

Reconstructive History: Airplanes of World War II



By Mr. Cegielski

Lesson Objectives:

1. Know how air power evolved during WWII
2. Know the role air power played in WWII and its significance
3. Know the significance of the Allied air campaigns
4. Build digital 3D models or flying replicas of these aircrafts!

WHAT WILL
YOU BUILD?

Review

- ◎ A. What were the main combatant nations in WWII?
 - (1) **Allies** – Britain, France, U.S., Soviet Union, and China
 - (2) **Axis** – Germany, Italy, Japan

- ◎ B. What were the differences in how air power was used in WWI and WWII?
 - (1) WWI – Observation
 - (2) WWII – Strategic bombing

- ◎ C. What were some of the key events leading to war?
 - (1) Japan invades China
 - (2) Germany invades Poland then Soviet Union
 - (3) Japan attacks Pearl Harbor

How was air power developed during World War II?

- A. By the late 1930's, air power had become more reliable, and military leaders began to think ever more seriously about its prospects.
- (1) Visionaries knew aircraft would some day serve in more than a supporting role.
 - (2) With World War II, that day arrived. Both the Allies and the Axis Powers soon developed new strategies for waging war in the air.
- B. The development of bombers, fighters, and transports
- (1) Between the end of World War I and the start of the second world war, both the United States and Britain cut defense spending drastically.
 - (2) The Axis Powers were doing just the opposite. So when Germany invaded Poland in 1939, the Axis nations were well prepared for war. The Allies were not.
 - (3) At the time of the Pearl Harbor attack, the United States had 2,900 aircraft. Many weren't fit for combat duty.
 - (4) In 1939 US manufacturers could build no more than 2,100 aircraft per year. By 1940 they increased that to 570 a month. And by 1941 they could build 1,900 airplanes a month.
 - (5) Requests from Britain and France, as well as the US military, spurred the factories to ramp up production.
 - (6) Pilots flew three key kinds of aircraft in World War II: the bomber, the fighter, and the transport.

WWII Bombers

- (1) America had the long-range B-17 Flying Fortress bomber as early as 1935. This, along with the B-24, saw a lot of action in Europe.



B-17 Flying Fortress

WWII Bombers

- 2) The B-24 Liberator was developed by 1938 and was in production by 1941. It had a 2,850-mile range and could fly 303 miles per hour (mph). Some 18,000 were built during the war.



B-24



WWII Bombers

- ◎ (3) The B-29 Superfortress was the long-range bomber of the Pacific theater. It was bigger than the B-17 and the B-24. It could also fly greater distances—5,830 miles, with a top speed of 365 mph. It was designed for bombing runs over Japan.



WWII Bombers

- ◉ (4) Medium-range bombers included the B-25 Mitchell (1938) and the B-26 Marauder (1939). Both were in mass-production by February 1941.
 - (a) Lt Col Jimmy Doolittle used the B-25 in the 1942 Tokyo raid. This attack showed Japan that Allied planes could reach the home islands. The B-25 had a range of 1,200 miles and flew 275 mph.
 - (b) The B-26 Marauder flew mostly in England and the Mediterranean. It could fly 1,100 miles at a top speed of 285 mph. This bomber claimed the distinction of having the fewest of its numbers shot down of any Allied aircraft.



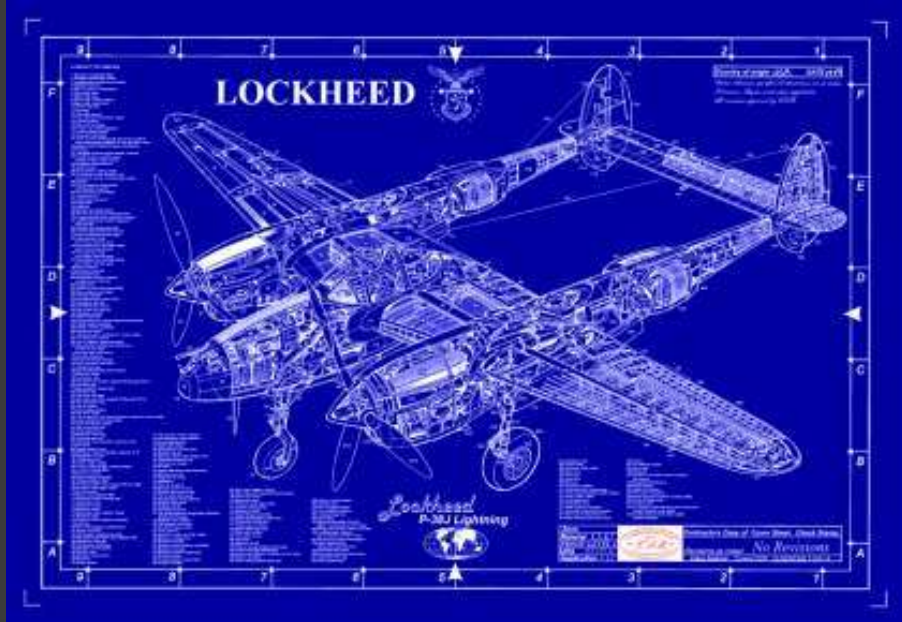
B-25 Mitchell



B-26 Marauder

WWII Fighters

- ◉ (1) Among the American fighters that saw action in World War II were the Lockheed P-38 Lightning, Bell P-39 Airacobra, Curtiss P-40 Warhawk, and Republic P-47 Thunderbolt.



P-47 Thunderbolt

WWII Fighters



- ⦿ (2) Perhaps the most famous fighter was the North American P-51 Mustang. Both the P-51 Mustang and the P-38 Lightning escorted long-range bombers. These fighters protected the bombers on missions deep into Germany. (4) The P-38 gained a reputation among the German Luftwaffe in North Africa. They called it the “fork-tailed devil.”



P-51 Mustang



P-38 Lightning

WWII Fighters

- 3) P-39 pilots went on many strafing runs. The P-40 was a tough, sturdy plane. It saw action from the very start, going up against Japanese fighters at Pearl Harbor.
- The ranges on these fighters reached from 650 miles (the P-39) to 1,100 miles (the P-38). The P-51 had a top speed of 437 mph while the P-40's fastest pace was 362 mph.



P-39



P-40

WWII Fighters



- 4) The Navy, meanwhile, enjoyed success in the Pacific with the P-38, as well as with the carrier-launched Grumman F-4F Wildcat, the Grumman F-6F Hellcat, and the Chance-Voight F-4U Corsair.



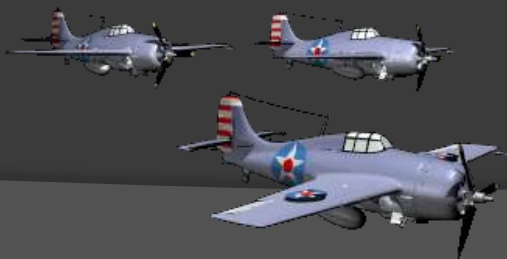
Grumman F-4F Wildcat



Chance-Voight F-4U Corsair



Grumman F-6F Hellcat



WWII Fighters

- ⑤ Developing any new aircraft was costly. The P-38, for instance, cost \$852,000 to design. It would be considerably more in today's dollars.
- ⑥ Unlike other countries at the time, the United States held design competitions for its military aircraft. The Army Air Forces believed this resulted in better aircraft. The designers came up with unique features that furthered advances in air combat capabilities.

WWII Fighters



- 6) Other fighters of note included the British Supermarine Spitfire (range 395 miles; maximum speed 355 mph), the Hawker Hurricane (700 miles; 325 mph), and the twin-engine De Havilland Mosquito (1,400 miles; 378 mph).



Supermarine Spitfire



Hawker Hurricane



De Havilland Mosquito



WWII Fighters

- 7) Germany's main fighters were the famed Messerschmitt 109 (405 miles; 292 mph), the Messerschmitt 110 (1,305 miles; 342 mph), and the Focke-Wulf 190 (560 miles; 408 mph).
- Germany also launched the world's first operational jet fighters at the end of the war, the Messerschmitt 262 Schwalbe (650 miles; 540 mph) and the Heinkel 162 Volksjaeger (606 miles; 562 mph). Fortunately for the Allies, these jets appeared too late in the war to affect the outcome.



Messerschmitt 109



Heinkel 162 Volksjaeger

WWII Fighters



- 8) Japan's premier fighter was the Mitsubishi Zero (1,930 miles; 331.5 mph), which completely dominated its American counterparts at the beginning of the war.



Mitsubishi Zero

Transports

- ◉ (1) Transports were built to move people and cargo. They were less comfortable than commercial aircraft.
- ◉ (2) As applied to all branches of the military, a **transport is a vehicle—aircraft, ship, or other— that carries people, supplies, tanks, and artillery.**
- ◉ (3) The best-known air transport was the C-47 Skytrain. It was based on the Douglas Aircraft DC-3. It could fly 1,513 miles. It could reach 232 mph but generally cruised around 175 mph.
- ◉ (4) Besides ferrying ground troops and equipment, it moved paratroopers and towed gliders. Some 9,348 C-47s were built by the end of the war.



C-47 Skytrain

A historical painting depicting a B-24 Liberator bomber in flight over a city. The bomber is shown from a low angle, flying towards the viewer. It has a dark green and brown camouflage paint scheme. The tail fin features a white circle with a black 'C' and the letters 'K' below it. The fuselage has the letters 'K' and '3R' in yellow. A white star with a black outline is visible on the side of the fuselage. The bomber is flying over a city with a grid-like street pattern. In the background, another B-24 is visible in the sky. The overall scene is set against a backdrop of a cityscape with smoke and fire, suggesting a bombing raid.

Historical Background: WWII's Air War

The Allies' strategy:

1. Overall plan:

- ⦿ (a) Protect Allied supply routes between the United States and Britain to stop the Germans from blowing up Allied ships carrying **materiel—the equipment and supplies of a military force**.
- ⦿ (b) Bomb the German war industry (factories and warehouses).
- ⦿ (c) Destroy German roads, bridges, and communication lines.
- ⦿ (d) Allied plan had one big hitch. Until 1944 most bombers flew without fighter escorts. The fighters weren't equipped to make the long flight to Germany.
- ⦿ (e) Allies suffered huge losses, especially in 1943 over Germany. Not until March 1944 would bombers reach Berlin.
- ⦿ (f) Fighters eventually accompanied the bombers. In the meantime, the Allies also focused on German positions in France from 1942 to 1943. The hop across the English Channel was just more than 20 miles.

Growing German Aggression

- ◎ (1) Germany resumed hostilities in Europe in 1938 to take lands it felt belonged to it:
 - Austria, Czechoslovakia, and later, Poland. Most of Europe caved quickly before German aggression.
 - Britain was an exception. This small island nation was about all that stood between Germany and total conquest.



U.S.-British Relations

Before the United States joined Britain in its campaign to free Europe, the military and civilian leaders of the two countries met many times. They talked strategy.

- (1) The United States was already supplying Britain with ships, planes, and parts.
- (2) The Allies considered the chance Japan would one day attack the United States. They asked themselves how this would affect the Allied strategy.
- (3) The United States and England came to some important conclusions. They decided that even if Japan struck the United States, the first objective of the Allies would still be to defeat Germany.
- (4) Germany was in Britain's backyard. Its factories churned out excellent planes and tanks. It had been hammering Britain for two years.
- (5) As of 1941 the combined forces of the US and England would have been hard pressed to fight all-out war on two fronts.
- (6) But by 1944 that was no longer true. Helped by the Soviets' battle with the Germans on the Eastern Front, they could take on Germany and Japan full force.
- Once the United States entered the war, air power had a big part in the European and Pacific theaters. It played both its old support role and its new offensive role of strategic bombing. Significant Allied air campaigns in the European theater—all Allied air actions in Europe had a single goal: to shut down the German offensive. The first great clash was the Battle of Britain.

The Battle of Britain

A Spitfire fighter plane is shown in flight against a cloudy sky. In the background, a cityscape is visible, with a prominent bridge and buildings. The overall scene is a historical representation of the Battle of Britain.

- ◎ (1) **The Battle of Britain** was one of the most important of the war. This was a defensive battle for the British. The British were the first to stop the Nazi war machine.
- ◎ (2) The battle began in **August 1940**. The Germans did small-scale raids to test British strength.
- ◎ (3) England relied on its fighters for defense. Both British resolve and poor German planning helped Britain hold out.
- ◎ (4) The Germans had only short- and medium-range bombers. They needed long-range bombers to hit Britain effectively.
- ◎ (5) Germany made another big mistake. It didn't count on British radar. Radar let the British spot German squadrons heading toward them across the English Channel.

The Battle of Britain continued...

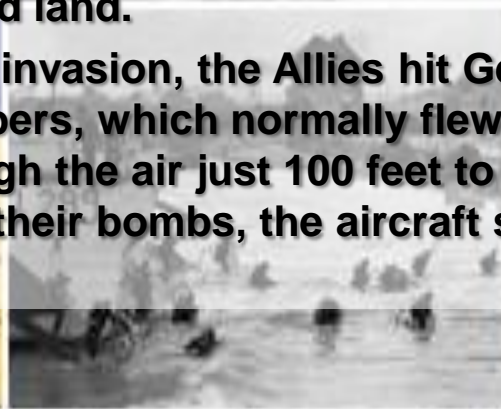
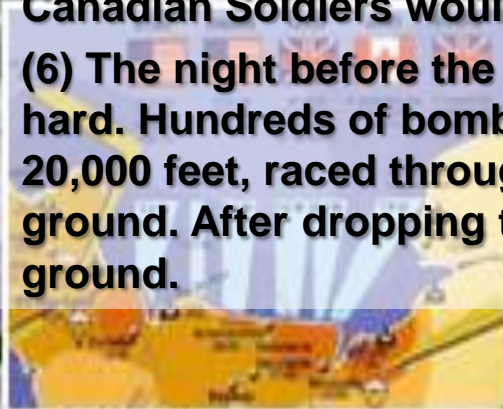
- ◉ (6) Because of radar, the RAF didn't have to waste fuel patrolling in the air. And it didn't have to waste manpower or put unnecessary wear and tear on its planes.
- ◉ (7) Having radar was a bit like being able to see into the future. It allowed the RAF to send its fighter pilots where and when they were needed.
- ◉ (8) Even so, German bombers did manage to get through to bomb London and the surrounding areas. They inflicted serious death and damage.
- ◉ (9) But German efforts grew weak by 1941. The Luftwaffe had lost too many planes and crews to British fighters. British air power had saved Britain.

D-Day



D-Day

- (1) The Western Allies delivered a backbreaking blow to Germany in 1944. They called it **Operation Overlord**.
- (2) The purpose of this invasion, which would take place on “D-Day,” was to retake Western Europe once and for all.
- (3) The D-Day invasion began on **6 June 1944** at Normandy, on the northern coast of France. But preparations had begun much earlier.
- (4) For two months, bombers and fighters of the Army Air Forces and RAF had been striking at German positions in and around Normandy. They wanted to soften the German defenses.
- (5) They hit airfields, railroads, and coastal barriers. They downed Luftwaffe planes. They wiped out as much as they could within a 130-mile radius of the Normandy beaches where American, British, and Canadian Soldiers would land.
- (6) The night before the invasion, the Allies hit German forces extra hard. Hundreds of bombers, which normally flew at an attitude of 20,000 feet, raced through the air just 100 feet to 1,000 feet above ground. After dropping their bombs, the aircraft strafed targets on the ground.



D-Day continued...

- ◉ (7) On D-Day, fighters played a critical role. They, too, conducted bombing missions. The P-38 Lightning could carry two 1,000-pound bombs. One group of fighters flattened a German command center.
- ◉ (8) In addition, fighters strafed German infantry. They protected ships crossing the English Channel en route to the Normandy shoreline. They were also used to **escort**, *or accompany, bombers and air transports*.
- ◉ (9) The first wave of transports that crossed the channel on D-Day was breathtaking. It was nine aircraft wide in a line extending for 230 miles.
- ◉ (10) Many of the Soldiers arriving on the beach by air transport were paratroopers. **A paratrooper is an infantry Soldier who is trained to parachute, often behind enemy lines.**
- ◉ (11) Transports also towed gliders carrying men and materiel. Most of these gliders were made of wood and fabric, just as the earliest planes were. On the evening of 6 June one glider took off from England for France every 15 seconds.
- ◉ (12) The D-Day invasion and the Battle of Normandy cost 57,000 Allied Soldiers and Airmen their lives.
- ◉ (13) But, it was a major turning point in the war. It gave the Allies a foothold in Europe.
- ◉ (14) More than 1 million men landed along 60 miles of beaches within seven weeks of D-Day. But there was still more to be done to achieve final victory in Europe.

The Final Push

The Final Push

- ◉ (1) Despite these gains, the Allies had not yet won the war in Europe. From the beaches in Normandy, the Western Allies pushed through the rest of France, then Belgium, and Luxembourg.
- ◉ (2) Meanwhile, on the Eastern Front, the Soviets pushed the Germans out of the Soviet Union and through Eastern Europe. In September the first US patrols entered Germany.
- ◉ (3) At the end of December 1944, the Germans made a desperate surprise counterattack in Belgium. They wanted to divide the Allied armies and force a negotiated peace.
- ◉ (4) The epic battle in the Ardennes Forest is known as the **Battle of the Bulge**. Allied air power provided crucial help to the brave ground troops in beating back this attack.
- ◉ (5) Luftwaffe planes attempted to support German forces by attacking US troops on the ground. But in most cases Allied fighters stopped them short of their targets.
- ◉ (6) Although poor weather limited flying on several days, Allied bombers seriously hampered German efforts. They bombed roads, railroads, and bridges behind the lines. This made it more difficult for the Germans to move up supplies and troops.
- ◉ (7) German defeat in the Battle of the Bulge not only sealed the Nazis' fate on the ground, it also destroyed German air power. The commander of the Luftwaffe fighter arm, Lt Gen Adolf Galland, wrote, "*The Luftwaffe received its death blow at the Ardennes offensive.*"

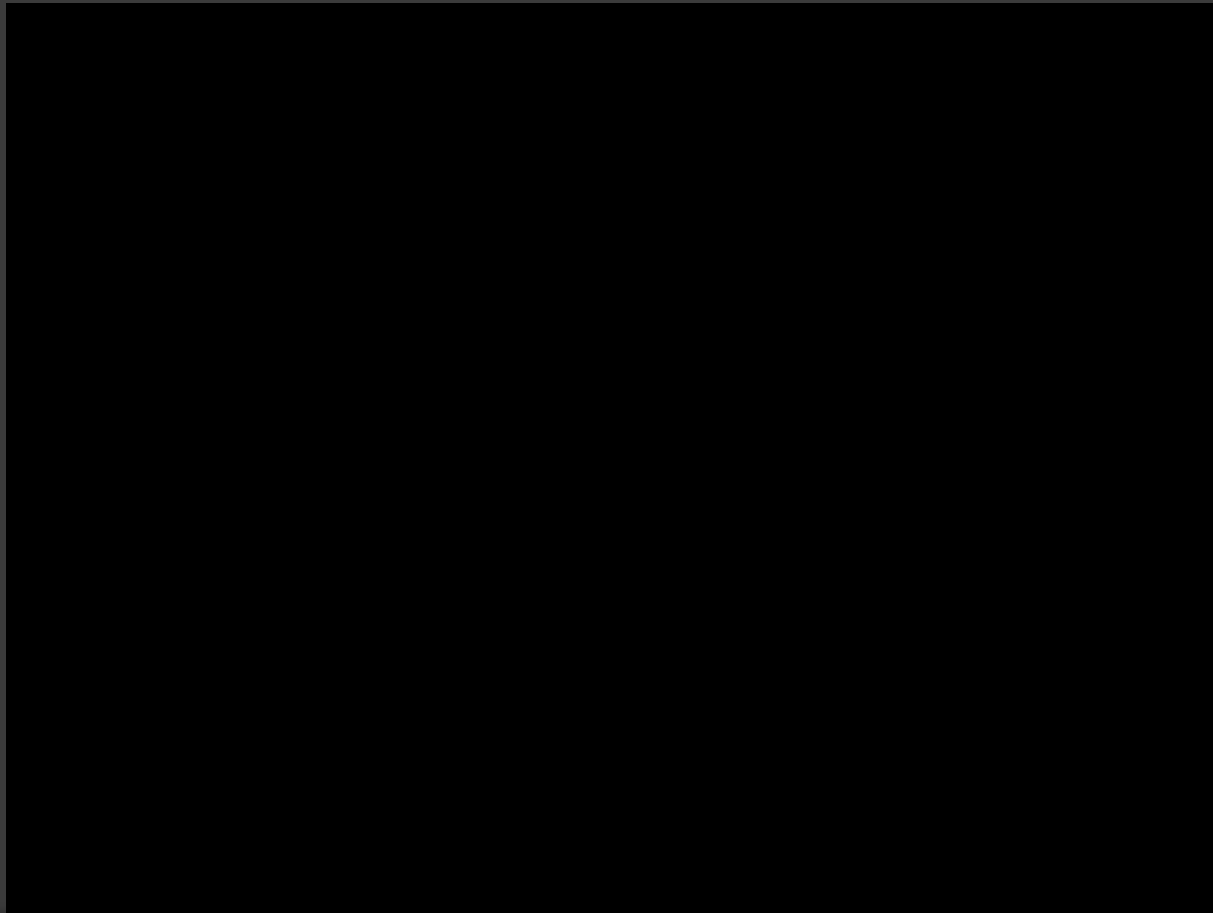
The Final Push continued...

- ◉ (8) The strategic bombing of Germany went on. The Allied bombers and escorts hit airplane factories, oil refineries, and roads.
- ◉ (9) By 1945 most bombing runs over Germany involved between 1,000 to 1,500 bombers. The Eighth and Fifteenth Air Forces conducted these missions.
- ◉ (10) The Army Air Forces and RAF ran out of targets by 15 April 1945. They had unloaded 2.5 million tons of bombs on the Axis Powers in Europe.
- ◉ (11) **The United States and Britain lost 8,000 bombers and 7,000 fighters. But the Luftwaffe, despite its initial advantage, lost 33,000 airplanes.**
- ◉ (12) **On 7 May 1945 the Germans surrendered.** The European chapter of the war was closed.
- ◉ (13) The nuclear arms race, jet airplanes, and humanity's first steps in space all happened because of developments during the war.
- ◉ (14) **The war also ended in a new rivalry between the Western democracies and the Soviet Union.**
- ◉ (15) At the same time, however, the US economy and the recovering economies of Europe would grow rapidly after the war. And advances in commercial aviation were at the forefront of that growth.



Battle of Berlin

**What are the basic physics of flight?
Watch this video “The Aerodynamics
of Flight” (7 min)**



World War II Airplane Project!

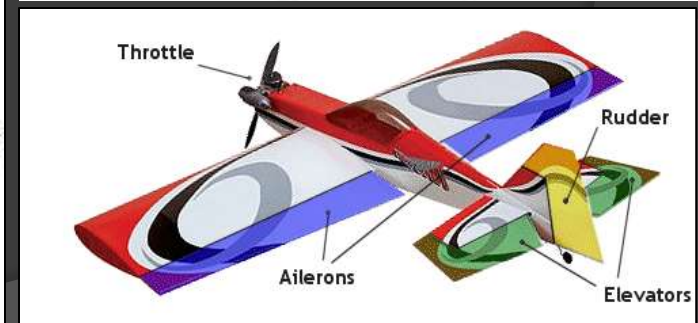
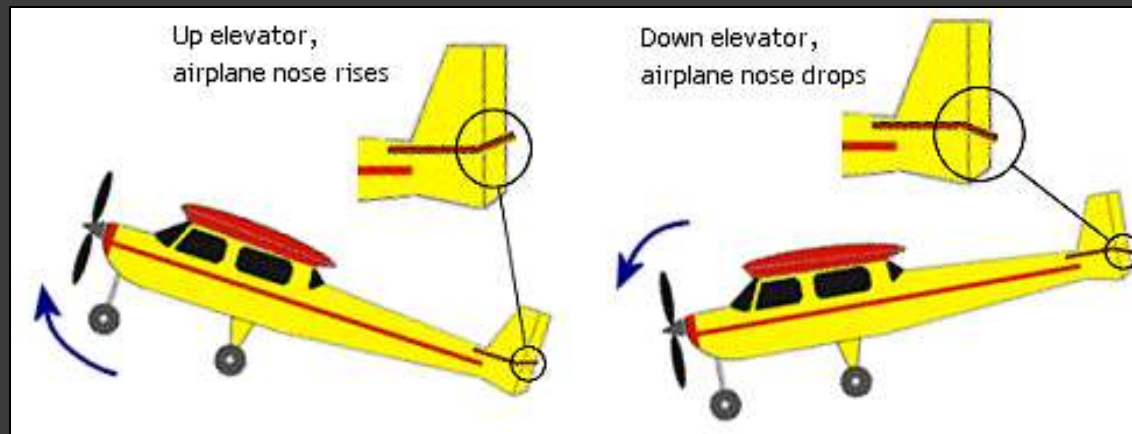
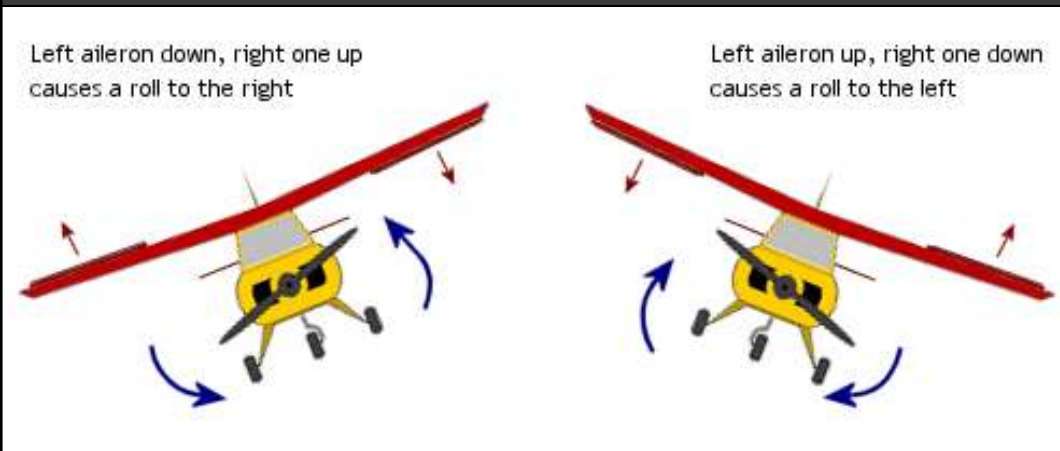
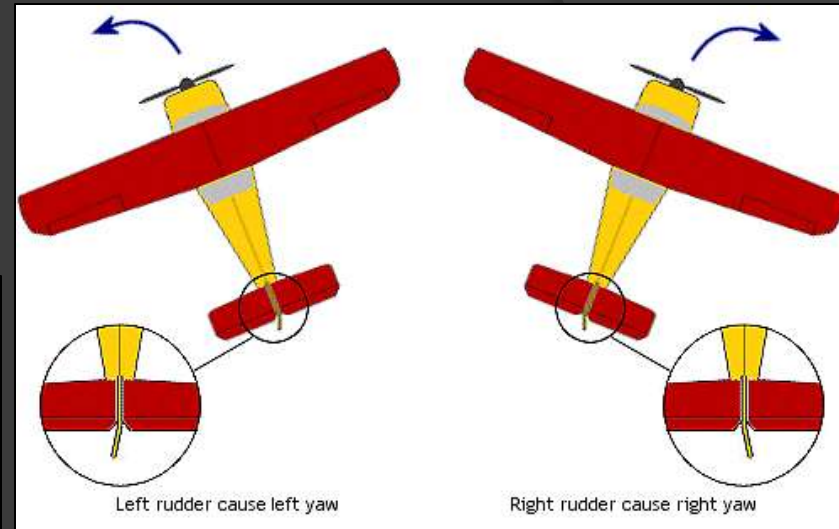
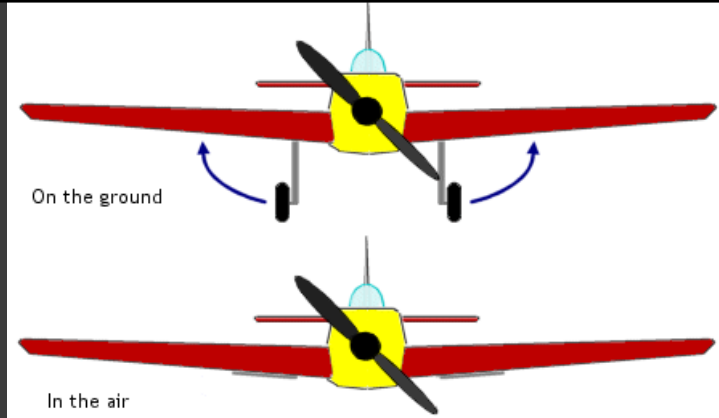


- **PURPOSE:** To provide a cross-curricular approach by fusing history, technology, engineering and elementary physics to create a successful flight of a either a real model or a 3D animated airplane!
- **DIRECTIONS:** In this project, you will work in a small group to build a working airplane, based on a real WWII combat plane! **Here are the choices and the requirements:**
 - **CHOICE #1: BUILD A FLYING MODEL WWII PLANE:** You must purchase your own kit or bring your own building materials, including: glue, balsa wood, light canopy paper, exactor knife, propeller, rubber bands or motor, wheels, etc. You must follow the blueprints of the model. (I have several to choose from. If you find your own, please let me know.) Your model should be scaled correctly and feature the correct proportions. You must also design this to be a sturdy, but light aircraft. Research to discover how your plane looked You must color or paint your model to reflect how the aircraft actually looked. Include appropriate decals (remember Mickey Mouse?) Your plane should fly! The motor or rubber band inside the plane should spin the propeller and allow the plane to accelerate through the air! **50 points!**
 - Also, you must present a 3-5 minute video presentation on the elementary physics of flight and the use of your plane in WWII missions and battles. What was your plane's impact on WWII and its lasting legacy in U.S. air and/or naval history? **50 points! TOTAL: 100 POINTS!**
 - **CHOICE# 2: DESIGN /CREATE A DIGITAL, 3-DIMENSIONAL SCALE MODEL OF A WWII PLANE:** Create a scale-model WWII plane in Google Sketchup or a similar program such as 3DS Max. If you animate the plan in a flight sequence for your video (see below), you will receive extra credit. **50 points!**
 - Also, you must present a 3-5 minute video presentation on elementary physics of flight, the use of your plane in WWII missions and battles. What was your plane's impact on WWII and its lasting legacy in U.S. air and/or naval history? **50 points! TOTAL: 100 POINTS!**

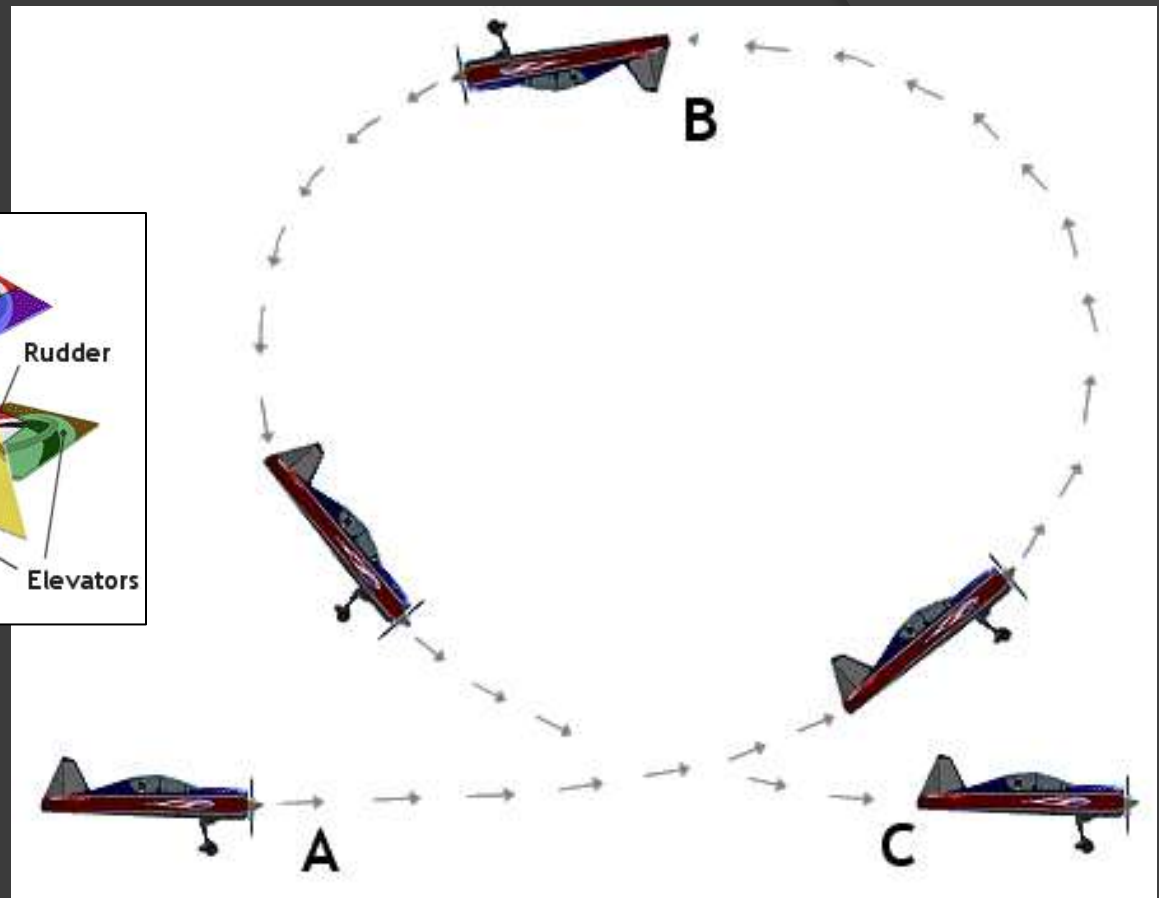
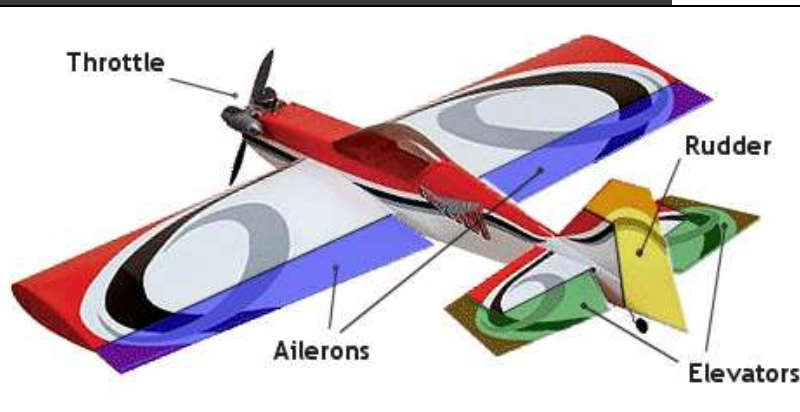
DISCLAIMER: I will monitor the students very carefully in class as they build their models (Choice #1); however, I cannot be held responsible for potential accidents. **STUDENTS ARE NOT PERMITTED TO CARRY TOOLS WHICH COULD BE CONSIDERED WEAPONS WITH THEM ON SCHOOL GROUNDS!**

Please sign below, indicating that you are giving your approval for this project:

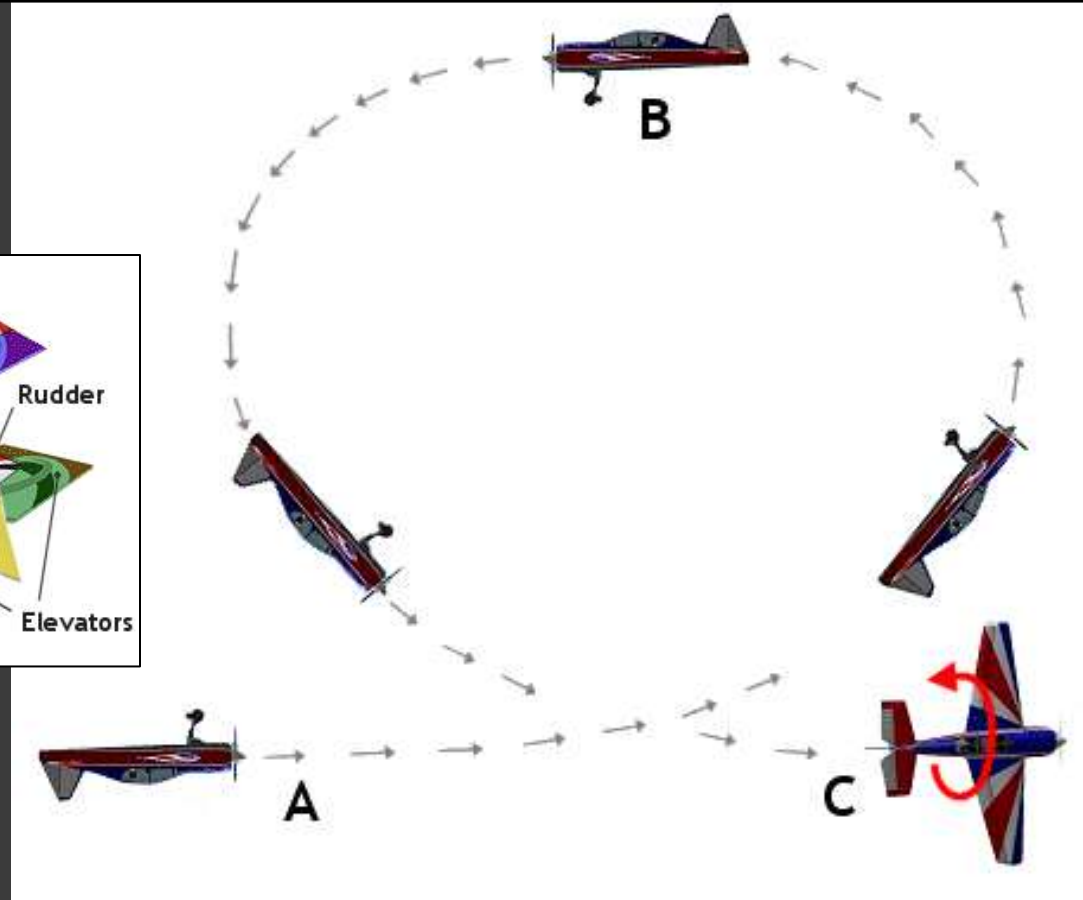
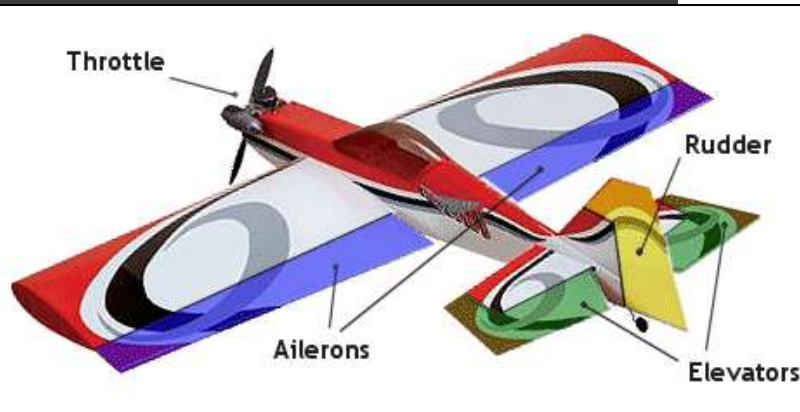
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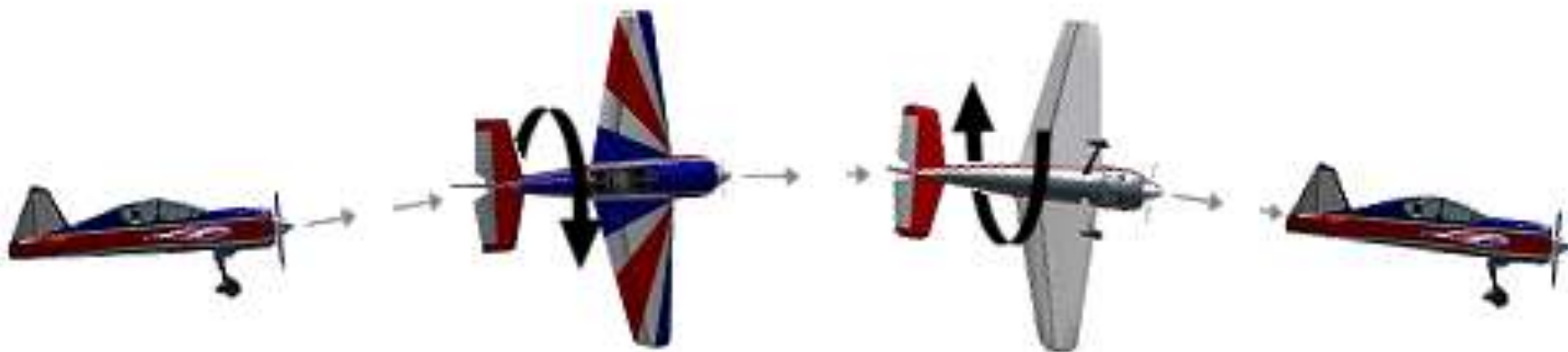
Basic plane controls!!!



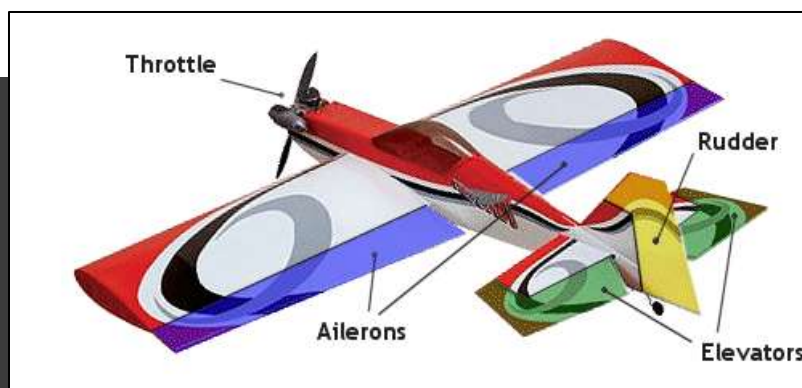
- **INSIDE LOOP** - How to fly it: The inside loop is the easiest of all stunts to pull off and any rc airplane with elevators is capable of looping. Start by flying straight and level into wind, no lower than, say, 50ft/15m high. Open the throttle to full power and, at point A in the picture above, pull back on the elevator stick to start a climb - not too suddenly, be gentle but definite. Keep the power on. The airplane will go into a vertical climb, let it keep going until it starts to roll over onto its back - point B in the picture. At this point, close the throttle and keep holding the elevator stick back, adjusting it as necessary to maintain a tidy path. You might also need to use ailerons/rudder to keep the path of the loop as vertical as possible. At point C in the picture, level out the airplane by returning elevator to neutral and increase power to exit the loop, flying straight and level again.



- ◎ **OUTSIDE LOOP** - How to fly it: Method 1: The outside loop, also called a bunt, is an inside loop but with the airplane inverted *i.e.* the top of the plane faces outwards. Your airplane must be inverted (*i.e.* rolled through 180 degrees) at the start of the loop (point 'A' in the picture). The danger here is to remember to use down elevator to get the airplane to climb. Accidentally applying up elevator at this point will send the airplane crashing in to the ground! Keep holding in down elevator and let the airplane do a full loop. At the top of the outside loop (point 'B'), your airplane will be right side up. Reduce power and continue the loop back down towards the ground and at point 'C' roll through 180 degrees to bring the airplane right side up to exit the maneuver.
- ◎ Method 2: An outside loop can also be started from the top (point B in the above picture), by flying straight and level at a good altitude and applying and holding in down elevator all the way round the loop. You need to reduce power at the start of the dive until the bottom, then increase to full power to complete the second half of the loop.



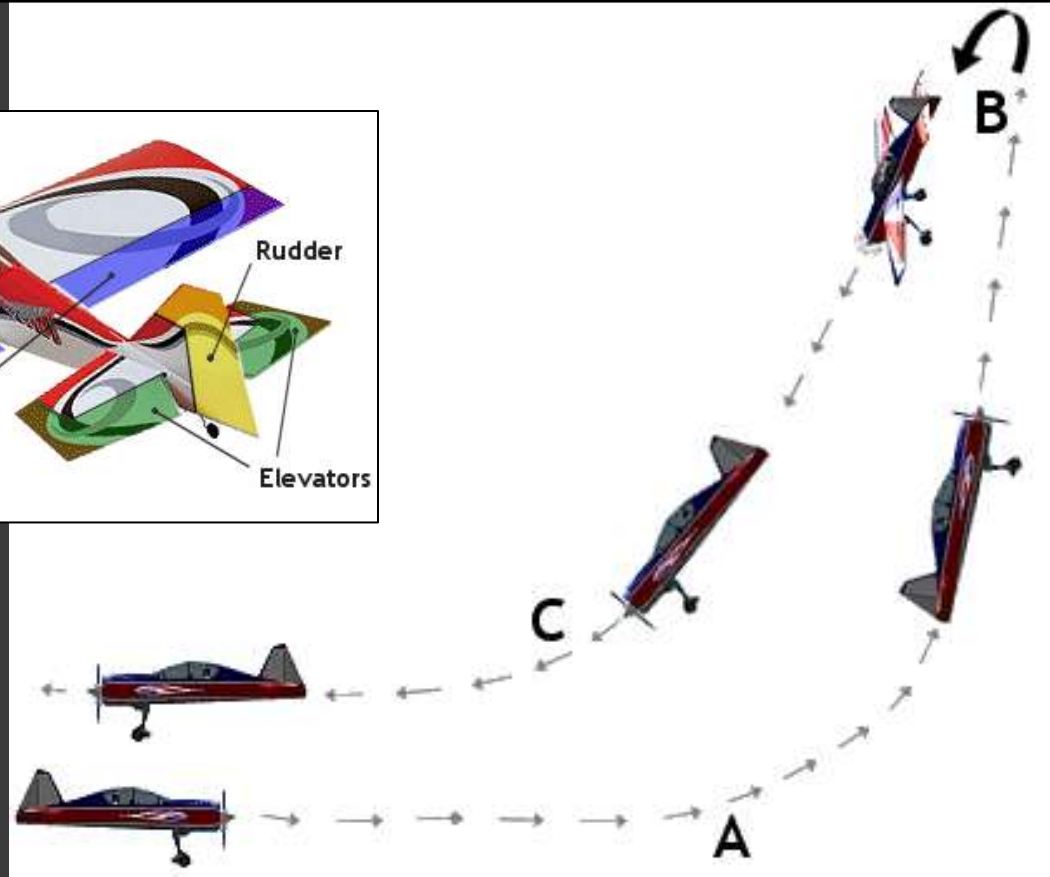
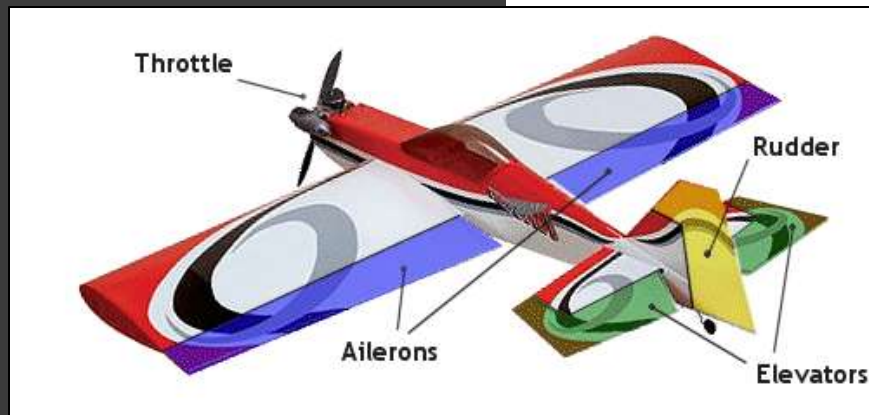
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THE ROLL - How to fly it: The roll requires ailerons but if your airplane only has rudder then you might be able to pull off a larger, somewhat untidier 'barrel roll'. A roll with ailerons is a very smooth maneuver and not too difficult to pull off. Same start as the inside loop; fly straight and level on at least half throttle. To begin a roll, apply a very small amount of up elevator and left or right aileron a split second afterwards. No need for full power this time, keep the throttle stick where it is throughout the roll. If you are using rudder alone you'll need to apply much more up elevator and put the plane in to a small climb before rolling.

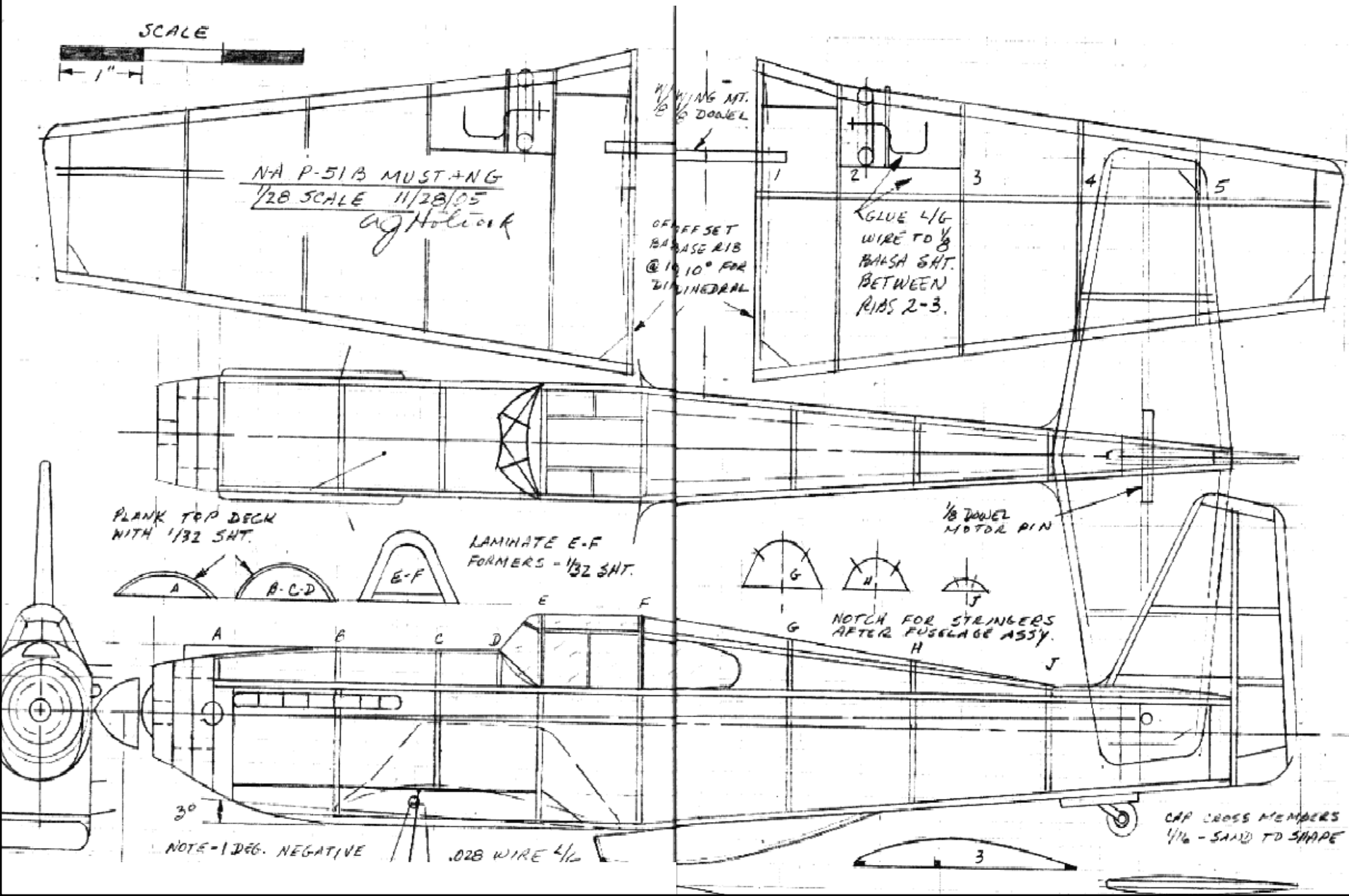
As you apply elevator and aileron, the airplane will start to roll over. Keep the aileron stick in the same position but you will probably have to adjust the elevator to keep the roll tidy. As the plane inverts, release elevator and apply a tiny amount of *down* elevator when the airplane is fully inverted, this will prevent any loss of altitude during the roll (generally speaking...).

Once the airplane is right-side up again, return the sticks to neutral and resume straight and level flying.



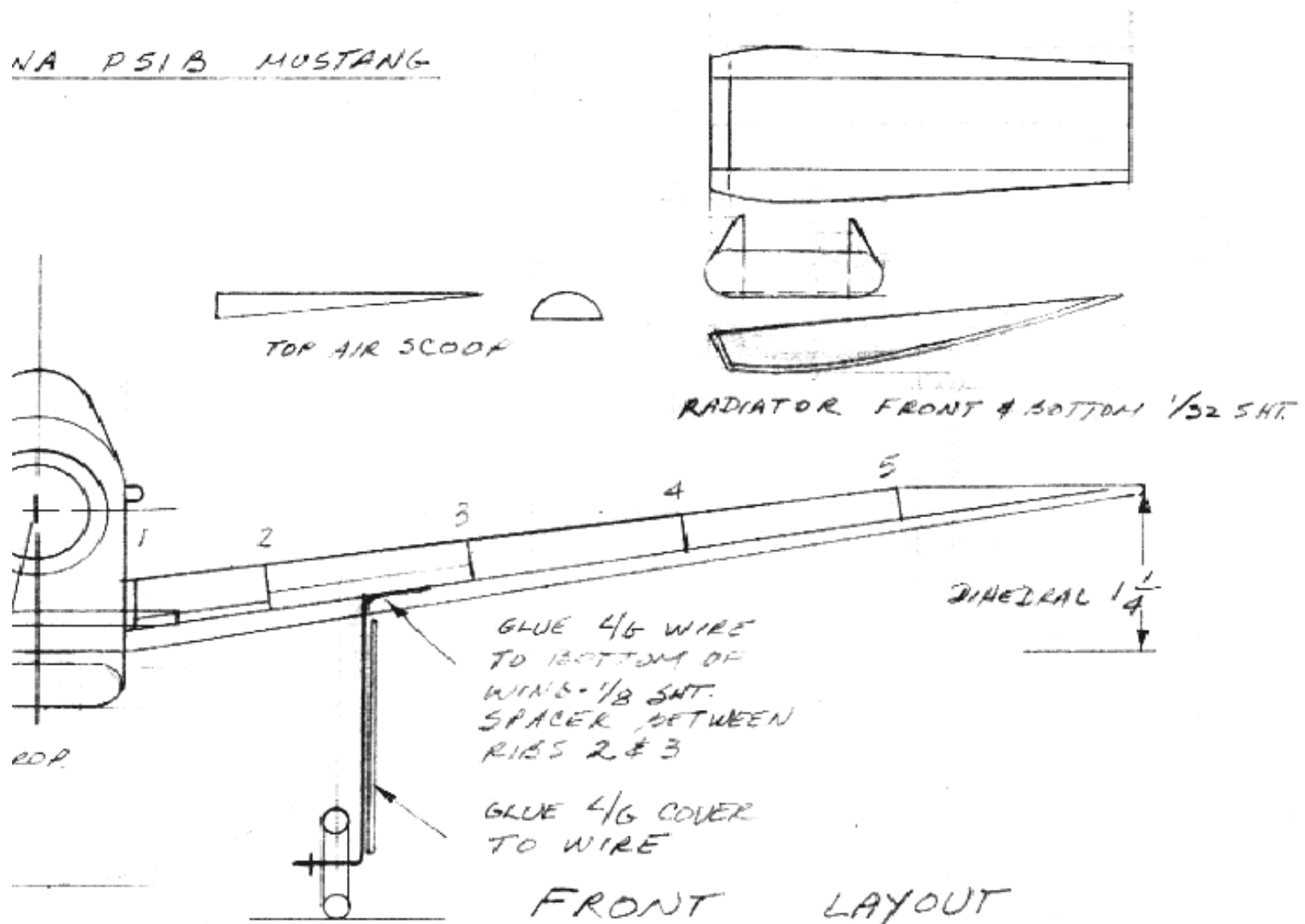
- ◎ **THE STALL TURN “HAMMERHEAD”** - How to fly it: As before, begin with a straight and level flight path. At point A in the picture above, increase throttle slightly and apply up elevator, putting the airplane into a vertical climb. Adjust the rudder and elevator as necessary to maintain the vertical climb *without* going into the beginnings of a loop. Let it climb for a couple of seconds and then, at point B, reduce throttle*, release the elevator stick back to the neutral position and - here's the important part - apply full rudder to the left or right. If the airplane doesn't look like it's going to turn on its tail, give the throttle a small blip to get some prop wash (air movement) over the rudder. Once the airplane has spun round on its tail, return the rudder to neutral and let the airplane go naturally into a brief vertical dive for a second or so. Then, at point C, apply both motor power and up elevator to pull out of the dive and resume straight and level flying.
- ◎ *How much you reduce throttle depends on a few things, not least of which is the type of plane and size of rudder. You might need to keep some power on to increase the prop wash (i.e. airflow) over the rudder, to facilitate the turn.

P-51 model plans

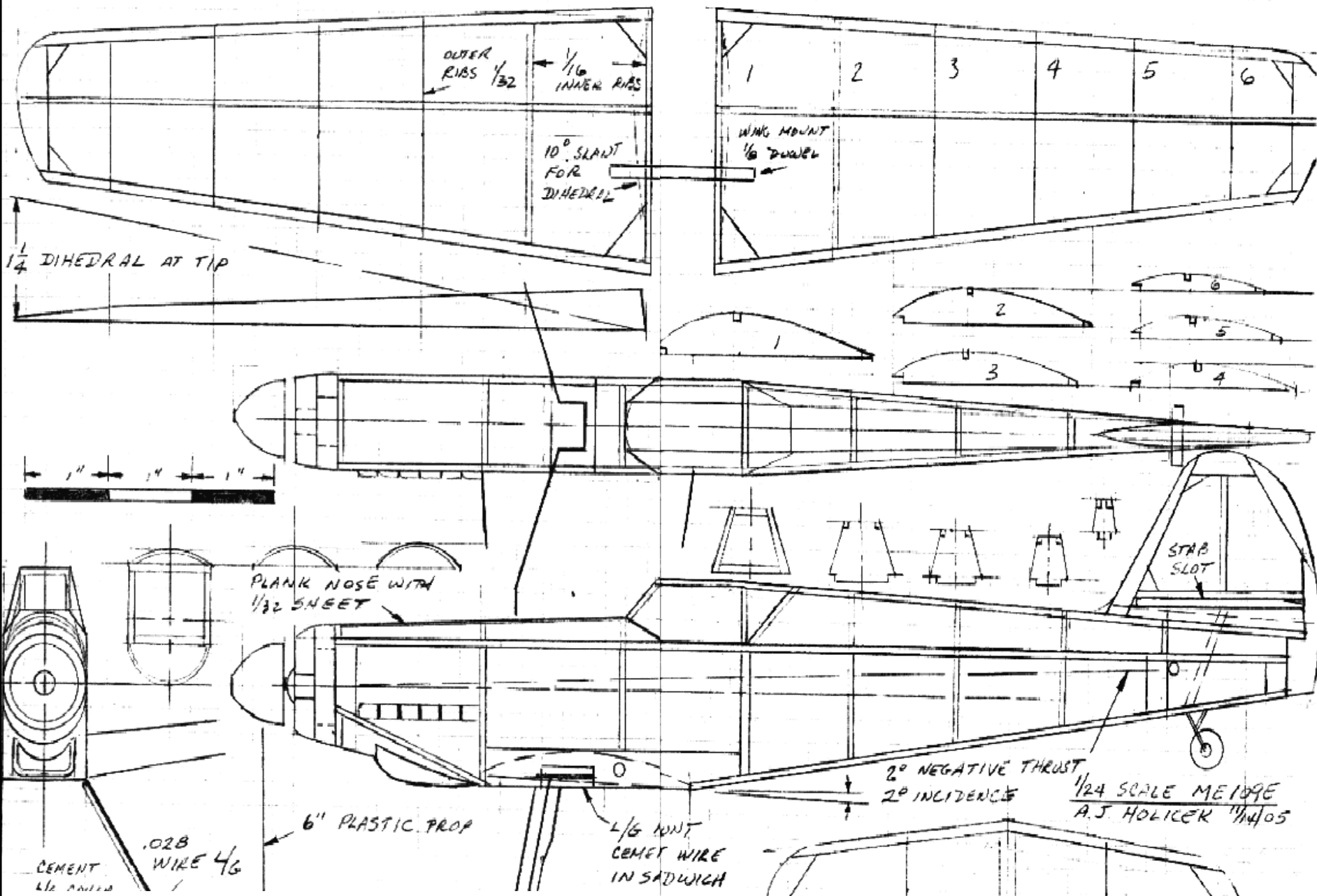


P-51 model plans

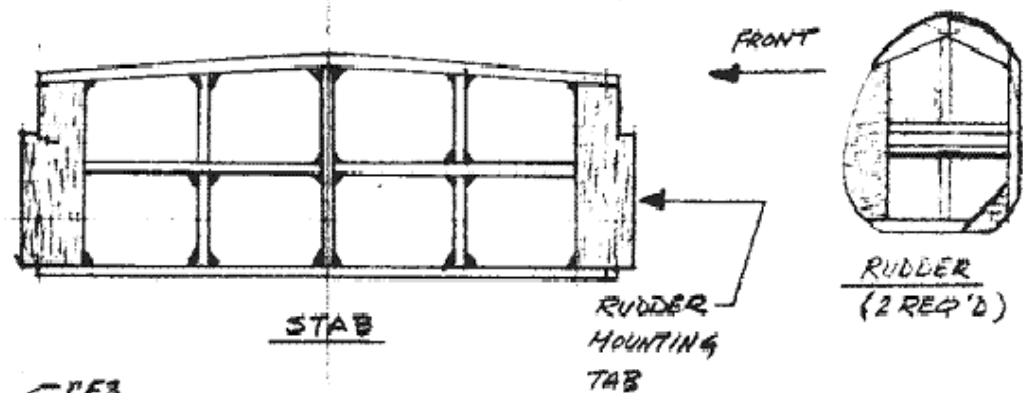
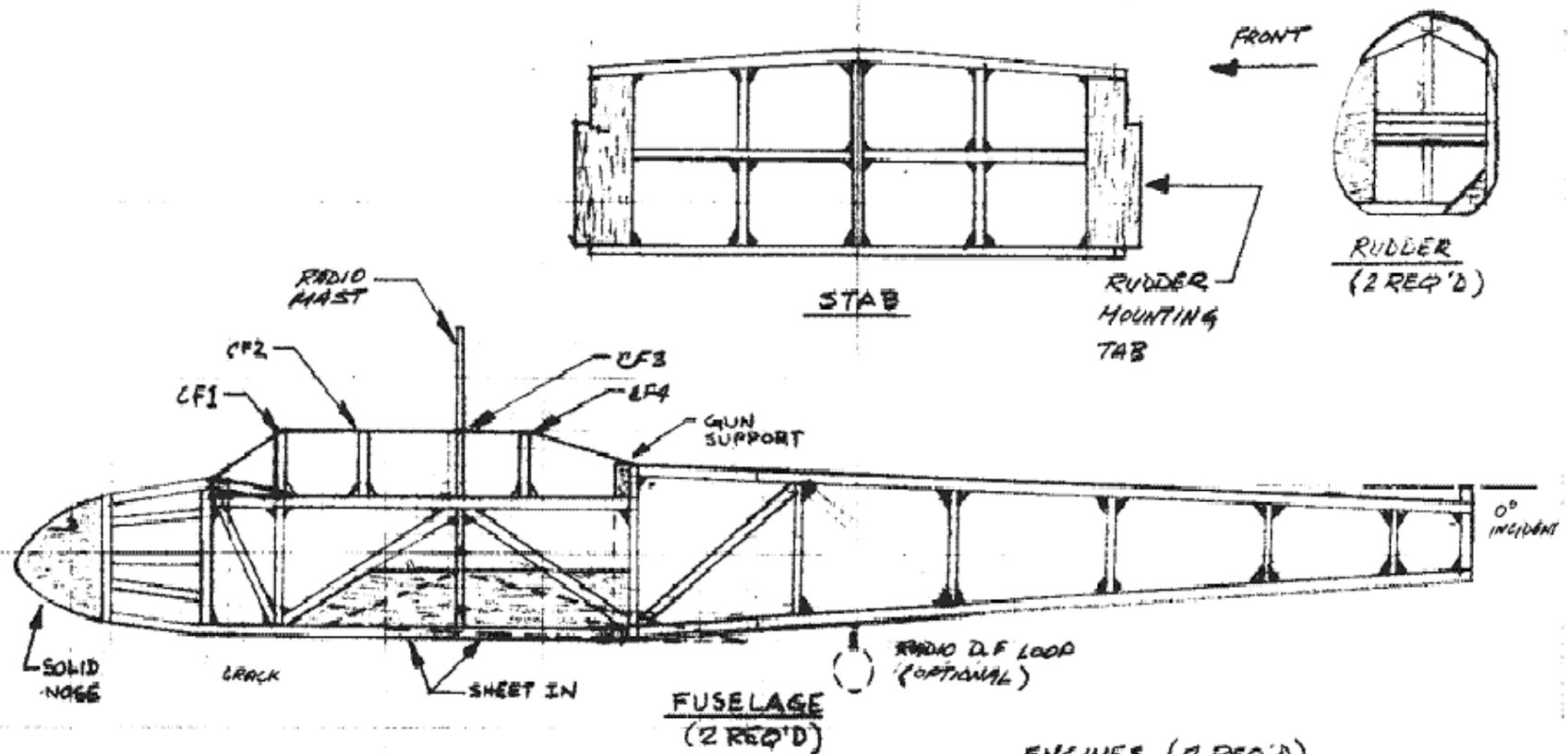
NA P51B MUSTANG



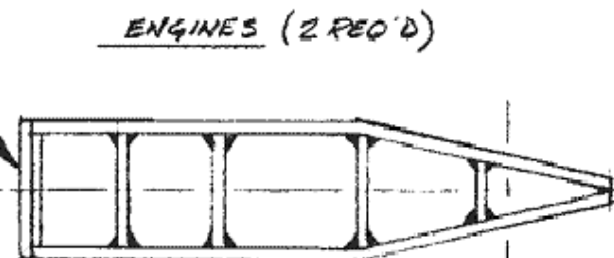
Holicek 109 model plans



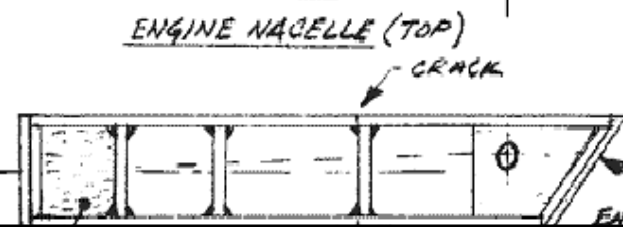
Schmitt 110 model plans



SOLID FRONT CAP

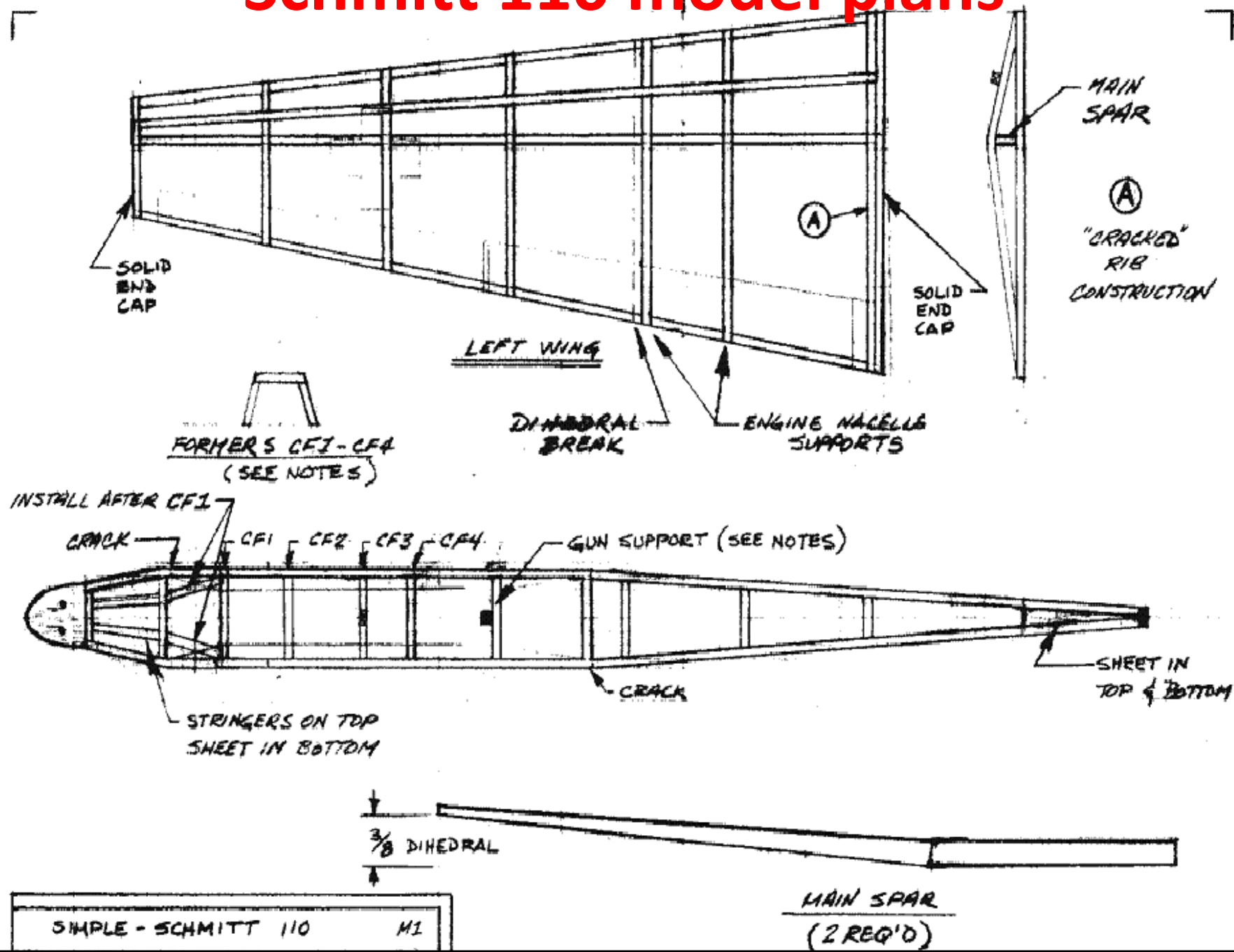


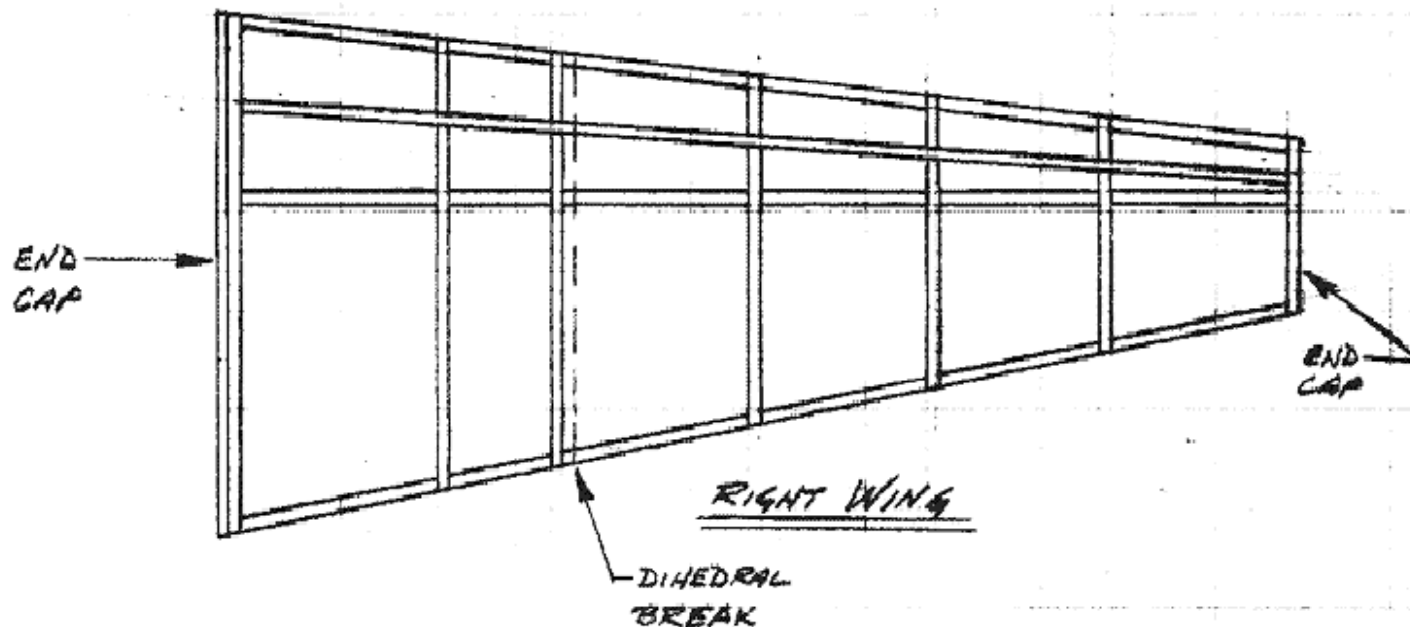
CENTER LINE



SIMPLE-SCHMITT 110 H1	
CLASS = PEANUT	WING SPAN = 13 IN.
SEE REMARKS FOR BUILDING INSTRUCTIONS	

Schmitt 110 model plans





NOTES

1. ALL WOOD $\frac{1}{16} \times \frac{1}{16}$ SQUARE
2. ALL SHEETING $\frac{1}{16}$ THICK
3. GUN AND GUN SUPPORT POST - OPTIONAL
4. PROPELLER CENTERLINE DROPPED .700 TO ALLOW ACCESS TO MOTOR PEG.
5. PRDP DIA APPROX 3 INCHES

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Schmitt 110 finished model

- For more plans and instructions, visit my website at www.historyscholars.weebly.com.

