saudi Arabia, King Fahd asked the Kingdom's allies for defensive assistance on August 6th. The United Nations immediately passed Resolution 660 demanding an Iraqi withdrawal, and President Bush ordered an immediate military deployment to defend Saudi Arabia from Iraq. By August 8th, Tactical Air Command's 71st Fighter Squadron was in Saudi Arabia and ready to defend. Operation DESERT SHIELD had officially started.

Within 5 days, more fighter squadrons arrived, and soldiers of the 82nd Airborne Division arrived via airlift. Egyptian and Moroccan forces arrived on August 11th, and American B-52s arrived in Diego Garcia, poised and ready to strike. By August 21st, American F-16, F-15E, F-4G, F-117, A-10, E-3B, RC-135, KC-135, KC-10, and C-130 aircraft had arrived.



That day, Secretary of Defense, Dick Cheney, declared that the threat of an Iraqi invasion had ended. Air power had already achieved its first victory in the desert.

The UN passed a resolution calling on the Coalition Forces to use “all means necessary” to compel the immediate and unconditional withdrawal from Kuwait all Iraqi forces, if Iraq did not comply by 15 January 1991. They did not. US, French and British troops arrived in Saudi Arabia, followed by forces from Saudi Arabia, Italy, Canada, Egypt, Syria, Qatar, Bahrain, Pakistan, Czechoslovakia, United Arab Emirates, Morocco, Bangladesh, Senegal, Niger, Germany and Belgium. DESERT SHIELD soon became the most massive airlift in the history of air power. Six weeks into the airlift operation, DESERT SHIELD had already flown more ton-miles than during the entire Berlin Airlift, and the Berlin Airlift took 10 times longer. The huge airlift operation was truly a team effort, composed of US Air Force active duty, Reserve, Air National Guard, and US commercial airliners. For the first time in history, the Civil Reserve Air Fleet (CRAF) was activated. Thirty-eight commercial airliners contributed cargo and passenger aircraft to the airlift effort. By the end of the operation, a total of 158 CRAF had been called to active duty.

War planners adopted the lessons of Vietnam into their preparations. Unlike Vietnam, President Bush let the military war planners develop and use their plans with little interference. As Commander-in-Chief, President Bush also set clear and measurable objectives for the military to accomplish. These were to first deter further Iraqi aggression and defend Saudi Arabia. This new initiative was called Operation DESERT STORM. The next objective came from the United Nations calling on the troops to expel Iraq from Kuwait. Again, these objectives were clear and measurable. The whole world understood that the objective was to restore the country of Kuwait, and that would be done when the Iraqis were completely out of Kuwait.

Previous air campaigns, like the Combined Bomber Offensive during World War II, had attacked



C-130 H Hercules is the workhorse of several air forces.

targets one at a time. When attention was focused on the next target, the enemy repaired the previous target. This time air campaign planners directed that targets would be attacked at the same time and keep the pressure on so they couldn't be repaired. In addition, they planned that all forces would work together. In Vietnam and Korea, the air campaign was divided up. The Navy would work one area and the Air Force worked in another. This time everyone worked as an integrated part of one team.



The plan was called an Air Tasking Order (ATO), and every day a new ATO was issued to all nine of the different air forces in the UN coalition.

This enhanced the effort of the entire coalition. The lessons learned during the World War II North African Air Campaign did not go unnoticed. Air Forces work better when there is one person directing the effort. This allows one person to mass and concentrate the air force effort where it is needed the most. It cuts down on wasted or duplicate effort, and allows for the different units to work off of each other's strengths.

The final coalition air campaign plan called for four phases: (1) target Iraq's command and control sites, air bases, surface-to-air missiles (SCUD) sites, Iraq's nuclear, biological and chemical facilities, and Iraq's war making industry, (2) target enemy air defenses to ensure unhindered flying over Kuwait, (3) cut supply lines and target the enemy's main troops in Kuwait, and (4) close air support of friendly troops as they conduct the ground campaign.

After several attempts were made to allow Iraq to leave Kuwait, and after the January 15th UN deadline for Iraq to leave had passed, the war started. Early on the morning of January 17, 1991, Special Operations Forces headed towards one enemy radar site. The idea was to open a small window in the enemy's defensive curtain; then fly through it, turn around and destroy the rest. While US helicopters attacked the radar site, low observable F-117 Stealth Fighters flew into Iraq and went all the way to downtown Baghdad. US naval ships launched Tomahawk Land Attack Cruise Missiles (TLAMs) and another 400 other fighter and bomber aircraft entered Iraq.

Just as the air campaign plan called for, the first day of the war saw a parallel attack. Air attacks were conducted on the largest number of separate targets in the shortest period of time in the history of war. Indeed, the major damage occurred in the first 10 minutes. Within that timeframe, the lights went out in Baghdad, microwave towers, telephone relay stations, cables and land lines were destroyed; thus destroying Saddam Hussein's ability to communicate. During the next hour, Iraq's integrated air defense system had collapsed. Hussein could not communicate, and his defense systems were being destroyed. Surface to air missile (SAM)



The FB-111A is a potent weapon system. Because of its unusual shape, it has been named the Aardvark!



and fighter air bases were attacked, radar was destroyed and command centers were reduced to rubble. Within several hours, attacks left key Iraqi airfields full of craters and known nuclear, biological and chemical weapon storage sites were rendered unusable. With no command and control system, the Iraqi Air Force ceased flying or risked being shot down. Air superiority had been won and now the battlefield was prepared for the ground campaign.



The A-10 Warthog was designed to be a tank killer. It proved itself in combat during the Gulf War in 1991.

In a desperate move to inflict US casualties and thereby erode American support at home, Iraq launched an attack into Saudi Arabia on January 29th. The plan called for a two-pronged strike that would go through the Kuwait Wafra Forest and other would be through the small Saudi Arabian border town of Khafji. However, the element of surprise was taken away from the Iraqis as US Air Force E-8 JSTARS aircraft spotted the Iraqi tanks moving toward the border, as well as US Marine Corps personnel spotted their nighttime move, three miles away. While the bulk of the Marines pulled back, some of them hid on top of a building in the outskirts of Khafji and called in air strikes. The Iraqis tried to move forward, but their reserves were cut off by coalition air strikes once the main movement was spotted. Attacked by F/A-18s from the USS *Saratoga*, and USAF A-10s, B-52s, and Special Operations AC-130 H Gunships for the next three days, the Iraqis only held Khafji for a day and were driven back into Kuwait. While the USAF lost one AC-130 gunship and its crew of 14, the Iraqis suffered 2,000 casualties and lost over 300 tanks.

On the 22nd of February, President Bush demanded Iraq's withdrawal from Kuwait or they would be forced out. Iraq again refused. The next day the ground war started at 4:00 am local time. Lacking the same big picture that the United States received from its satellites in space, Iraq had no idea that coalition forces had moved and were attacking from the west.

The left hook maneuver was made possible by cutting off Iraq's ability to communicate, and by keeping our own plans secret. The surprise attack from the west was accompanied by a straightforward push north into Kuwait, then another northeastern push through southwestern Kuwait. UN forces reached Kuwait City on the 25th of February. The vaunted Iraqi Republican Guard, elite units of the Iraqi Army, was no match for US and British armor.

UN casualties were extraordinarily low with 95 killed, 368 wounded, and about 20 missing during the 100-hour war. The Iraqis mostly abandoned their positions before UN forces arrived. Escaping forces were caught by coalition air power and pummeled. Iraq's losses were difficult to assess, but at least 60,000 Iraqis were captured, while another 30,000 and 60,000 were killed and at least 50,000



were wounded.

The poor Iraqi performance can be attributed to three factors. First, coalition air power completely dominated the Iraqi forces. They were denied aerial intelligence and coalition bombing destroyed their ability to communicate. Further strikes severely weakened their forces and ability to resupply. Second, Iraqi morale and the will to fight was devastated by continued coalition air strikes. Widespread desertions seriously



The state of the art C-17 jet transport now serves the USAF around the world. (Boeing)

weakened combat units. Only a few Iraqi units held together for the fight and they were surprised by the coalition left hook and their lack of knowledge of the coalition's advance. Lastly, Saddam Hussein made the mistake of letting UN forces build up. If Iraq had attacked Saudi Arabia and taken the ports, it would have been extremely hard and potentially very costly to land forces in Saudi Arabia.

The victory in the Gulf did exactly what UN Resolution 670 called for—the expelling of Iraqis from Kuwait and the Kuwaiti's return to their homeland. President Bush perhaps summed up the victory best in his commencement address at the United States Air Force Academy in Colorado Springs, May 29, 1991: “Gulf lesson number one,” he emphatically stated, “is the value of air power.”

Operation Allied Force

The breakup of Yugoslavia proved to be the North Atlantic Treaty Organization's (NATO) greatest challenge in the 1990s. Militant Serbian nationalism and policy of “ethnic cleansing” promoted by Yugoslavian President Slobodan Milosevic created a crisis in Kosovo in 1999. Meanwhile, Albanian separatists in the Kosovo Liberation Army (KLA) fanned the flames of violence. After diplomatic talks broke down, NATO worried about potential genocidal civil war and destabilization throughout the Balkans. As NATO debated intervention in early 1999, President Milosevic unleashed a ruthless offensive designed to crush the KLA and drive ethnic Albanians out of Kosovo. Faced with a massive humanitarian crisis, NATO turned to airpower.

In early 1992, General Merrill McPeak, Chief of Staff of the Air Force, revised the mission of the Air force: “to defend the United States through control and exploitation of air and space.” Resultant



organizational changes permitted the Air Force to attain an unprecedented level of integration between air and space capabilities by the time the Air War over Serbia (AWOS) commenced in 1999. On 24 March 1999, President Bill Clinton commenced Operation ALLIED FORCE (OAF), announcing three objectives: demonstrate NATO's opposition to aggression; deter Milosevic from escalating attacks on civilians; and damage Serbia's capability to wage war against Kosovo. Milosevic and Serbian forces presented US and NATO forces with an opponent with a capacity for skilled propaganda and utter ruthlessness. The ensuing 78-day battle would be directed against both the Serbian military and Milosevic's propaganda efforts.

From 24 March through 9 June 1999, NATO air forces flew over 38,000 sorties, with 13 of NATO's 19 nations pressuring Milosevic, destroying Serbian fielded forces engaged in Kosovo, and maintaining popular support for intervention. Initially, 214 strike aircraft followed a limited air campaign against approximately 50 targets. The Northrop Grumman B-2 Spirit flew its first combat missions, delivering 650 Joint Direct Attack Munitions (JDAMs) in forty-nine 30-hour sorties from Whiteman AFB, Missouri. On 27 March 1999, Serb air defenses shot down an Air Force F-117, but Combat Search and Rescue personnel recovered the pilot. After weeks of caution and frustration, NATO expanded the scale of the air campaign. The USAF sent 563 aircraft and 13,850 American Airmen to 24 deployed locations.

By June 1999, NATO airpower accomplished its objectives. However, despite a concerted effort to avoid civilian casualties, at least 20 major incidents occurred, including the accidental bombing of the Chinese embassy on 7 May 1999.

The 1999 air campaign against Serbia proved precise, effective, and rapid airpower represented the only means available to coerce an implacable foe. Assessments of Operation ALLIED FORCE concluded that air and ground commanders must agree on the enemy's centers of gravity (those characteristics, capabilities, or sources of power from which a military force derives its freedom of action, physical strength, or will to fight) and that micromanagement of the targeting process limits military effectiveness.



The McDonnell Douglas AV-6B Harrier II was originally developed by the British and is currently in use by the US Marine Corps. It can hover like a helicopter, yet fly an attack mission at speeds in excess of 500 mph.



The KC 135R Stratotanker and their crews are the unsung heroes of many air campaigns.

The Global War on Terrorism

Operation NOBLE EAGLE

On 11 September 2001, 19 terrorists from Al Qaeda, an Islamic extremist group, hijacked four airliners and crashed them into New York City's World Trade Center, the Pentagon, and a remote field in Pennsylvania, killing about 3,000 people in all. In response, President George W. Bush declared a global war on terrorism. Operation NOBLE EAGLE immediately focused on protecting the US homeland from both internal and external air attacks of the nature used on 9-11. US Air Force fighter, tanker and surveillance air assets provided up to 24-hour intercept response coverage for virtually the entire US in the form of ground alert and airborne combat air patrols over designated locations. Civil Air Patrol was also called upon to conduct reconnaissance flights over the devastation for accurate assessment by government agencies.

Operation Enduring Freedom

Operation Enduring Freedom (OEF) focused an international coalition, with forces from the United Kingdom, Australia, Canada, the Czech Republic, Denmark, France, Germany, Italy, Japan, Jordan, the Netherlands, New Zealand, Norway, Pakistan, Poland, Russia, Spain and Turkey. As of our final revision of this publication, Operation Enduring Freedom continues in hopes that a new democratic government can be established and the troops can return from the conflict in Iraq.



The F-16 Fighting Falcon is one of the greatest fighters of the 20th century.

The Future

There have been many remarkable accomplishments in the short time since the Wright brothers flew for the first time. The history of flight is filled with these remarkable stories and this text has tried to explore several of them. As each unsolvable problem is miraculously accomplished, new doors open and more unsolvable problems need to be solved.

Are these problems unsolvable or will new developments and accomplishments solve them just as they have all others? Only time will tell, but, without a doubt, there will be even more amazing developments in the future. Part One of this book has dealt with many of them, but there are more to come.



Key Terms and Concepts

- Cold War
- National Security Act of 1947
- Strategic Air Command (SAC)
- B-36
- P-51
- HE-178
- F-80
- ME-262
- vengeance weapons
- V-1 and V-2
- R-4
- Berlin Airlift
- C-47
- Korean War
- 38th Parallel
- radar
- DC-4 and the Constellation
- Convair series airliners
- turboprops and pure jets
- Vickers Viscount
- DeHavilland Comet 1
- Cessna, Piper, and Beech
- National Advisory Committee on Aeronautics (NACA)
- sound barrier
- X-1 and X-2
- swept-back wings
- century series fighters
- B-47, B-52, B-58
- smart bombs and precision guided munitions
- Vietnam War
- ROLLING THUNDER
- LINEBACKER I and II
- Tet offensive
- F-4, A-6, A-7
- MiG-15, 17, 21
- EC-121
- SAM and AAA
- guerilla warfare
- DESERT SHIELD and DESERT STORM
- satellites
- F-15, F-16, F-117, A-10
- KC-135, KC-10
- AWACS, JSTARS
- C-141, C-5, C-130
- Civil Reserve Air fleet (CRAF)
- Tomahawk Land Attack Cruise Missiles (TLAMS)

? Test Your Knowledge ?

TRUE OR FALSE

1. *At the end of World War II, the world was left with two major political forces — Soviet communism and Western democracy.*
2. *In the years immediately following World War II, Hungary, Poland, Romania, and East Germany belonged to the North Atlantic Treaty Organization (NATO)?*



3. During World War II, the United States led the world in jet propulsion development.
4. The two German “vengeance” weapons were the V-2 and R-4.
5. The helicopter became part of the Army Air Forces during World War II, but it was the Korean War that really demonstrated its value.
6. The expected great demand for general aviation aircraft after World War II failed to materialize.
7. Initially, the DC-4 was more popular than the Constellation because the Army built more of them.
8. The Constellation had two advantages over the DC-4 — it was pressurized and it was 100 mph faster.
9. The French developed the first turboprop and the first turbojet airliners.
10. In the late 1940s, the “big three” in general aviation manufacturing were Lockheed, Cessna and Piper.

SELECT THE CORRECT ANSWER

11. The United States reduced the size of its military forces after World War II because **(the United Nations outlawed war / it was the only country possessing the atomic bomb, and it felt secure with that weapon).**
12. In 1947, after the United States Air Force became a separate service, its primary mission was **(continental air defense / nuclear deterrence).**
13. The Berlin Airlift resulted **(from a massive earthquake / when the Soviet Union prevented any surface transportation in or out of the city).**
14. The Korean War began when **(North Korean / communist Chinese) troops invaded South Korea.**
15. The Korean War taught America a lesson: **(the atomic arsenal alone was not enough to prevent involvement in war / the United States must maintain an enormous standing Army).**
16. The **(B-52 / B-58) is still in use today.**
17. The world’s first production supersonic fighter was the **(F-100 / F-101).**
18. The first “pure” jet commercial airliner was the **(Vickers Viscount / DeHavilland Comet 1).**
19. The term “Mach 3” means **(three times the speed of sound / 30,000 feet above sea level).**

MATCHING

- | | |
|---|--------------------|
| 20. Built to supercede the B-47 because it had more range. | a. X-1 |
| 21. Broke Mach 3, but came apart due to frictional heating. | b. B-52 |
| 22. First VTOL aircraft. | c. P-51 |
| 23. Had a revolutionary new wing design called the laminar-flow wing. | d. X-2 |
| 24. First aircraft to break the “sound barrier.” | e. Flying Bedstead |

FILL IN THE BLANKS

25. In 1950, Vietnam was a _____ colony.
26. The South Vietnamese struggled with their civil war against the North Vietnamese and by 1961, President _____ expanded the commitment of the United States.



27. On August 7, 1964, Congress passed the _____ which allowed President _____ to “take all necessary measures to repel an armed attack against the force of the United States and to prevent further aggression [in Vietnam].”
28. _____ helped to “unpopularize” the Vietnam War.
29. The _____ marked the beginning of the end of the war in Vietnam.
30. _____ or _____ enabled US pilots to finally destroy the Thanh Hoa Bridge — a long-standing and critical North Vietnamese target.
31. As opposed to Operation _____, Operation _____ was conducted without as much worry about Chinese and Soviet reaction to the war in Vietnam.
32. During the Cold War, the Air Force’s _____ primary mission was to defend the United States from nuclear attack.
33. During Operation DESERT STORM, and for the first time in US history, the _____ was activated to provide logistical support.
34. Two aircraft were key links to moving troops, cargo and fighters into Southwest Asia during Operation DESERT SHIELD/STORM: _____ and _____.
35. The US/Coalition Air Forces quickly gained air superiority in Operation DESERT STORM by first attacking Iraq’s _____ and _____ systems with precision guided munitions.

SHORT ANSWER

36. Briefly define the “Cold War.”
37. How did air power achieve “victory” in the Berlin Airlift?
38. What roles did air power play in the Korean War?
39. Why were American pilots able to defeat the technologically superior Russian-built MiGs during the Korean War?
40. What aviation improvements developed as a result of World War II?
41. Early attempts to break the sound barrier resulted in what kinds of problems?
42. Name one advantage and one disadvantage to swept-back wings.
43. Why was new missile technology of the mid-1950s important?
44. Name three aircraft, along with their roles, that were built for the Strategic Air Command during the Cold War.
45. What lessons from previous air wars were used to develop the Desert Storm air campaign plan?
46. What impact did air power have on Iraq’s counterattack into Saudi Arabia?