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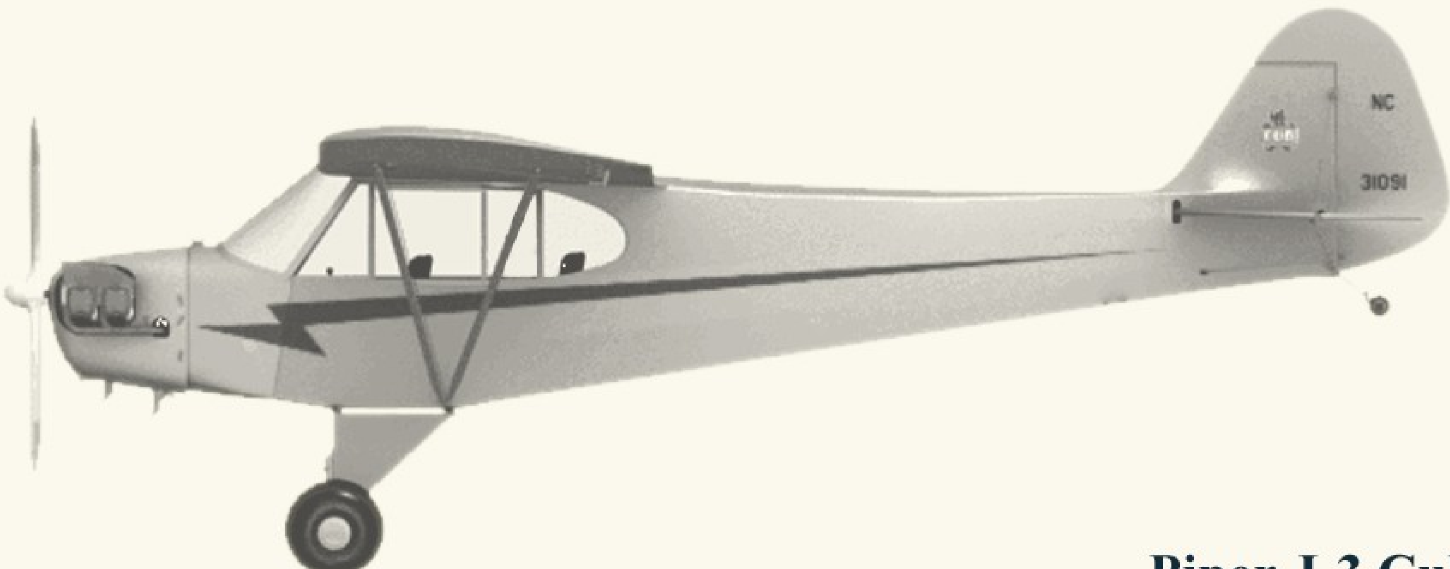
WINGS of SILVER



Piper J-3 Cub

Pilot's Manual

WINGS OF SILVER PIPER J-3 Cub OPERATIONS MANUAL & POH

(this Manual and POH is not intended for flight and is intended only for flight simulation use)

Written by Mitchell Glicksman, © 2009

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<u>Introduction</u>

“Piper Cub”. Almost everyone had heard of the “Piper Cub”, but the name “Piper Cub” evokes different things to different people. To the general public, it is often a generic term for all small airplanes (read: smaller than a commercial airliner). To many people, every single-engine private airplane, whether it is a Beechcraft Bonanza, a Cessna 182 or some other kind of Piper, is a “Piper Cub”.

However, to pilots and aviation buffs, when the words “Piper Cub” are mentioned, something very specific and special comes to their minds. To those who are familiar with this airplane, the Piper Cub embodies the very essence of the romance and gypsy-lure of flying. It's design is one of the most fundamental expressions of the basic, primal relationship between pilot and airplane; and few airplanes define “stick and rudder” more faithfully and distinctly than does the Cub. Aeroncas, Taylorcrafts, Stinsons, Luscombes, Cessnas and all the rest are but refinements and alternatives to what was created by the advent of the Cub. They are all the heirs of the Cub, and as such, owe homage and their very existence to their venerable predecessor.

Even if you have never actually seen a Cub in the flesh (and this is getting harder to do every year), if airplanes are your game, you have a good idea of what a Cub is all about. Virtually every pilot has flown or knows someone who has flown a Cub. It is the most often-modeled airplane by radio-control fliers, and for a very good reason: the models fly like a Cub, no matter what their size. In this manual, we will get into the details of what this means, and I think that you will come to understand why “it flies like a Cub” is considered to be a great compliment.

There is elegance in simplicity, and the Cub is nothing if not simple. It is as simple, or if you prefer, as basic or as elementary, as any device could be which is intended to carry human beings through the air. It has no “systems” *per se* to operate; the “fuel system” consists of a fuel control which is on or off, period. There is no fuel pump switch and no tank selector because there is only one fuel tank, and it has no pump (except for the internal engine fuel pump which is not switchable). There is no electrical system in a stock Cub, hence no switches to click (or to forget to click), no master switch, no generator, no lights, no cowl flap control (it has no cowl flaps), no intercooler or oil cooler controls (there is no intercooler and there are no oil cooler doors); no, there is nothing of that kind at all. The only switch in the cockpit is the big, iron magneto switch up on the inside left wing root marked “OFF”, “LEFT”, “RIGHT” and “BOTH”. There isn’t even a parking brake handle because there are no parking brakes.

What there is, however, is a typical manual engine primer, and a carburetor heat control which you must remember to pull out whenever substantially reducing power, particularly on humid days regardless of the outside air temperature. Of course, there is a throttle, but there is no mixture control, and no propeller control (the propeller is of the fixed pitch type). There is not even a fuel quantity gauge, except for a rod with a right-angle bend at its top sticking out from the fuel tank cap with a cork floating in the fuel tank attached to its lower end. This device sits right in front of your face (if you don't have a passenger in the front seat, that is) out there on the upper cowling, and is about as intuitive and primitive an indicator of how much go-juice you have left as could be imagined. As you can see, everything about the J-3 is simple and, accordingly, elegant.

That there are not a lot of things to turn on and off and fiddle with in the Cub does not meant that the airplane lacks charm or personality. Quite to the contrary, I think that very quickly you will find that the Cub exudes tons of charm and personality from every square inch of its usually-yellow fabric covering.

Other airplanes of its type, even those using the same engine, can go faster, climb faster, and fly farther on the same amount of fuel. Other airplanes in the Cub's class are easier to fly, are more comfortable to get into and to sit in, have better visibility out of the cockpit, and are more maneuverable. The Cub is not overall the best performing airplane, by classical standards, of its type. So what is it that has made the Cub one of the most popular and beloved airplanes of all time with pilots of all levels of experience? That is a question that you will have to answer for yourself, an answer that will come to you as it has to so many others, by flying it and getting to know it.

Airplanes, like people, do not come into the world fully grown and in their optimum state. They need careful development, nurturing, and thoughtful fine-tuning along the way until they reach their fullest potential as something useful and, perhaps, something great.

History is replete with examples of this. When North American Aviation was asked to build Curtiss P-40s for the R.A.F., they told the Brits that they could build a better fighter in less time with the same engine. The P-51 "Mustang" was the result. The "Mustang I" first went into action with the R.A.F. as a low-level ground attack and reconnaissance aircraft because, just like a P-40 with its Allison V-1710 engine, it could not perform well over 15,000 feet due to its lack of a two stage, two-speed supercharger, or any kind of turbocharger. The replacement of the Allison with the Packard-built, Rolls Royce "Merlin 61", with its two-stage, two-speed supercharger, ironically turned this low-level attack and reconnaissance aircraft into what is generally considered to be the best high-altitude piston engine fighter of World War II, and perhaps of all time.

A similar irony, but in reverse of the above example, befell the Republic P-47 “Thunderbolt”. Designed right off the drawing board with a sophisticated turbo/supercharger system, and intended to be a high-altitude fighter; P-47Cs and Ds served as the first effective daylight bomber escorts over Europe. However, in a twist of fate that rivals the story of the P-51, the P-47’s real fame and greatest usefulness came when the Army Air Corps realized that it was most useful near the ground, in low-level attacks. So utilized, it became one of the greatest ground-attack, fighter-bombers of all time.

Thus, with creative development and the application of significant modifications, the P-51, originally intended for low-level ground attack and reconnaissance, became a great high-altitude fighter. Originally intended for high-altitude, the P-47, but without the need for modifications other than ordinance delivery hardware, became a great low-level ground attack aircraft. There are many other examples in aviation lore of how intelligent tinkering and modification to an established design has turned what was at first, merely a good airplane, into an outstanding, definitive, and classic airplane. The Piper J-3 Cub is one of these.

As excellent and as elegantly simple as the J-3 is, its design has not been left un-modified. It is a jumping-off point for many subsequent aircraft designs. The first “improved” Cub was the PA-11, the so-called “Cub Special”. Commencing production as the J-3 was phased out in 1947, it had a real cowling around the engine, the seats were moved aft a tad, the fuel tank was removed from in front of the front seat and placed in the port wing, and the engine was mounted a little lower. Also, a more sloped windshield was installed, I suppose for “streamlining”, or some such reason. The first models of the PA-11 had a blue and yellow fuselage with yellow wings to distinguish them from the J-3. The “Cub Special” could be soloed from the front seat which, along with the lowered engine, improved the pilot's forward visibility somewhat. After a while, the Continental C-90-8, 90-100 hp engine was installed, as well as an electrical system and a starter. These features are all fine, and they add convenience, versatility, comfort and performance to the airplane, but the result is no longer a J-3.

I flew an early, blue trimmed model of this airplane which had an upgraded A-65-8 which was purported to put out 75-85 hp. I liked it. It had a sort of Cub feel to it, but it was different. The balance and handling of the airplane was entirely different, and it did not have the same feel at slow speeds either. It was distinctly more modern than the J-3, being a product of the post-war, late 40's; but it lacked the J-3's 1930's charm. The PA-11 flew faster (spec'ed at 112 mph all out, but I never saw anything like that in this airplane in level flight) and climbed bit faster (100 fpm or so); but for all that, it gave up a great deal of that classic Cub élan and personality. It was a hot-rodded Cub for sure, and being such, not really a Cub at all.

It wasn't long before the humble Cub was turned into a tiger. The PA-18 "Super Cub" was and is a great airplane. Introduced as the PA-11's short production life of two years came to an end in 1949, it was and is the ultimate inevitable evolution of the J-3, and specifically of the PA-11 which it was much akin to. The first "Super Cubs" were really just dolled-up PA-11s with the same C-90-8, and usually a second fuel tank in the starboard wing. Before long, flaps were added and bigger and bigger engines were installed up to the Lycoming O-360-A4A ,which puts out a whopping 180 hp. Engines of even greater size have been shoe-horned into the SC's trembling airframe by those wishing for even more performance.

Interestingly, but not surprisingly for such a draggy airframe, even with so much additional power, the old Cub just doesn't want to go anywhere very quickly. Even with engines putting out 260 hp installed, the SC is not reported to do much more than 100 mph in level flight. The last year of the production of this airplane by Piper was 1991, and another company fitfully built them under license until 1994, making the Cub and its derivatives one of, if not the longest running shows in aviation, having being in production in one form or another for more than 64 years.

Let me say right away that the "Super Cub" is one of the great airplanes of all time. It can do things that few other airplane can do, getting into and out of fields that you can barely see from the air ,while carrying a whole lot of useful load. It's a blast to fly, and I have very fond memories of flying one on floats in the Winnipeg, Canada area one summer...ah, that was a good time. However, as great as this airplane is, it has absolutely nothing in common with the Cub except for its appearance (sort of). It's a completely different animal and cannot in any way be compared to the Cub in terms of how it feels and flies. I have heard Canadian bush pilots argue with each other about the relative merits of the "Super Cub" and the J-3. Some swear that the J-3 can get into and out of places that even the "Super Cub" dares not go. I don't have an opinion about that; but, I can tell you that the J-3 is still very highly respected up there where flying is a very important, and sometimes the only means of getting from one place to another.

So, now you are going to fly the Cub. Welcome to a very large and illustrious club. Luminaries such as Eleanor Roosevelt, Generals Dwight Eisenhower, George Patton and George Marshall, as well as 80% of all military pilots who flew in World War II, are fellow members. Probably more pilots of all kinds have received dual instruction in, and have soloed in a Cub, than in any other airplane ever built.

I think that you will find, as I have, that the Cub is a delight to fly, and that it is very intuitive and responsive. It is reliable, predictable, light and sensitive to your input and touch. It will always let you know what it wants: such as more or less airspeed, more or less rudder, etc. The Cub sends its message to you clearly, and seemingly telepathically. As with many things in life, you will coax better performance from it, and have a more satisfying relationship with it, if you simply pay attention to what it is telling you it wants and needs, and heed that message. It can be (and has been) operated from fields as small as 600', from beaches, tiny sandy islands, golf courses, ball fields, farmer's fields, roads, rough strips, snowscapes and waterways, both frozen and not, all over the world. Pretty much any clear area, wet or dry, is an airport for a Cub.

You can do some simple aerobatics in it if you like, or you can cruise around at low levels and take in the scenery at a relaxed pace with the big double doors wide open. You can even fly it backwards into a stiff prevailing wind, and hover it to a landing like a helicopter. It is easy to fly, but challenging to fly really well. It is a mirror of your skill, ability and dedication; and, no matter how long you have been flying, or what you have been flying, it will teach you something (maybe a lot) about committing aviation.

Perhaps you have been to an airshow over the last few decades and have seen the "Flying Farmer" act. What happens is that one of the pilots from the airshow is going to take a "farmer", dressed in stereotypical "farm" clothing, complete with a big floppy straw hat and a suspicious looking long black beard, for a ride in a Cub to assuage the "farmer's" anger at the airshow airplanes which have been scaring his cows, or some such thing. Well, the "farmer" gets in the rear seat, and the pilot pulls the prop through from the front of the airplane. The engine starts; but, before the pilot can get into the Cub, somehow, the throttle is opened and the Cub takes off with only the "farmer" in it, who, ostensibly has never even been in an airplane before. All the time, the airshow narrator is shouting instructions to the "farmer" over the P.A. system on how to fly the Cub, and how to get it back down safely. Of course, the "farmer" does everything wrong. For about ten minutes, the Cub flies around drunkenly and crazily, doing things that you would not believe, including very slow loops and rolls at no more than 100'. After a while, the narrator says. "If you haven't figured it out yet, the Cub is being flown by an expert pilot, Charlie Kulp". Then Charlie does some really fabulous precision aerobatic flying, eventually shutting the engine off in flight, landing, and coming to a stop exactly where he started from.

I have seen this act a few times over the years, and I have always enjoyed it tremendously. After one performance I went over to where the Cub was parked to speak to Charlie Kulp. He was very friendly, and he welcomed my questions. My first question to him was, “So, how have you modified that Cub to do all those things that you do in it?” He grinned a big grin and said, “It’s a stock, 65 horsepower, 1946 J-3. I haven’t done a thing to it.”

Well, you may never become as proficient a pilot as Charlie Kulp, few of us ever will; but, as you become more and more familiar with its ways and habits, the Cub will become a good, reliable friend, as well as a challenging mentor. Like all great airplanes, it wants to fly; all you have to do is guide it gently, but firmly, like a spirited thoroughbred, and it will reliably perform for you and bring you safely to your journey’s end. I know that you will enjoy flying it as so many have before you.

The 747 Captain Who Forgot How to Fly

Sometimes during our lives, the familiar things that we think we know best and which we therefore take most for granted are, for that reason, forgotten. A good friend of mine who is a flight instructor, told me about a student he had a short while ago. This student of his happened to be a 747 Captain with twenty-five years flying experience and with over 45,000 hours of flight time, much of it in heavy, commercial jet airliners, as Pilot-in-Command. The Captain came to the flight school where my friend worked because he felt that he needed to re-connect to his flying roots, he wanted to reacquaint himself with and enjoy the more basic and personal flying experience that he fondly remembered. Most of all, he was curious as to just how much he still remembered about flying.

Now, to some, it may seem somewhat strange that the experienced Captain of a commercial airliner might wonder if he could still fly. It sounds a bit peculiar, yes? Not at all. You see, flying commercial airliners like the 747 is not exactly a seat-of-the-pants, hands-on, “stick and rudder” affair. No, it is more like a “program the computer, turn the dial and, push the button affair”, done strictly by rigid, unwavering procedures and routines, and by exact numbers. During a typical flight of an airplane of that kind, very little of what we might call “flying” is involved; even the landing is often automated. Accordingly, as our erstwhile Captain’s heart, mind and soul was distinctly dedicated to aviation, not unlike we devoted flight-sim pilots, he was concerned that he had backslid somewhat in the flying-skills department. As a good and diligent professional, he wished to address the deficiency and to employ whatever means were necessary to cure it.

The appointment was made, and a two-hour block of time was reserved for the Captain in the school's 1945 J-3C-65 Cub. This was reputed to be a completely "stock" airplane with nothing more or less installed in it than was there when it left its Lock Haven, PA birthplace on November 14, 1945.

Sure, all of the dozens of FAA ADs (air directives) which apply to J-3s had been performed on it; its fabric had been recovered three times, the last one a really nice Stits job with the latest in chemical preservatives and paint applied. A new Hartzell metal propeller replaced the old Sensenich wooden one in 1964 and another new metal prop was installed in 1995. More recently a new wooden prop replaced the metal one. The original Continental A-65-8 had only 50 hours on it since it was completely re-built. This Cub was on its seventh set of landing gear bungee cords. The tires and brakes had been replaced quite a few times over the years as well. Of course, periodically, magnetos, spark plugs, filters and screens were replaced as needed. A few of the original control cables and their fittings had been replaced with new ones, and the original Piper factory lift struts had recently been replaced with Univair sealed units that did not require frequent inspections. The tail flying wires had also been replaced. Some rusted-out metal in the fuselage frame under the rudder had to be replaced, the new metal welded onto the original tubular-steel frame, which was mostly in remarkably good condition. The original "whiskey" compass had gone dry and had been replaced a few years ago, and the original altimeter having gone to its eternal reward a while back, was replaced with a brand new one which sat in the old one's place in the instrument panel. The original rear, left-side window and the windshield, having become crazed and scarred beyond any reasonable use, had been replaced. At some time, the original glass gascolator had been changed for a newer and safer brass one, and it now sported a fairly new Maule tailwheel assembly and wheel. Except for these things, it was as 'stock" as most of the Cubs in the FAA registry.

This reminds me of the story of "Daddy's ax": the handle had been replaced four times and the blade had been replaced three times, but it was still "Daddy's ax".

So the Captain and my friend did the walk around, checking the tires, the oil level and the gascolator for water in the fuel, pulling and shaking everything to make sure it would stay attached during the flight. They generally eyeballed every part of the airplane that might have worked loose or which might have broken during or since its last sojourn "up, up the long, delirious burning blue". Agreeing that the Cub looked like it would once more take wing without adverse incident, they got on board. My friend, a slim and fit young man of modest height, squeezed into the little 14" wide front seat. The Captain, a tall man of substantial middle-aged heft and not at all recently accustomed to gymnastic exercises, painfully twisted and folded himself through the hexagonal opening in the side of the Cub, which passes for a "door", into the narrow rear part of the cabin, and awkwardly enthroned himself in the far more capacious, but still only barely adequate canvas-sling rear seat. As the Captain settled into this cramped but cozy space, he could clearly smell gasoline fumes emanating copiously from the Cub's sole 12-gallon fuel tank which sat just in front of the instrument panel a few feet in front of him. He could see the stained, grey, corrugated metal of the tank peeping out below the panel.

It being a warm spring day, my friend slid down the left side window, to improve the air circulation in the cabin. He checked to see that the fuel handle was in the "ON" position, and primed the engine with a few squeaky strokes because it had not yet been started that day. One of the flight school's mechanics, who had received the usual fifteen minutes of training necessary to safely perform his forthcoming task, took his position at the front of the airplane and the time-honored, sacred ritual of aviation's call-and-response began:

"Brakes." The mechanic called out.

"Brakes", my friend replied, pushing his heels forward and maintaining pressure on the tiny metal brake tabs sticking out of the wooden floor, inboard of the rudder pedals. The mechanic pulled forward on the once highly varnished and polished wooden Sensenich propeller to see if the Cub's brakes were engaged, thereby preventing it from lurching forward when and if the engine started.

"Switch off?" came the call.

My friend reached back and up to the left wing root and put his hand on the large magneto switch to ascertain that it was indeed off.

"Switch Off", he called back.

The mechanic briskly pulled the prop through eight blades counter-clockwise from his position looking at the front of the plane. Everyone could clearly hear the loud click of the magnetos as they engaged and released at each compression stroke. Satisfied that there was, at last, sufficient fuel in the carburetor and in the cylinders by the squishy sound and feeling when he moved the prop up and down between compression strokes, and by the distinct smell of gasoline dripping from the carburetor, he called out,

"Switch on?"

My friend reached up and back again and turned the hefty magneto switch three quite audible clicks clockwise to "BOTH" and called back,

"Switch on." Holding the control stick fully back, he opened the throttle just a tad, and pushed his heels against the little brake tabs a bit harder.

The mechanic pulled forward on the prop again to see that the brakes were still engaged, and satisfied that they were, he smartly pulled it down through the lower compression stroke, quickly stepping back and to the side. The reliable little air-cooled Continental A-65-8 caught immediately, and ticked over gently. That the engine started on the first try was a bit of luck; that certainly didn't happen every time. My friend pulled the throttle back to its stop, checking to see that the oil pressure was reading in the green.

The temperature being on the high side of 70º, little warm up was necessary. During the slow, s-turning taxi to the active runway my friend went through the checklist which he had memorized using the mnemonic, CIGAR. He first made sure that all the controls were free and moved correctly (C); checked that the altimeter was reading the field elevation (I for "instruments"); glanced at the fuel indicator rod which was standing up at its full length (G for "gas"); checked the trim tab control for neutral (A for "attitude") cranking it back a half turn to give it some nose up trim, because there were two people in the airplane which moved the Cub's center of gravity a little forward in that configuration. Coming to a stop near the side of the runway, he performed the runup (R), which consisted of a magneto and carburetor heat check at 1,500 rpm.

Satisfied that all was well with the airplane, my friend performed a 360 degree turn at the end of the runway to check for incoming traffic, closed and secured the double doors, left the side window partially down for cooling in the cabin, opened the throttle, and with little fanfare or fuss, the Cub was in the air in a little less than 400 feet.

In a little while, my friend leaned against the left side of the narrow cabin and turned his right shoulder toward the Captain, looking back towards him. He did this so that he could be heard over the rattling, clacking and clamoring of the engine earnestly and busily churning out all of its more-or-less 65 horsepower only a few feet in front of the cabin, and so that he would clear that part of the instrument panel where the altimeter and the compass were located so that the Captain could see them. He shouted,

"Alright, climb her at 55 M.P.H. indicated and hold a course of 150 °."

Thinking that this would surely not be a difficult chore for the international 747 Captain, he relaxed and absently observed the painfully slowly receding ground outside the right window. No more than a few seconds later he had to hurriedly turn forward and take the controls as the airplane was in a steepening left bank and was beginning to stall. My friend put the Cub back on its course, returned the nose to the correct angle so that the airspeed indicator read 55 M.P.H. again, and handed the controls back to the Captain, with the admonishment to hold it steady at that speed and course. After a few minutes, the airplane began to gyrate once more and took a strange attitude as if there was no one in the back seat at all.

My friend looked back and saw that the Captain was trying with great effort (but alas, in vain) to keep the airspeed at 55 and the wings level. He was over-controlling the plane badly and was growing more and more frustrated every second. Finally, the Captain gave the controls back to my friend and shouted over the engine,

"Boy, am I rusty. I guess I really did forget how to fly after all these years pushing automatic pilot buttons. You had better give me some instruction and let me practice the basics until I get my feel back again."

Truth be known, if the Captain had simply released the controls, the Cub would have settled down and flown perfectly well all by itself. Properly trimmed out at full throttle, hands off, it will continue to climb in a gentle left turn until it reaches its maximum ceiling. If trimmed for level flight, it will fly hands off all day…well, at least until the fuel runs out anyway; and then it will glide perfectly calmly and silently, with only the soft swish of the air passing over its frame, and quite possibly might land itself and come to an easy stop. The fact is that the Cub, which has neither an auto-pilot nor any need for one, knows how to fly better than we know how to fly it. Sometimes I think that we pilots, for all our valiant efforts, are just interfering with it most of the time.

My friend then took the Captain through all of the basic piloting routines and exercises designed to cause his mind and body to fall into the graceful cadences of flight. Like a dancing master patiently leading a potentially talented and capable, but delinquent pupil, my friend gradually brought the Captain back into the groove that he had once known well, but had left neglected in a dark corner of his memory until it had become a distant and all-but-forgotten echo.

By the end of the second hour, by the resolute agency and expert tutelage of my friend, the Captain was flying much better. His "feel" was, indeed, coming back to him, although his earnest, but flawed, attempt at a three-point landing was just short of a catastrophe. Back on the ground at the post-lesson de-briefing, my friend and the Captain discussed what had happened during the flight. My friend later told me that the Captain was humiliated, but sobered by the revelation that he had allowed himself to have completely lost his touch and faculty for flying an airplane. My friend explained to him that for all its seeming crudity and simplicity, the Cub was a perfect device for informing you as to what you really knew about flying. It was not that it was demanding to fly, it just demanded that you fly it.

The Captain, much abashed, but also much enlightened by this experience, continued his lessons and eventually befriended the Cub, soloing and checking out in it after four more hours of dual. He never let his basic flying skills become so tarnished again, and he never forgot the lesson that the humble little Cub had taught him: even the simplest airplane must be flown with skill; and that precious skills once mastered, must be maintained through practice and diligent execution, lest they become lost over time.

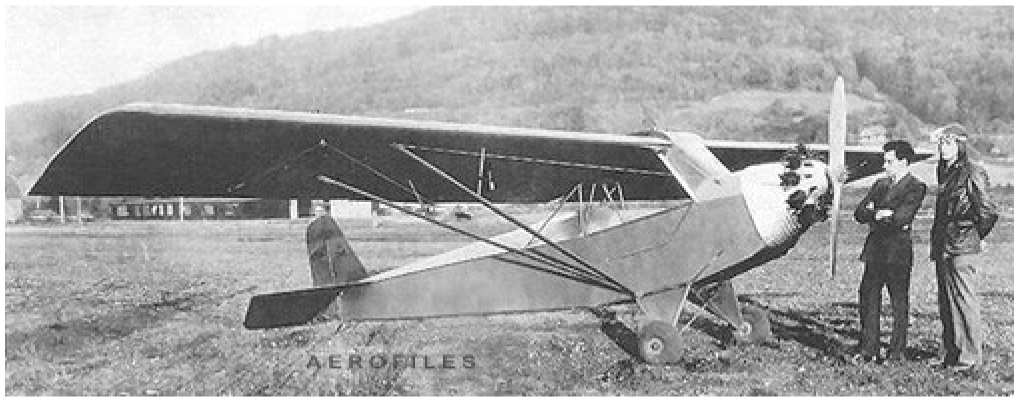
A Short History of a Small Airplane

The progenitor of the J-3 Cub was the Taylor E-2. This airplane, which had many of the familiar lines of what would become the J-3, appeared in 1930 in the beginning of the Great Depression. Clarence Gilbert Taylor, know to all as “C.G.”, or “C. Gilbert”, a self-taught aeronautical engineer from Nottingham, England, had believed for a long time that there were many people who wanted to fly, and that they would positively respond to and purchase an airplane that was affordable and economical to operate. In 1926, as an engineer employed by North Star Aerial Service Corp, Newark N.J., he designed and built an airplane that he thought would fill the bill, which he optimistically called the “Chummy”.

Severing his ties with Northstar in 1927, and taking his design with him, he became the president and founder of Taylor Brothers Aircraft Corporation, in partnership with his brother and pilot, Gordon A. Taylor. In 1927 their factory was located at first at 42 Allen Street, Rochester, New York, and was re-located in 1928 to Emery Field, Bradford, Pennsylvania after Gordon died in an aircraft accident. Taylor, now in association with Arrowing Company located at 127 Alexander Street, Rochester, New York, was trying, without much success, to sell the “Chummy”, now called the “A-2 Arrowing Chummy”, to the public.

1927 - The Taylor Brothers Aircraft Corporation “Chummy” The pilot may be C.G.’s brother Gordon.

Unfortunately the “Arrowing Chummy” was fairly complicated to build, and a bit too expensive (around $4,000.00 in 1928, more than $47,000 in today’s dollars). Taylor built two more versions of this airplane in addition to the A-2 over the next four years, the B-2, with a 100 horsepower Kinner K-5 radial engine, and the C-2, with a 90 horsepower Kinner K-5. They sold very few of them. Recognizing that he had to produce a simpler, cheaper airplane, C. Gilbert hit the designing table and in September 1930 the company began to produce the new Taylor E-2. This airplane had a simple but strong fuselage frame made of tubular steel, and the wings were made primarily of wood, as was the custom in those days. The wing was mounted above the cabin, which had open sides, and the entire airplane was covered in fabric. The engine cylinders hung out in the breeze. All in all, it looked very like the Cub as it eventually came to be and as we know it today; and it is indeed the ancestral father of all Cubs to come. The first engine selected to fly the E-2 was the 20 hp Brownbach “Tiger Kitten”, which was as effective as its name implies. At around 900 pounds takeoff weight, the first version of the E-2 couldn’t lift itself more than a few feet from the ground, flying essentially in ground effect only. Time and money were running out for Taylor.



1929 - C.G. Taylor (left) and company Chief Pilot Bud Havens with the prototype Taylor E-2.

Notice the tiny, ineffectual and inadequate 20 hp Brownbach “Tiger Kitten” engine and its relatively enormous propeller, which C.G. seems to be eying skeptically, possibly just after the airplane’s first, somewhat disappointing, “flight”.

As it did for so many, the Depression and hard times overtook Mr. Taylor's dream, and Taylor Brothers Aircraft Corporation had to declare bankruptcy in late 1930. In 1931, William T. Piper, a successful Pennsylvania oilman and one of Taylor Brothers Aircraft Corporation's local sponsors, encouraged and inspired as so many had been by Charles Lindbergh's epic solo flight across the Atlantic, had come to share C. Gilbert's belief in and desire to foster affordable aviation in America. That year Piper purchased the assets of Taylor Brothers Aircraft Corporation, reformed it as Taylor Aircraft Company, and kept it afloat. Bill Piper was not an aeronautical engineer or designer. What he was, however, was an astute businessman, and he clearly perceived a need for a cheap and simple airplane for the masses. It is for this reason that he is sometimes referred to as the "Henry Ford of Aviation".

Piper, the businessman, kept Taylor, the engineer, on as president of the company. He encouraged C. Gilbert to continue to develop the E-2. It clearly needed a more powerful engine. Piper understood that the E-2 ,which was far simpler, and accordingly, far less expensive (initially $1,325 in 1930, $16,355.61 in today's dollars) than the "Chummy" had been, could succeed where the more expensive airplane had failed. Soon the Continental A-40, 37 hp engine was installed in the E-2. This made all the difference. Now they had a good performing, very simple, and, very importantly, inexpensive to build airplane to sell. At some point it was dubbed the "Cub". When exactly and who it was who came up with that adorably cute, aptly descriptive, and eternally memorable moniker is now unknown, but the name instantly struck a positive chord with people then, as it does today.

The Taylor E-2 Cub received its CAA type certificate on June 11, 1931 and business began to improve very well indeed for Piper and Taylor. The sale of 22 E-2s in 1931 kept the doors open and the airplanes rolling, albeit slowly, off the assembly line at Taylor Aircraft. Over the next few years a series of E-2 types were built and sold- the F-2, G-2 and H-2, which were based on the E-2 airframe but with different engines installed.

1935 was an important year in the life of the Cub. By the end of that year, over 200 Cubs had been sold. It was time to move forward once again, even if not everyone involved with the Cub was ready to. Late in 1935 a talented 19-year-old employee of Taylor Aircraft, Walter Jamouneau, with Piper's approval and encouragement, redesigned the open sided H-2 airframe. He closed in the cockpit, thereby reducing drag while adding comfort for the aircraft's occupants, increased the wing's aspect ratio (span divided by chord) by narrowing the chord slightly, increasing the efficiency of the wing while also lightening it somewhat, rounded the wingtips and tail surfaces, both an aesthetic and an aerodynamic improvement, slightly lengthened the fuselage to improve balance and stability, and added a steerable tail wheel and brakes (neither of which were then common on aircraft of this class). Jamouneau made a few other minor cosmetic and aerodynamic changes, and came up with a new airplane; the 1936 Taylor J-2 Cub. The controversy still rages among aviation historians: Was it "J" for Jamouneau, or was "J" just the next useful letter after "H", skipping "I", which might look too much like a number "1"? Does it matter?

Realizing that the J-2 was a marked improvement over the H-2, Piper was more than pleased with Jamouneau's work. C. Gilbert was not. Forgetting his own early days as a Young Turk at Northstar with a new aircraft design running around his brain and the burning ambition to see it fly, and perhaps more than a little jealous that this young upstart had stolen the march on him, Taylor took the J-2 as an insult to himself and to his old design, and petulantly fired Jamouneau. Taylor and Piper had a history of many vitriolic clashes over company policy, as might be expected when two dynamic, talented, and self-assured people share the helm of one organization. Piper, who recognized and valued new, and unfledged talent when he saw it, hired Jamouneau right back, an action which must have greatly aggravated C.G. When Piper could not mollify C.G.'s unreasonable resentment and antipathy towards Jamouneau, and convince him of the efficacy and quality of the Jamouneau's excellent design, he bought out Taylor's interest in the company. Taylor, insulted, and not at all loath to leave under the circumstances, formed the Taylorcraft Aviation Corporation, and went on to design and produce a number of excellent airplanes over the next many years; all, you may be sure, created by their designer to be "better than the Cub".

In 1937 a fire destroyed the Bradford, P.A. factory. Piper relocated it to Lock Haven. Pennsylvania and soon thereafter re-named his company "The Piper Aircraft Company". Piper built the J-2 there, and was able to sell enough of them to keep the factory solvent. His dream of providing affordable aircraft to the masses was beginning to become a practical reality. He encouraged Walter Jamouneau, to whom he owed so much, and who he promoted to Senior Engineer, to continue to refine the J series aircraft, and in 1938 the first J-3 was built. At first, it had an improved Continental A-40, 40 hp engine, similar to that which had been installed in the J-2. Soon thereafter, a 50 hp upgrade of that engine powered the J-3; and finally, in 1940, it acquired the Continental A-65-8, 65 hp engine, and a truly classic airplane was born.

The Civilian Pilot Training Program (CPTP- 1938-42)/ War Training Service (WTS 1942-44), instituted shortly before the United States entered World War II, made good use of the J-3. Approximately ¾ of all of the 435,165 pilots, notably including: U.S. Marine Corps fighter pilot, test pilot, Astronaut, and later Senator, John Glenn; U.S. Navy ace, Commander Alex Vraciu; Douglas Aircraft test pilot Robert Rahn; the highest scoring WWII ace and Lockheed Aircraft test pilot, U. S. A. A. F. Major Richard Bong; WWII European Theatre's U. S. A. A. F. triple ace, Col. Bud Anderson; WW II U. S. A. A. F. bomber pilot and former Senator George McGovern; WASP (Women Airforce Service Pilots) Dora Dougherty; and Tuskegee Airman, Major Robert Diez, trained in that program and trained in J-3s. Eight out of ten pilots who served in WWII took primary training in the Cub.

The J-3's service record is legendary. A coat of olive drab paint, some insignia and markings, some added glass above and to the rear, enlarged windows, in some instances a simple electrical system and a radio, sometimes a wing fuel tank or two, and sometimes a heater, converted the J-3 into the L-4, (previously O-59) for the Army Air Forces, and NE-1 for the Navy and Marines, but it was still a J-3 in every substantial way. It served in all of the services and in all of the theatres of war with distinction in WW II, and in Korea as a "Grasshopper", along with other similarly converted Aeroncas, Taylorcrafts, Stinsons, etc. During World War II, it was flown on coastal patrols searching for enemy submarines, and for the victims of submarine attacks by the newly formed Civilian Air Patrol (CAP). It was occasionally jerry-rigged with guns or a bazooka, and used for ground attack work. It had the distinction of having famously fought in what is thought to be the last air-to-air combat of World War II in Europe, when the bold, pistol-wielding crew of an L-4 forced a Luftwaffe Feiseler-Storch observation plane to land and surrender.

A total of 19,073 J-3s were built when the production of the J-3 ended in 1947. As mentioned before, it was replaced by the PA-11 and after that, the PA-18 “Super Cub”. It didn't stop with only those two; all in all, there were 11 different “Cub” designs produced, of which the J-3 is by far the most popular and beloved by so many. The J-3 continued to be the primary training airplane of choice at many flight schools well into the 1960s until, partially by attrition, and partially because of new trends in training aircraft, it was replaced by tricycle-geared (nosewheel) airplanes, the Cessna 150 and 152, the Piper Colt, the Beech Musketeer, and the Piper Cherokee series. The advent and popularity of the tricycle landing gear, which simplifies taxing, take-offs and landings, spelled the end of the use of tail-draggers like the J-3 as primary training airplanes, and the end of expensive repairs from all-too-frequent student ground loops and nose-overs. There are few pilots today under the age of 60 who took their early training in an airplane with a tailwheel. The J-3 has become a fairly rare bird, a truly cherished collector’s item. Today, and for a while, it has commanded a higher purchase price by far than any airplane of its era and kind.

As of February 2009, there were 5,469 Piper J-3 Cubs of all kinds, 4 NE-1s (Navy), and 31 L-4s (Army) registered with the FAA worldwide, the most numerous model being the J-3C-65, the Cub with the Continental 65 horsepower engine. That’s not many out of the more than 19,000 which were built; and the number of survivors dwindles each year. It is becoming harder and harder to find a J-3; much less rent one to fly. Few if any flight schools use them anymore, and they are becoming more and more expensive to purchase.

Fortunately, A2A has a solution to this: you can now fly the most definitive and accurate flight simulator model of the J-3 to your heart’s content, and experience the feeling of flying one of aviation’s most beloved and enduring legends.

Quick Start Guide

Chances are, if you are reading this manual, you have properly installed the A2A Piper J-3 Cub. However, in the interest of customer support, here is a brief description

of the setup process, system requirements, and a quick start guide to get you up quickly and efficiently in your new aircraft.

System Requirements

The A2A Simulations Wings of Silver J-3 Cub requires the following to run:

REQUIRES LICENSED COPY OF MICROSOFT FLIGHT SIMULATOR X

SERVICE PACK 2 (SP2) REQUIRED

Note: While the A2A Piper J-3 Cub may work with SP1 or earlier, many of the features may not work correctly, if at all. We cannot attest to the accuracy of the flight model or aircraft systems under such conditions, as it was built using the SP2 SDK. **Only Service Pack 2 is required. The Acceleration expansion pack is fully supported but is NOT REQUIRED**.

OPERATING SYSTEM:

Windows XP SP2 (or higher)

Windows Vista

PROCESSOR:

2.0 GHz single core processor (3.0GHz and/or multiple core processor or better recommended)

HARD DRIVE:

250MB of hard drive space or better

VIDEO CARD:

DirectX 9 compliant video card with at least 128 MB video ram (512 MB or more recommended)

OTHER:

DirectX 9 hardware compatibility and audio card with speakers and/or headphones

Installation

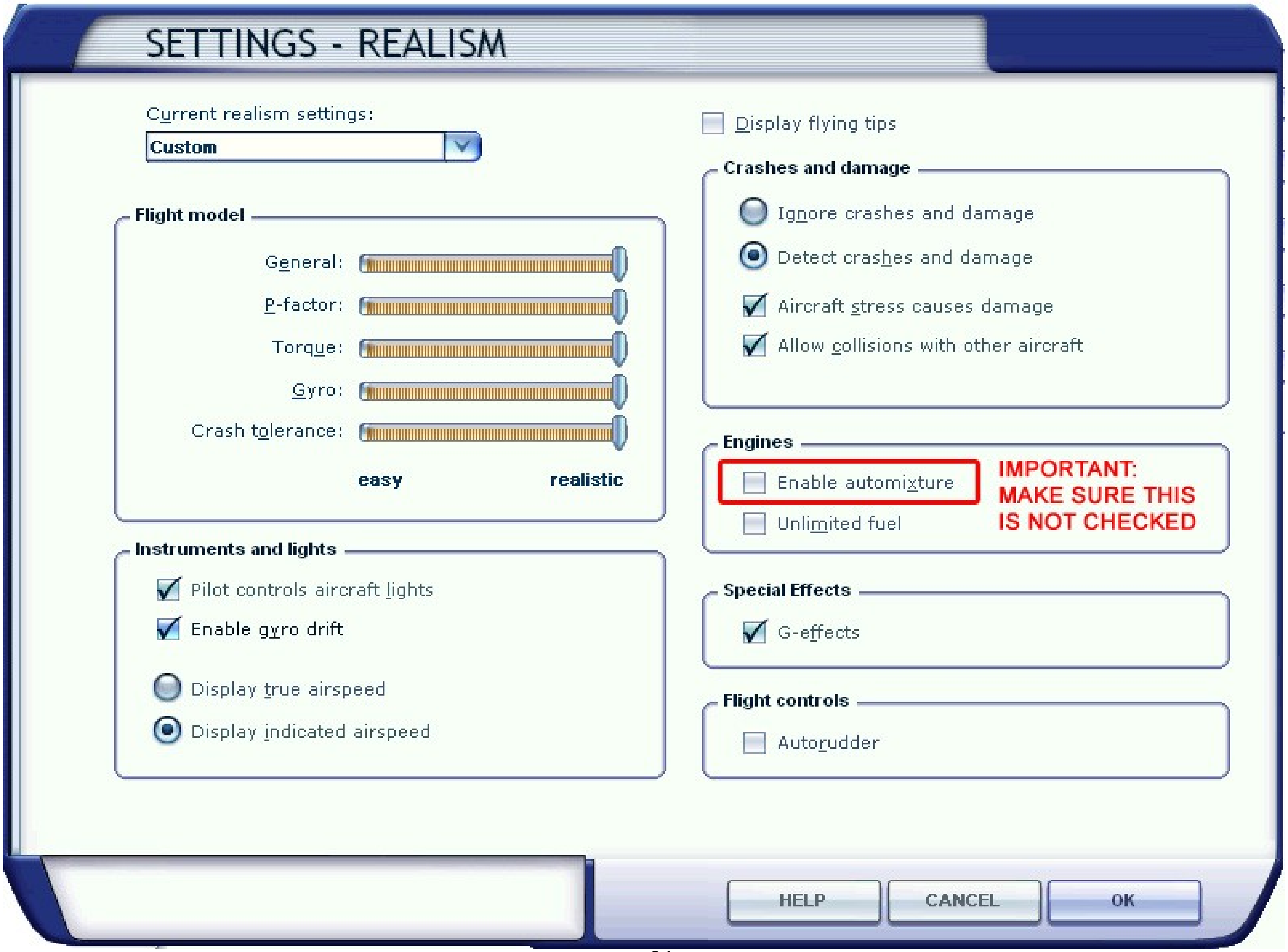
Included in your downloaded zipped (.zip) file, which you should have been given a link to download after purchase, is an executable (.exe) file which, when accessed, contains the automatic installer for the software.

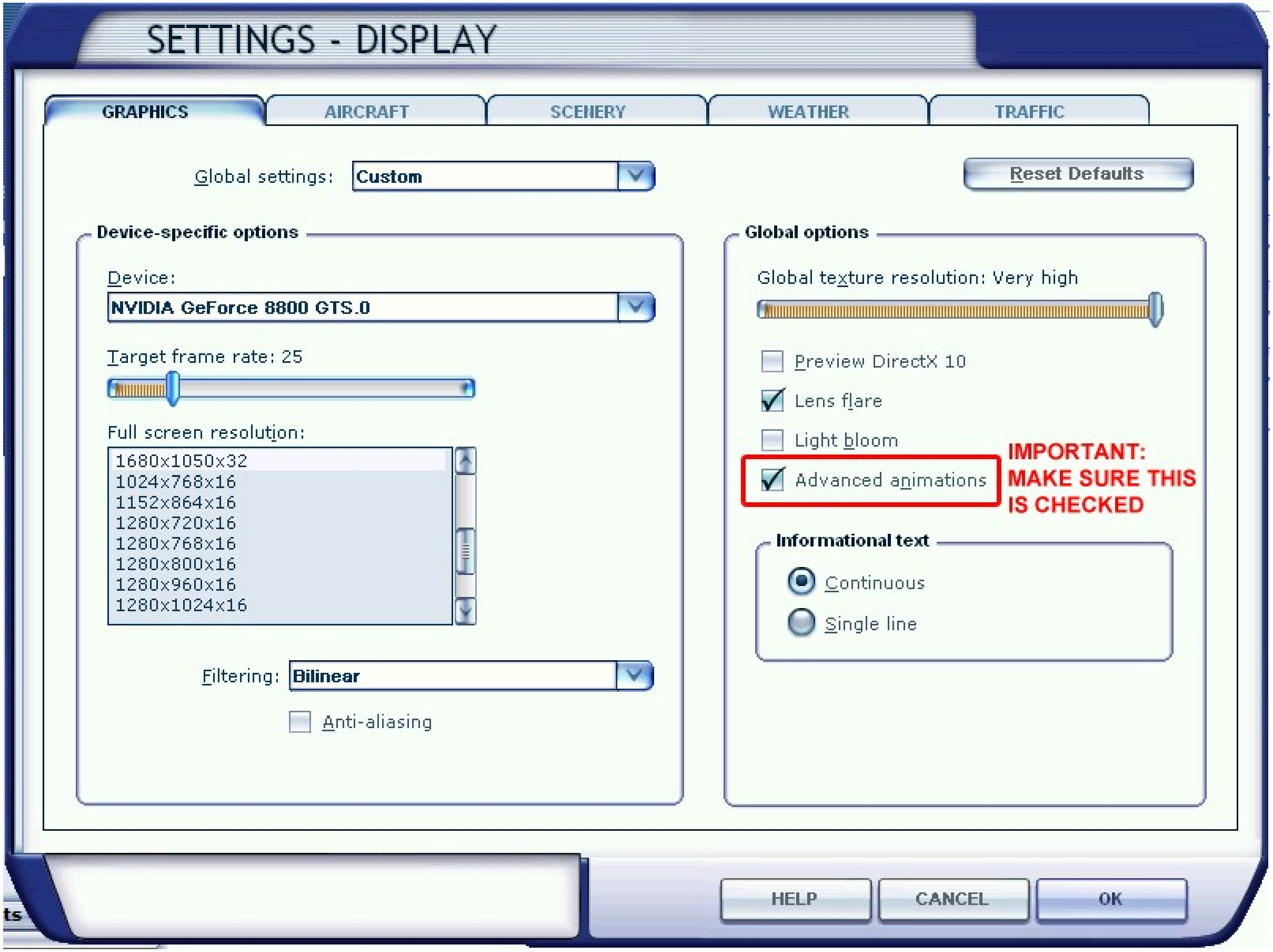
To install, double click on the executable and follow the steps provided in the installer software. Once complete, you will be prompted that installation is finished.

Settings

The A2A Simulations Piper J-3 Cub was built to a very high degree of realism and accuracy. Because of this, it was developed using the highest realism settings available in Microsoft Flight Simulator X.

The following settings are recommended to provide the most accurate depiction of the flight model. Without these settings, certain features may not work correctly and the flight model will not perform accurately. The figure below depicts the recommended realism settings for the A2A Piper J-3 Cub.




SETTINGS - DISPLAY
GRAPHICS
AIRCRAFT
SCENERY
WEATHER
TRAFFIC
Global settings:
Custom
Reset Defaults
Device-specific options
Device:
NVIDIA GeForce 8800 GTS.0
Target frame rate: 25
Full screen resolution:
1680x1050x32
1024x768x16
1152x864x16
1280x720x16
1280x768x16
1280x800x16
1280x960x16
1280x1024x16
Filtering:
Bilinear
Anti-aliasing
Global options
Global texture resolution: Very high
Preview DirectX 10
Lens flare
Light bloom
Advanced animations
IMPORTANT: MAKE SURE THIS IS CHECKED
Informational text
Continuous
Single line
HELP
CANCEL
OK

FLIGHT MODEL. To achieve the highest degree of realism, move all sliders to the right. The model was developed in this manner, thus we cannot attest to the accuracy of the model if these sliders are not set as shown above. The only exception would be "Crash tolerance."

INSTRUMENTS AND LIGHTS. Enable "Pilot controls aircraft lights" as the name implies for proper control of lighting. Check "Enable gyro drift" to provide realistic inaccuracies which occur in gyro compasses over time.

"Display indicated airspeed" should be checked to provide a more realistic simulation of the airspeed instruments.

ENGINES. Ensure "Enable auto mixture" is **NOT** checked. The A2A J-3 has it's own internal mixture and this will interfere with our extensively documented and modeled mixture system.

FLIGHT CONTROLS. It is recommended you have "Auto-rudder" turned off if you have a means of controlling the rudder input, either via side swivel/twist on your specific joystick or rudder pedals.

ENGINE STRESS DAMAGES ENGINE. (Acceleration Only). It is recommended you have this **UNCHECKED**.

Quick Flying Tips

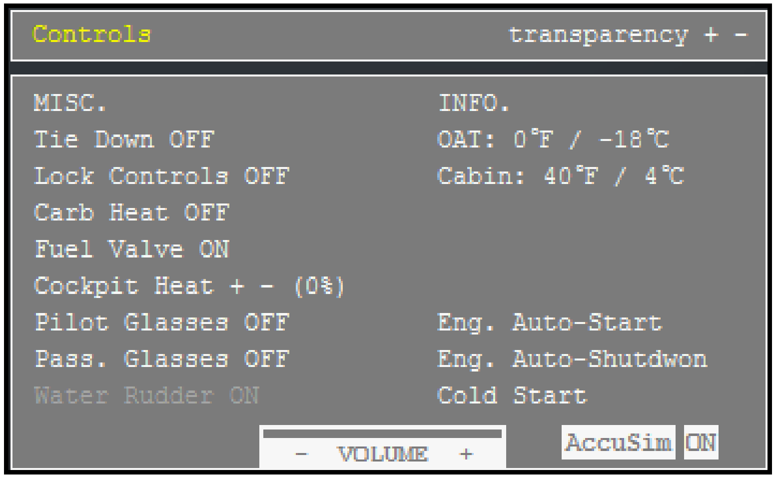
- Use the A key (and Shift-A) to cycle between rear, side, front, and prop starting positions.
- Never take off if your oil temperature is below 40 degrees Fahrenheit. If starting cold, give your engine some time to **WARM UP**.
- **Press H for CARB HEAT** when throttling back to avoid carb icing, especially in warm humid conditions.
- **Use the MAGNETOS to shut the engine down,** not the fuel cutoff.
- Click on left window to crack open, fully open, and close it.
- **FLOATS**: Use CTRL-W to lower or raise the water rudder, or click on the lever which has replaced your left brake. Raise the water rudder prior to takeoff. **Pull back on the stick to get the front tips of the floats up**, 'on the step.' Once up on the step (20-25 mph), neutralize stick and speed will pick up faster. A passenger makes a big difference here.
- **TUNDRA TIRES**: Be careful when landing on pavement, as they will grip and can nose you over. **Make tail low, or three -point landings with Tundras.**
- **DO NOT** over-speed your engine in dives. Pull back the throttle to keep your RPM from exceeding the redline.
- For landings, take the time to line up and plan your approach. Use slips to increase descent rate and/or slow down if needed (opposite aileron and rudder).
- Using a Simulation Rate higher than 4X may cause odd system behavior

2D Panels

Controls (Shift-3)

This control panel is a convenient little place where we put anything we wanted to have quick access to. You can tie down your aircraft, lock the controls with the seatbelt, set the aircraft to a cold start condition, check outside and inside air temperatures, manipulate internal controls, and even put sunglasses on for both the pilot and passenger.

Accu-Sim users can enable or disable the entire expansion pack with a single click and also adjust the volume of the custom sound system.



Payload and Fuel Manager (SHIFT-4)

This real-time payload and fuel manager allows you to visually click and load your aircraft and shows your total weight and individual weights of all items on board.

You can also load a passenger and choose the type of personality you wish.

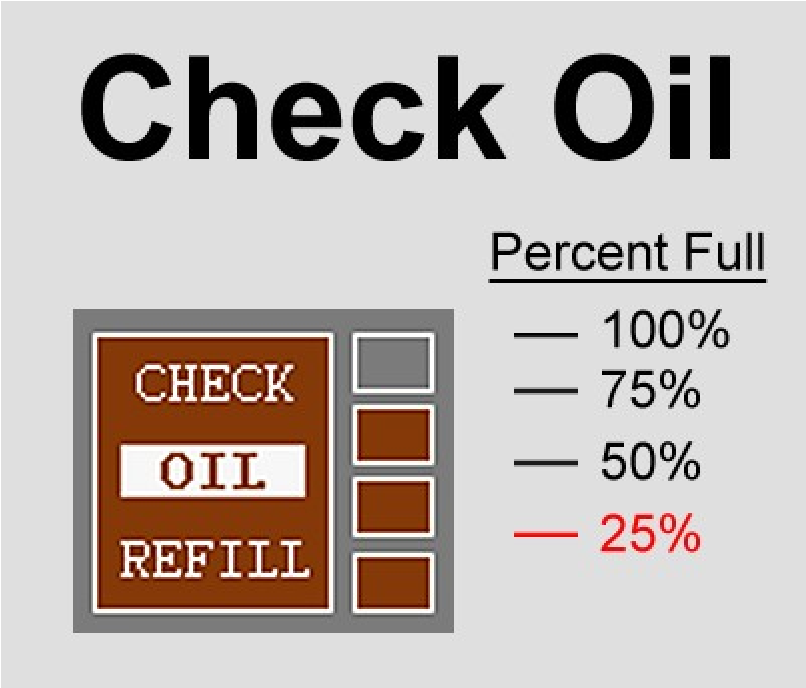
You can adjust the weights of both the pilot and passenger, load up to 20lbs of baggage in the rear, service the oil, and also charge the battery in your remote radio.

In the lower right you can also select either US English or Metric systems.

If you save your flights, conditions such as fuel, oil level, battery, and even things like your pilot wearing his glasses is saved as well. However, oil level is a critical thing to check in any engine, and Accu-Sim includes this check.

When on the ground, you can check and even re-fill your oil in the payload manager. While the oil lever is tracked and consumed continuously, checking your oil level is not always a precise operation. The oil level in your engine will look different if the engine is running, has been running, has been idle, is cold, warm, etc. So to simulate this, we give you indications of the level by quarts.

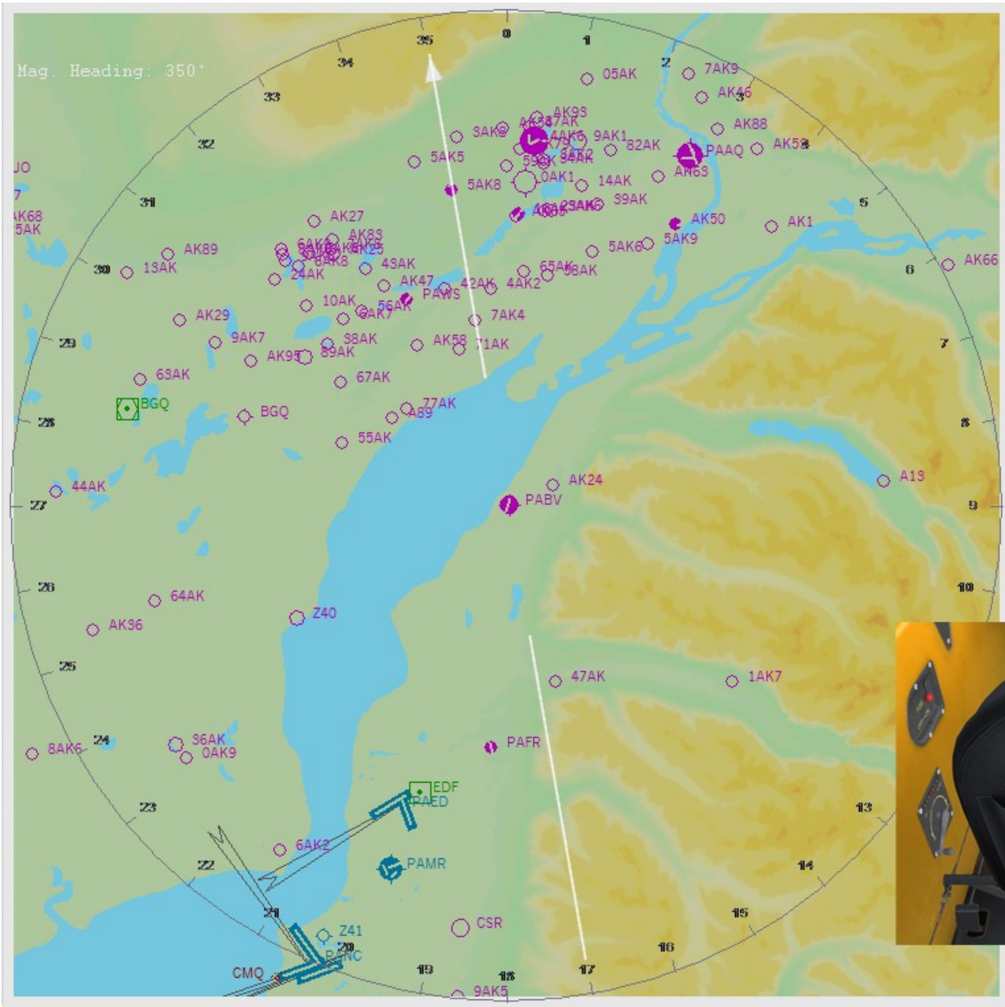
When you click on the CHECK, four boxes will appear, each representing about 1 quart of oil. A brand new engine may consume ½ quart or less per hour of operation, whereas an older, worn engine may consume as much as a quart per hour.



If your engine has a full 4 quarts of oil, and is running, roughly three quarts will lie in your oil pan while a quart is circulating above through the engine. If you let your oil level get down to 2 quarts, you will only have one quart in your oil pan while the other quart is above doing it's job. Letting your oil level get close to or below 1 quart will eventually lead to intermittent oil starvation, resulting in loss of oil pressure. The oil will be pumped up, run out, then fall back down, pumped back up, run out, fall back down, etc. This continual loss of oil pressure will result in rapid wearing and ultimate engine failure, so if you save your flights then you will need to check and possibly top off your oil before every flight.

To re-fill your oil, simply click on REFILL.

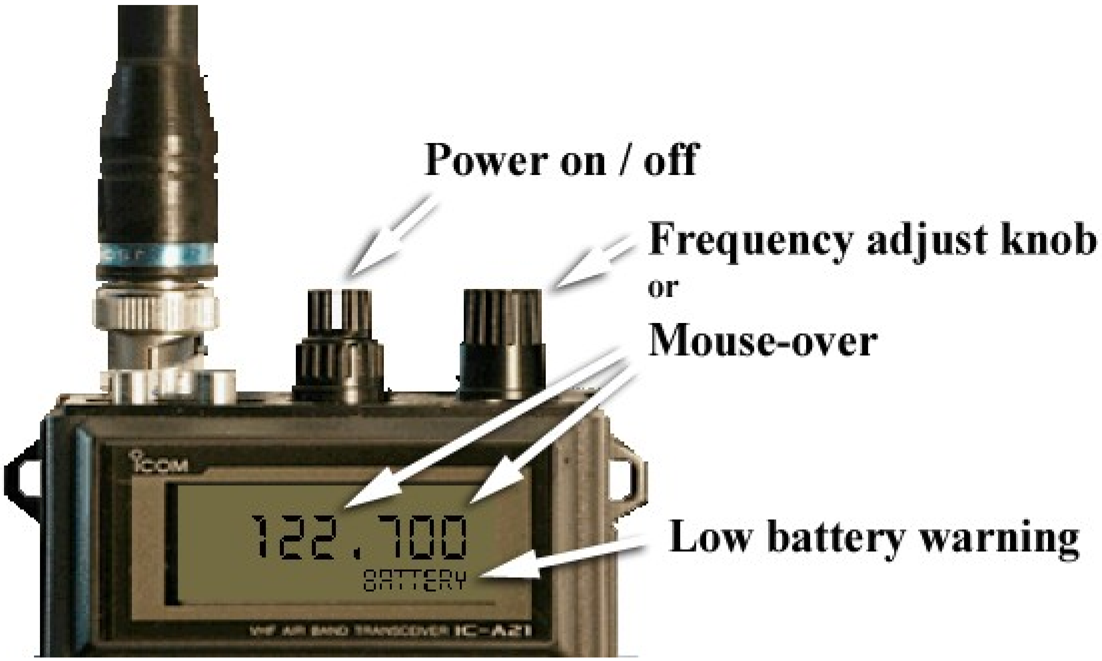
Pilot's Map (SHIFT-5)



You can open the pilot's map by clicking the map in the back seat. This custom map gives you full access to similar information that may be found on real maps and allows this information to be easily accessed rather than have to use the default map from the upper menus. This is a period aircraft, so we tried to create this in the true light of a pilot needing to still use visualization or VOR to know precisely where the aircraft is over the map, hence, we did not include the little aircraft icon in the middle.

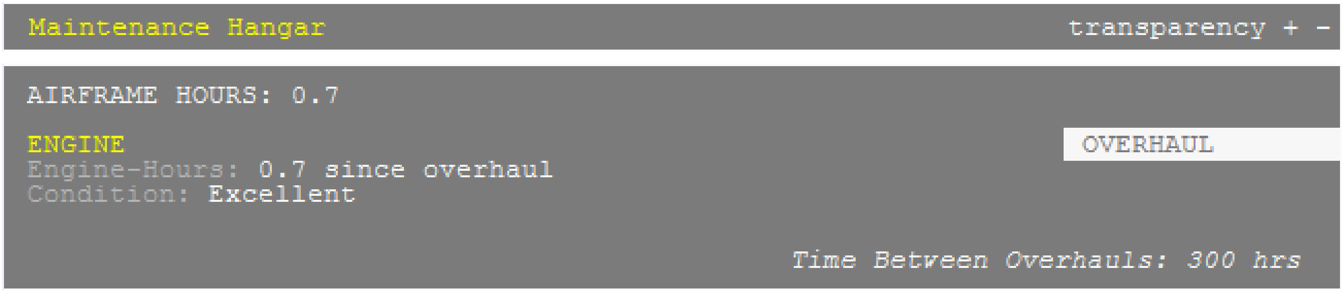
Portable Radio (SHIFT-6)

You have an older-style portable radio that has a battery life of just under 2 hours. If you plan a long flight be sure to turn the radio off when not in use to conserve the battery.



Maintenance Hangar (SHIFT-7)

The maintenance hangar is where you can get a review of how your aircraft engine and major systems are functioning. It keeps track of airframe hours, engine hours since last overhaul, and gives the condition of the engine. If there are some specific issues, like overheating damage, your mechanic will write those notes here. You can also overhaul the engine by clicking on the OVERHAUL button.



Time Between Overhauls (TBO) can be toggled between 1,800 hours or 300 hours, depending on the level of realism vs the time you actually have to fly the simulator.

The engine hours accumulate real time inside the tachometer. These hours are saved automatically for each variant (Regular, Tundra, Ski, and Float).

General Description

(All specifications given below are from publications issued by the Piper Aircraft Corporation, and/or The U. S. Army Air Forces)

A-691 - THE NEW PIPER AIRCRAFT, INC. Model J3C-65

Model J3C-65 (Army L-4, L-4A, L-4B (Navy NE-1), L-4H, L-4J (Navy NE-2)),2 POLM, Approved July 6, 1939.

Army L-4 (previously Army 0-59) is the same as Model J3C-65. Army L-4A (previously Army 0-59A) and Army L-4B are the same as Model J3C-65 except for transparent turtledeck enclosure, revised rear seat with seat back belts, addition of rear shelf and rear floorboard. Army L-4H is same as L-4A except for G. F. radio equipment and revised method of installing the transparent cockpit enclosure. Army L-4J (Navy NE-2) same as any L-4, L-4A, L-4B and L-4H except for installation of variable pitch, metal propeller.

Crew: one pilot

Capacity: one passenger

Length: 22 ft 5 in. (6.83 m)

Wingspan: 35 ft 3 in (10.74 m)

Height: 6 ft 8 in (2.03 m)

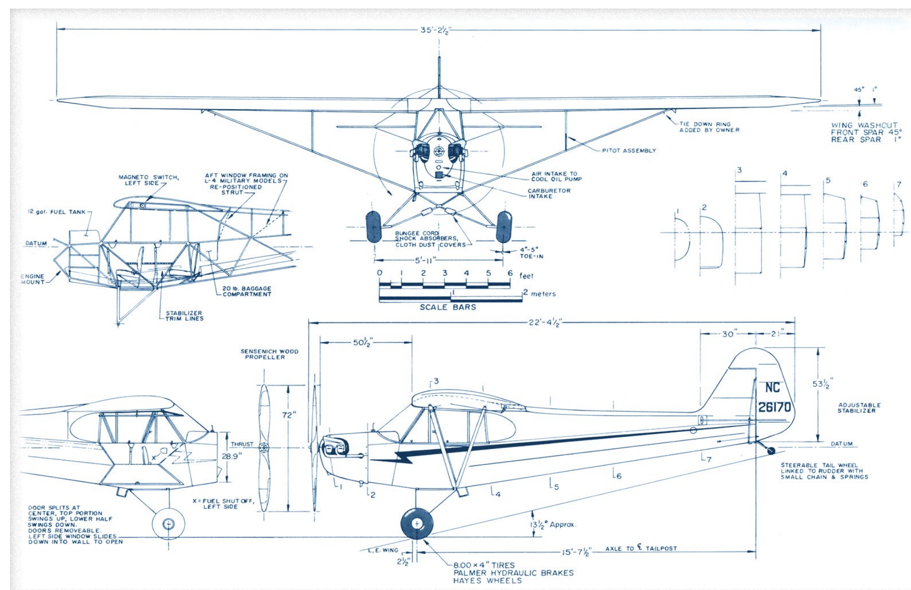
Wing area: 178.5 sq. ft (16.58 sq. m)

Empty weight: 765 lb. (345 kg)

Useful load: 455 lb (205 kg)

Max takeoff weight: 1,220 lb (550 kg)

Powerplant: 1x Continental A-65-8 air-cooled flat four, 65 hp (48 kW) at 2,300 rpm



Seaplane (Float) Version

All operational numbers are the same as the wheels version of the Cub. Useful load and performance in the air will be reduced because of the substantial additional weight and drag of the floats. For more details, see "Floatplane Operations" below.

Ski Version

Similar to the float version, except that there is not much if any drag added with skis, and little useful load reduction except if the heavier, full hydraulic-retractable skis are installed. For more details, see "Ski Operations" below.

Tundra Tire Version

The replacement of standard wheels and tires with tundra wheels and tires will add a small amount of weight and lots of drag to the airframe, slightly reducing useful load, raising the stall speed, and reducing overall performance accordingly. Some instability at slow airspeeds particularly in turns has been reported. Exact figures regarding these factors have not been published. For more details, see "Tundra Tires" below.

Performance

Maximum speed- level flight @ SL : 87 mph CAS- (76k, 140 km/h)

Cruise speed, SL @ 2,150 rpm: 75 mph, (63k, 121 km/h)

Stall Speed, SL: 35-38 mph (30.4 – 34 k , 56 -61 km/h) SL @ gross weight

Cruising Range, SL: 220 stat. mi (191 NM, 354 km)

Service ceiling: 11,500 ft (3,500 m)

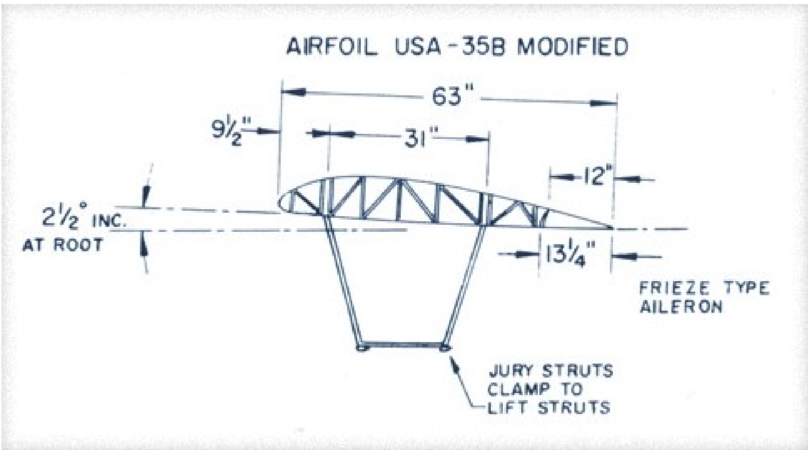
Best Rate of Climb- @ Vy – 55 mph: 450 ft/min (2.3 m/s) – @ gross weight

Takeoff (SL, standard day, gross weight): ground roll – 370' - over 50' obstacle – 730'

Landing (SL, standard day, gross weight): ground roll –290' - over 50' obstacle – 470'

Wing Loading: 6.84 lb/ft² (33.4 kg/m²)

Power Loading: 18.75 lb/hp (11.35 kg/kW)



Fuel
73 minimum octane aviation gasoline (STCs available for use of automotive fuel)

Engine Limits
For all operations, 2350 rpm @ SL (65 hp)

Airspeed Limits (CAS)
Vne: 122 mph (106 k, 196 km/h)

Level flight or climb: 90 mph (78 k, 145 km/h)

Glide or dive: 122 mph (106 k, 196 km/h)

Propeller Limits
Static RPM at maximum permissible throttle setting (No additional tolerance permitted):

(a) With A-65-8 engine: Not over 2300, not under 2000.
(b) With optional engines (Lycoming/Franklin) and metal propeller: Not over 2300, not under 1950.

Diameter: Not over 81 inches, not under 69.7 inches (with fixed pitch wood propeller)
Not over 74 inches, not under 72 inches (with metal propeller).

C.G. Range
Empty Weight C.G. Range: (+10.6) to (+22.7)
If placard "Solo flying in rear seat only" is installed: (+8.5) to (+20.3)
When empty weight C.G. falls within range given, computation of critical fore and aft C.G. positions is unnecessary. Range is not valid for non-standard arrangements.

Maximum Weight
Serial Nos. 7842, 7845 through 7883, and 7912 and up are eligible for 1170 lb. These airplanes are also eligible for 1220 lb. maximum weight provided the landing gear is revised in accordance with Piper Dwgs. 31472 and 31423.

Serial Nos. prior to 7912, and not listed above, are eligible for 1100 lb. maximum weight. These airplanes are also eligible for 1170 lb. maximum weight provided the lift struts and attachments are revised in accordance with Piper Dwgs. No. 12352, 13233 and 21642 and for further increase to 1220 lb, upon revision of the landing gear in accordance with Piper Dwgs. No. 31472 and 31423.
Serial Nos. 10339 and up and 2356-A and up of Model J3C-65 eligible for 1220 lb. maximum weight.

Number of Seats
2 (one at +9 and one at +36)

Maximum Baggage
20 lb. (+49)

Fuel Capacity
12 gallons (-18)

Oil Capacity
1 gallon (-29)

Detail Specification for Engine, Aircraft Continental
(Mfrs. Model A65 Series 8, 8J, 8F, 8FJ

CONTINENTAL MOTORS CORPORATION

<u>CONTINENTAL ENGINE SPECIFICATIONS FOR MODEL A65</u>
The engine warranty is subject to cancellation if the engine installation does not conform with the minimum requirements of these specifications.

General Specifications

Type: 4-cylinder air-cooled horizontally opposed aircraft piston engine

Bore: 3.875 in (98 mm)

Stroke: 3.625 in (92 mm)

Displacement: 171 in³ (2.8 L)

Length: 31 in (787 mm)

Width: 31.5 in (800 mm)

Height: 29 5/16 in (745 mm)

Dry weight: 170 lb (77 kg)

Valvetrain: One intake and one exhaust valve per cylinder, pushrod-actuated.

Fuel system: Updraft carburetor

Fuel type: 80/87 octane avgas

Oil system: Wet sump

Cooling system: Air-cooled

Engine Performance

Power output: 65 hp (48 kW) at 2,300 rpm

Power-to-weight ratio: 0.38 hp/lb (0.62 kW/kg)

Specific power: 0.38 hp/in³ (17.1 kW/L)

Compression ratio: 6.3:1

Fuel consumption: 4.4 US gal/hr

Oil consumption: maximum desirable 0.37 US quarts/hr

TBO: 1800 hours or 12 years, whichever comes first

Variants

You have four primary models included with your A2A Piper J-3 Cub, each with at least two different paint schemes:

- Stock
- Tundra Tires
- Floats
- Skis

Flying the Cub

I was going to call this part "The Quick Guide to Flying the Piper Cub". First of all, nothing that has anything to do with a Cub can be reasonably called "fast" or "quick" except the preparation for flight, the runup, the take-off roll, and the speed at which it will endear itself to you. Oh yes, it does turn very tightly and fast. In the air the Cub seemingly turns almost in its own length (it can't actually do that, but it feels like it can). However satisfying they may be, fast and tight turns are not what the Cub is all about. This is an airplane for relaxed, leisurely flying. It's not a nimble aerobat, although it can do some very nice aerobatic maneuvers, if you have the necessary skill. It's not a rapid means of transportation, although it will take you as far as you want to fly, given sufficient fuel, time, and plenty of patience. It won't carry your whole family, unless your whole family happens to consist of you and one other person. What the Cub is, however, is far greater than what it is not, as you will discover.

Opening It Up and Checking it Out

So, first things first. To open the doors, if there is an exterior door handle, which is not, by the way, standard equipment, pull down the handle on the lower door and pull it towards you. Let the lower door fall to the open position. Pull out and lift the top "door", which is actually the right-side window, towards you, and secure it to the wire fixture provided for that purpose on the right wing (see "Cockpit Controls, Right Cockpit Wall").

If there is no exterior door handle, slide down the left side window, reach across to the interior handle and pull it down. Push the bottom door open and walk around to the right side and proceed as mentioned before. Many Cubs which have no exterior door handle have a barrel-type key lock similar to that which is used on store showcases to lock the left side sliding window as a security device.

You can fuel the Cub without the need for a ladder or a step stool. The fuel tank is just behind the engine and just in front of the windshield. The fuel tank filler cap is at around eye level or slightly above for most people. It is often red and it is located on top of the cowling. Only an extremely tall person could peer into the fuel tank to see what was in there. You could dip a measuring stick in the tank to measure the fuel; or, as most people do, just refer to the floating rod "fuel gauge", sticking out of the fuel filler cap. Always give the fuel measuring rod a little push as you walk by it to make sure is hasn't stuck in one place. Most Cub pilots fill the fuel tank before flying. It holds exactly twelve U.S. gallons, or approximately seventy-two pounds of gasoline. The same applies to the oil: never take off if the oil tank it is not full and the oil is not clean. The oil capacity is one gallon (four quarts). Just as with an automobile engine, dirty, black oil will not do the job it was intended to do, except that in the Cub, or in any airplane, if your engine stops in flight, you can't just pull over and call AAA. To check the oil pull up the load manager (SHIFT – 4) and use the oil check and refill utility.

When pre-flighting the Cub pay extra attention to the security of the cowling cotter-type connector pins and the tail flying wires (bracing struts). Check the tailwheel assembly for cracks. Too many three-point landings result in actually touching down on the tailwheel first, causing extra stress to that part; so check it out every time. The following are the things you will want to check in the pre-flight walk around:

General Walk Around

(fabric smooth & tiedowns undone, fuel and oil levels checked)

Port Side (The left side when looking forward, for you landlubbers):

- Bungee cords taut and covers in good condition and taut
- Landing gear in good condition, all connections secure
- No fluid leaks (hydraulic)
- Brake disc & pad not warped and in good condition
- Tire inflated, secure, rubber not cut or damaged, in good condition
- Wing struts, all connections secure, all cables in their pulleys and free to move, condition good, leading edge of wing clean and in good condition
- Pitot tube clean, unblocked, connected, unbent and in good condition
- Wing spar flexes and is in good condition
- Aileron free, attachments, hinges and cables in good condition
- Belly fabric not punctured or damaged and in good condition

Tail

- Trim mechanism secure
- Flying wires (braces between the stabilizer and fin and fuselage above and below) and attachments secure
- Elevator and rudder cable attachments secure, hinges and control horns in working order and in good condition
- Tailwheel steering springs, chains, leaf springs, tailwheel assembly no cracks, wheel in good condition

Starboard Side (You know, the other side from port)

- Belly fabric not punctured or damaged and in good condition
- Aileron free; attachments, hinges and cables in good condition
- Wing spar flexes and is in good condition
- Wing struts, all connections secure, all cables in their pulleys and free to move, condition good, leading edge of wing clean and in good condition
- Tire inflated, secure, rubber not cut or damaged and in good condition
- Brake disc & pad not warped and in good condition

- No fluid leaks (hydraulic)
- Landing gear in good condition, all connections secure
- Bungee cords taut and covers in good condition and taut

<u>Engine</u>

- Underside and port cowling pins secure
- Port ignition harness secure and in good condition
- Propeller secure, no cracks or dents (if wood - no de-lamination)
- Ignition harness secure and all intakes unobstructed
- Starboard ignition harness secure and in good condition
- Oil clean, level at 3-4 quarts, cap secure
- No “significant” oil leaks (don’t get too picky about this)
- Starboard cowling pins secure
- Fuel tank full, cap secure (rod up according to fuel on board and free floating)

<u>Cockpit</u>

- Controls free and correct movement of flying surfaces
- Seatbelts secure
- Magnetos off (touch switch with hand)
- Altimeter set to field altitude
- Elevator trim free and operating correctly, set neutral or according to load
- Primer closed and locked (except as advised herein)
- Carburetor heat off (except as advised herein)

Engine Starting

(NOTE: Accu-Sim is required for in-game hand starting)

There is no trick to starting the engine. A trained helper who can give the prop the correct spin makes it all pretty easy. You just follow and answer the helper's call outs ("Brakes", "Switch off", "Switch on", or sometimes, "Contact"), and all will be fine. When the temperature is at or above 60° F there is no need to prime the engine from the cockpit. If it's colder, before the helper pulls the prop through, give it one shot of prime at 40-59° F, two shots at 32-39° F, and three shots at 32° F or colder. When it is colder than 32° F, leave the primer out (unlocked) during the start. This will enable you to pump-prime the engine if it is choking and balking after it starts. When the helper calls for "Switch on", the throttle should be cracked about ½" after the magnetos are turned to "BOTH".

Solo starting is another story and requires a series of definite steps to insure safety as well as a good start. When you are out flying alone, and you land at a distant airport, beach, lake or field, there may be no one around who can spin the prop for you, and you will have to do it yourself so that you can fly home; so learn and practice starting the engine until it is familiar. There are many in the aviation community who do not recommend solo hand starting under any situation. This procedure carries serious risks in the real world which are obvious. **This manual does not intend to advise real-world pilots with regard to any procedure or method of flying and/or operating this or any aircraft. It is intended as a flight simulation manual only.**

Before attempting to hand start any aircraft, whether solo or with a qualified pilot in the cockpit, you should observe and do these few things in order to minimize the risk of injury:

1. The individual who is going to turn the propeller should **not** wear the following: tie, hat, glasses, bracelets, rings, necklaces, chains, or anything worn around the neck, loose clothing or anything else which could be caught up by the spinning propeller.
2. Only the first row of knuckles of both hands should ever be placed on the propeller and the thumbs should not be placed behind it.
3. Before beginning to pull the propeller through for starting, it should be placed so that it is on an approximate 45º angle with the upper blade past TDC (top dead center) on the left side of the nose when starting the engine from in front of the propeller, or on the right when starting it from behind the propeller.
4. When starting the engine from in front of the propeller, the right leg should be raised and swung strongly down and back in coordination with the downward pull of the propeller so that the starter's body moves back and away from the propeller as it is pulled down through the compression stroke.
5. The starter should take a full step backward after pulling the propeller through and wait until the propeller has come to a complete stop before attempting to pull it through again.
6. If the engine does not start on the first attempt, the starter must observe all of the above when attempting all subsequent starts.

- Open the doors, because you will be reaching inside for a few things in a little while. Now reach inside (see, I told you) and turn on (push in - forward) the fuel valve on the left side cockpit wall. Do a thorough inspection of the airplane and the engine, including the gas and oil levels.

  Before starting, check to see that the carburetor heat control is off (pushed in- forward); but leave it on (pulled out- rearward) if it is below 40° F as the warmer air and throttle plate helps the fuel to atomize.

- Prime as described above, and check to see that the magnetos are "OFF". Follow all the methods described above for cold starting. Do not rely on a visual check of the magneto switch. It may be old and no longer precise, or it may look "OFF" when it is actually in the "LEFT" position. You don't want the engine to start until you are ready for it to do so.

- The method recommended (but not exclusively required) by the FAA of starting any aircraft engine that has no electric starter is to chock the wheels and/or tie down the aircraft securely so that it cannot roll forward after the engine starts, and to pull the propeller through from in front of the aircraft. For reasons having to do with FSX and its inherent limitations, we have modeled the solo starting procedure from behind the propeller which is a common, if not FAA recommended, method for doing this.

  In the real world, solo engine starting is often done as follows:

  Standing in front of the propeller, or if behind the propeller standing on the right side of the airplane ahead of the landing gear, grab the propeller at its mid-point and pull it through six to eight blades or more if this is the first start of the day, or if it is really cold outside. It is advisable to rock the propeller back and forth between the compression strokes as well. You will hear a distinct "squish" sound when the carburetor is primed, and the propeller will feel stiffer to turn. You may also see, and/or smell gasoline dripping from the carburetor. If you see/smell gasoline before eight blades have been pulled, the engine is ready to start. If the engine has recently run, and is still warm or hot, do not pull it through with the switch off at all before starting, as this will likely flood it.

- Reach into the cabin and turn the magneto switch to "BOTH" and crack the throttle very slightly (½", no more). This is a very tricky bit. If you crack the throttle too much you will have a "hot" start, meaning the engine will run too fast immediately after starting. If you are not sure about how much to crack the throttle, don't do it; the engine will usually start anyway and most likely keep running at low idle until you can get in, hold the brakes and open the throttle a little to clear it.

- There is no parking brake in a Cub. If you have them, put wheel chocks against the front of the wheels, or you can tie down the airplane so that it cannot roll after the engine starts. If you're starting the engine from behind the propeller and you don't have chocks, you can "brake" the Cub the old fashioned (and definitely not FAA recommended) way, by wedging your left foot against the bottom of the right main tire. If behind the propeller, with your left hand holding onto the forward door opening, lift the propeller slowly with your right hand until you feel it come up against the high position compression stroke, and pull it down sharply through the lower compression stroke, immediately pulling yourself back with your left arm, removing your right arm and hand from the vicinity of the propeller arc. If in front of the propeller pull it through counter-clockwise with both hands proceeding otherwise as above, stepping away from the propeller as soon as you have pulled it through. The engine should start within a few attempts, not always on the first one, and will tick over nicely and gently. Immediately after the engine has started, reach in and close the throttle all the way to idle. The Cub will not roll on level ground with the throttle at idle.

- If you flood the engine, and until you get the hang of this, you occasionally will; turn off the magnetos, make sure the fuel valve is still on, open the throttle all the way and pull the engine through BACKWARDS (clockwise from in front of the propeller) very hard a few times through at least 2 compression strokes on each pull. To do this with the floatplane version, stand on the left float, and pull the prop through from behind. You will find that more force is necessary to pull the engine through backwards than when pulling the engine through forward. Pull a few blades, three or four, so that the excess fuel will flow back into the tank. Then, and this is critical and dangerous if you forget, **CLOSE THE THROTTLE**. Now you can wipe your sweaty brow, take a few deep breaths, and start the engine using the method described above.

Another very nice and old-school way to start the engine when alone is to do everything stated above until you are ready to pull the prop for the start. This method takes a little practice, but it is a very good way to get the engine going on the first try. Now, with your right hand, gently bounce the propeller against the lower compression stroke like bouncing a ball but with not enough force to pull through. Let it bounce up to and back down from the upper compression stroke. Then, adding to the propeller's downward momentum from the bounce down from the upper compression stroke, pull it down through the lower compression stroke, briskly. You will need much less force to pull the propeller through using this method as it will pull through faster this way, just about insuring a start on the first attempt (if the engine is properly primed and the engine gods are favorably disposed toward you). The compression of the Continental A-65-8, and of the other similar engines that may be installed in the Cub, is fairly low; accordingly, it is very easy to hand start these engines.

By the way, the method for solo starting from behind the propeller is how you always start a Cub on floats or any floatplane with a small engine which has no electric starter. Whoever is starting the engine just stands on the right float, and does everything else the same way as described above.

Note that the original Continental A-65-8 had magnetos that did not make a clicking noise when you pulled the propeller through a compression stroke. For aesthetic value and because we modeled the engine sounds in your Cub from a more modern engine, you will hear the magnetos make a satisfying and reassuring click.

Warm up

Immediately after starting the engine, check the oil pressure gauge to see if the needle is reading some oil pressure. If the needle has not moves within 30 seconds after the engine has started, shut it down immediately an have the engine looked at by a qualified mechanic. Let the engine idle at 700 rpm until the oil temperature gauge needle begins to move. A warm engine should idle with the throttle fully closed at 550 to 600 rpm.

Taxiing

Since forward vision on the ground is nil, particularly from the rear seat, and extra-particularly if there is an occupant in the front seat, taxiing is done utilizing the time-honoured series of S-turns. At least the Cub's fuselage is narrow, and the area which is blocked ahead is small. The tailwheel lags behind the rudder input a little because of the springs which take up some of the force of the pull of rudder application on the ground, and it can feel a little spongy at times. You can make very sharp turns without brakes if the tailwheel is a direct link version, such as the factory tailwheel, or a Scott (which is actually a bit too much tailwheel for a Cub). If a modern "Maule" tailwheel is installed, you can only turn it so far when taxiing before it breaks away from its detent and castors freely. You must use the brakes to steer when the tailwheel is castoring. To bring it back onto the steering detent, applying opposite brake from the turn direction ought to do the trick. When the tailwheel is castoring, opposite rudder to the turn will definitely cause you grief and do nothing at all. The rudder is ineffective on the ground when taxiing slowly without a blast from the prop on it, which will work very well.

The standard brakes are effective, if not overly powerful, which is just as well as there is the possibility of a nose-over if the brakes are jammed on too hard when taxiing quickly with any tailwheel airplane. The little heel brake pedals look and feel ineffective, but they work. The Cub is a light airplane and doesn't create a great deal of momentum at moderate taxiing speeds. A trick that experienced and skilled Cub pilots use to turn sharply, regardless of what kind of tailwheel is installed, is to lighten or lift the tail a few inches with a little forward stick while opening the throttle a bit, and use the aerodynamic force of the rudder in the prop blast to turn. It takes practice and should be done with caution; but this is one of the marks and tricks of an expert Cub driver.

- If the factory brakes have been replaced with the Cleveland type as is required by the STC when tundra tires are installed, be very cautious and conservative with your braking. The factory brakes will hardy ever cause a nose over; but the Clevelands can, and will, if you have a heavy foot (or heel as is the case here).

- Taxiing in a strong prevailing wind requires that you fly the airplane, even though you are on the ground. It is well said of all aircraft, and taildraggers in particular that you never stop flying the plane until it is tied down. When taxiing in a strong wind in a light taildragger like the Cub, hold the elevator so that the oncoming wind strikes its upper surface, holding the tail down. The old tailwheel taxiing rule is: "climb into a headwind, dive away from a tailwind". Hold the stick or yoke back if the wind is blowing towards the nose, hold the stick or yoke forward if the wind is blowing from the tail. In a strong wind, the lightweight Cub will lift its tail like a dog in heat, if you let it. It's harder to steer when the tailwheel is not firmly pressing against the ground. The time that you will have to be most careful when taxiing is when you have a strong wind and you are turning the airplane so that the wind becomes a tailwind. If the wind is strong enough, and the stick or yoke is still back when you turn away from the wind, the tail will come up as sure as the wings are yellow.

  Of course, if you are taxiing one of those newfangled airplanes with a nosewheel, you won't hold the stick or yoke back into a headwind. That would tend to raise the nose and reduce the pressure of the nosewheel against the ground - not a good idea. Neutral, or slightly forward stick or yoke is fine. For nosewheel airplanes, tailwinds present the problem in reverse. Hold the stick or yoke forward to lift the tail, and keep that nosewheel firmly against the ground. Of course, the position of the ailerons when taxiing in a strong prevailing wind is the same for a nosewheel airplane or a taildragger.

  With regard to the ailerons, you want to prevent the wind from striking the underside of the aileron on the upwind wing. If the prevailing wind is blowing directly at the airplane from either side, or directly ahead or behind, the ailerons should be held neutral. If the prevailing wind is anything off those positions, a quartering wind, the old rule is "turn into a headwind, turn away from a tailwind." This makes sense if you think about it. When you push the stick or yoke laterally towards a quartering headwind, you raise the aileron on the upwind wing so that the wind strikes the top of the raised aileron from the front, which tends to push the upwind wing downward. In this way you reduce your chances of getting the wind under the wing, which you definitely do not want to happen in a Cub. Conversely, when you push the stick or yoke away from a quartering tailwind, you lower the aileron on the upwind wing so that, again, the wind strikes the top of the aileron, but this time from behind it. This, too, tends to push the wing down, and thus, once again, prevents the wind from getting under the wing.

Pre-Takeoff

- As mentioned before, there is no parking brake in a Cub, so run-ups require constant pressure on the heel brakes while the throttle is advanced. This can be a problem for particularly short pilots flying solo, as you have to reach up to the wing root where the magneto switch is, to check the magnetos. This may require a stretch up, and while doing this, inadvertently releasing some pressure from the heel brakes. Obviously, with the throttle open for the runup, this is not a good idea, as you will careen across the field in a big hurry. In the simulator, we are saved from this indignity by the mouse and keyboard.

The pre-takeoff checklist is simple: "CIGAR"

C - Controls free and correct
I - Instruments correct - Altimeter set, compass moving free, oil temperature and pressure in the green
G - Gas- check that the fuel rod is floating and is appropriately high
A - Attitude correct (trim set for takeoff-neutral or slightly nose up with a passenger)
R - Runup – check magnetos at 2,100 rpm. No more than 75-100 rpm drop on any one mag., carburetor heat on should show a drop of approximately 100 RPM, if no drop, or much more of a drop than that, stop the engine and have a mechanic investigate.

- In the cockpit your attention will not be distracted by very many instruments. In a stock Cub, you'll find an altimeter, an airspeed indicator, a "whiskey" (float type) compass, a tachometer and a combination oil pressure/oil temperature gauge (See "Instruments"). Back in the day, some flight schools who used Cubs installed an inclinometer, which is the "ball" part of a "needle and ball" turn indicator, so that students would learn how to make coordinated turns with reference to the instrument, and not just the pressure on their butts. As a youth, I occasionally flew a Cub with an actual, complete needle and ball turn indicator, and felt quite spoiled by it.

- Always check the operation and position of the pitch trim crank during your pre-flight check. It's a good idea to crank it one turn forward, one turn backward, and then back to neutral, to make sure that it is working smoothly and will operate properly when you need it later. The pitch-trim crank is intuitive; forward direction lowers the nose, backward direction raises it. This is far better than the confusing overhead pitch trim crank of later Piper models like the Tri-Pacer and the Colt and other airplanes. I could never remember without looking at the arrows; was it a turn to the right to raise the nose or a turn to the left? This is not a problem in the Cub. Before takeoff, if solo, leave it at neutral or crank in a quarter turn nose down before takeoff; and if you're flying with a passenger in the front seat, crank in a quarter turn or more nose up depending upon his or her weight; you'll be glad you did. The all-moving stabilizer is a really great pitch trim system which enables the pilot to trim out smoothly and easily. This system was way ahead of its time, in the 30's and a sophisticated aerodynamic feature for an airplane of its type. It had been used before on far more powerful and faster airplanes such as the pre-war Boeing Navy fighters, starting with the XF3B-1 in early 1927. This state-of-the-art aircraft in its time had a similar trim system, and pre-dates the similar trim system on the Cub by eight years.

- When I was learning to fly Cubs, Orville and Wilbur taught us J-3 pilots to make a 360 degree turn on the ground, and to look all around before taking the runway. (Actually, my most memorable instructor was a very crusty Sergeant-Instructor named Willis, bless him.) This is done to scan for incoming aircraft, because the visibility from the rear seat is so bad. By the way, that little window in the roof above your head is only good for letting in a little light. You can't see much anything of value from it, and it's usually so badly scratched and crazed from stuff falling on it and the sun relentlessly beating on it that it's usually mostly opaque, in any event. Many owners apply green or blue tinted plastic film to it on the inside to block the sun's light and heat. When taking the runway for take-off, be sure that the tailwheel is centered by rolling forward a little ways before opening the throttle. Take notice of the position of where the horizon crosses the front of the airplane, and remember it; you will use this position later for judging your flare if you want to do a three-point landing.

- The rudder is very effective and sensitive, and you can easily over-control the yaw. In any event, you won't need a lot of right rudder on takeoff as in a Corsair or a P-51. They had 2,000 and 1,490 horsepower available respectively for takeoff, and they swung enormous propellers. You only have, at most if you're lucky, 65 hp in the Cub, swinging a 2-blade 69.7" to 81" wood or a 72" to 74" metal propeller. The Cub propeller's P-effect on takeoff (propeller blade angle of attack and, to a smaller extent, prop wash, and not torque as many believe) is easily manageable with just a little pressure on the right pedal, which you will mostly need to counter the gyroscopic precession of the prop changing its axis as the tail comes up. (You remember that from high-school physics don't you?) Of course, when you have a strong or gusty cross-wind from the left, it is a different story altogether. The left cross-wind wants to weathervane the plane to the left, and this exacerbates the leftward-turning P-effect and precession effect dramatically, so be wary. The Cub is a light airplane, and even light winds must always be respected. Cross winds from the right may just negate, or overcome the P-effect and precession entirely. Once the tail is up, you will only have to counter whatever crosswind-generated yaw-axis forces may exist, so be prepared to remove some, or all, of the right rudder that you held at first. In any event, you have plenty of rudder at all times as soon as the throttle is opened (prop wash) and/or you are moving forward.

Takeoff

- Upon opening the throttle for takeoff, if you hold the stick or yoke in the neutral position, the tail will come up right smartly by itself. You should not need much, if any, forward stick or yoke to do this if you have someone in the front seat; but, if you are solo, you might want to hold the stick or yoke a little forward to get the tail up more quickly. The tail-up effect and the way that the elevator responds to the propeller wash is realistically modeled here, and is unique among flight sim aircraft. Be aware that the faster the tail comes up, the stronger the P-effect and precession trying to turn the airplane to the left will be.

  Surprisingly little throttle, perhaps half power or less, along with a judicious amount of forward stick or yoke will create sufficient prop blast to raise the tail, even while sitting still. You can balance the Cub on its main wheels with the brakes on and taxi and even turn like this if you practice it. I've seen this done frequently at airshows, and I have done it a few times; although it makes me a little nervous. Just be careful not to ground-strike the prop.

- When the tail comes up, your visibility will improve greatly. It's still not so good straight ahead if you have a passenger in the front seat; but, it's better than having nothing at all, as you do when the tail is on the ground. On takeoff, Cubs, and most taildraggers, are steered largely by reference to peripheral vision anyway, and you might as well get used to it. You should set up a control on your yoke or stick to move your eyepoint laterally at will. You'll need it in this airplane. When I flew the Cub, I always had my head against the left-rear window when I took off and landed, so that I could judge my position *vis a vis* the side of the runway, and to see a little way ahead past the left side of the engine.

  Crosswind takeoffs are no different or more difficult in a Cub than in any other light airplane. Just remember to hold the stick or yoke into the prevailing wind, and be ready to use whatever rudder and/or brakes as may be necessary to keep the nose on the centerline. Once you are off the ground, a coordinated turn into the wind will keep you climbing out over the center of the runway. No surprises here.

- In any event, the Cub will lift off so soon after you open the throttle that you won't have time to get into much trouble. If the trim is set at or near neutral it will lift off by itself at around 40 M.P.H. Some wags say that the Cub only lifts off because the earth is curved, but that is nonsense; everyone knows that the earth is flat, don't they?

Climb

- Once in the air, it is an entirely different animal than it was on the ground - from an awkward flightless dodo to an eagle, or something like that. Well, maybe not exactly an eagle, more like a tired starling (apologies to Jack Bruce). The pitch in the climb is fairly flat and the climb is positive and very stable, if not very dramatic. With 65 hp, you will climb at between 400 and 500 feet per minute, depending upon the density altitude (see below) and your weight. 55 MPH indicated will do the trick. You can add a few MPH if the wind is gusty, or if you're at or near gross weight.
- Unlike some airplanes you may have flown, the Cub is flown more by feel than by precise numbers. Experiment with different airspeeds in the climb, depending upon the aircraft's weight and the density altitude on the day you are flying. No matter what you do, it will take a while to get to altitude, so relax and enjoy the flight.
- When climbing, I always put the horizon between the first and second screw in the windshield frame on the horizon, more or less, depending upon the conditions of the day, and that always works fine. In a strong headwind you will seem to climb faster after takeoff, since you will be at a much higher altitude than usual by the time you reach the end of the runway. This is, unfortunately, just another one of nature's cruel illusions. It's not that you climbed at a faster rate, it's just that it took you much longer to reach the end of the runway – sorry.
- You don't need much right rudder to trim out in the climb, which is just as well, as there is no rudder trim control. That's the good news. The bad news is that you will spend a lot of time climbing. When climbing to an altitude to practice maneuvers, getting to 3,000 feet will sufficiently try your patience. That's high enough to do everything a Cub can reasonably do. Many Cub pilots rarely fly higher than 1,000-1,500 feet. You should plan on practicing your stall series and spins at the end of the practice session so you don't have to climb back up again after the last stall or spin.

In Flight Notes

A simple, rugged, open-air engine

You can hardly do harm to the Continental A-65-8 as long as you don't over-speed it in a dive with the throttle opened. In fact, despite what the engine or other manuals might say, you can run it at full throttle (2,300 RPM) all day. As long as you are moving at a nice speed through the air, it will not overheat, provided, of course that there is a sufficient quantity of oil circulating in the engine. Of course, you will prolong the life and health of the engine greatly by running it at no more than 2,150 rpm when in level flight, and never letting it run faster than 2,300 RPM at any time. Use common sense and you will have no trouble from this reliable, tough little powerplant.

Use carburetor heat EVERY TIME you pull the throttle all the way back

You must remember to turn on the carburetor heat (CH) before substantially reducing the throttle. Small throttle reductions when cruising do not require this; but reduced power descents or landing approaches should not be attempted without pulling out the little CH knob located near your right foot on the right wall ahead of the door opening. In the Cub this is an uncomfortable stretch to reach, especially (ahem) if you have put on few inches around your middle as of late. Certain kinds of seatbelt-combo harnesses do not permit you to reach that far forward even if you could do it otherwise. Here, in the cyber world of aviation, your mouse or a key stroke will once again save you from discomfort. In the real world, pilots use all kinds of devices, from string to it pull on and right foot to turn it off, to back scratchers with one tooth cut off so you can snag the knob to pull it open and push it closed. Our equivalent device is to key map it.

But seriously, <u>don't forget to open the carb heat control before you greatly reduce the throttle, especially on humid days regardless of the temperature.</u> Forgetting to turn on the carburetor heat when you reduce the throttle may cause ice to form in the carburetor on the throttle plate (not the intake venturi as many believe). The carburetor on the Continental A-65-8 is mounted below the engine block and remote from any radiant heat that it might acquire from it. The throttle plate needs to be heated when the throttle is closed. The ice which can form there will restrict or even block incoming air, causing you to lose power or have an engine failure. Even if the engine stops in flight for any reason other than fuel starvation, turning on the carburetor heat control opens a door to let unfiltered and un-ice blocked air enter the carburetor. You can then air-start the engine. After the engine is re-started, leave the CH control on for a while to melt whatever ice might have formed on the throttle plate. When the engine is running normally again, close the CH control.

Air Starting

(NOTE: Accu-Sim is required for in-game air starting)

Air-starting the A-65-8 is easy. Old Sgt. Willis ("old" Sgt. Willis was younger then than I am now) liked to demonstrate this technique - in flight. In the non-cyber world, I don't recommend deliberately turning off a perfectly good-running engine in flight, and the FAA frowns upon you doing this in a single-engine airplane, as you might imagine. However, if you find yourself in a suddenly quiet airplane, here is how you do it:

First, check to see that you have some fuel in the tank. There is no point in wasting precious time and altitude trying to re-start if you have no gasoline. If you determine that there is some fuel left, check the fuel switch to see if it got inadvertently switched off. If so, turn it back on (Duh). If the prop is still windmilling at a decent rate, this alone may get the engine to start again. If this is not the problem, and if the prop is windmilling, switch the magnetos to “LEF” and wait a few seconds, then if no joy, switch it to “RIGHT” and wait again, and then to “BOTH”. You do this procedure to determine which magneto is faulty and to fly on the other one. Sometimes the magneto switch gets sticky and needs a little jiggling to clean it, although this is rare. It is more likely that one of the magnetos gave up the ghost, and switching to the other one will get you going.

If the prop has stopped, and assuming that you have the requisite altitude to do it, lower the nose a little to get the prop to turn. You don’t have to do a screaming dive; just lower the nose 10 to 20° or so for a few seconds. 45 MPH indicated or so should be enough to get the prop turning. If there is gas in the tank, the fuel switch is on and either of the magnetos is working and switched on, you should be back in the usual noisy, but otherwise satisfying environment that you were in before.

If you do not have sufficient altitude to air start, or if the engine just won’t start for whatever reason, you will have to plan a forced landing. If you have to think about where to land for more than a second, you have not been paying sufficient attention to your environment. During the course of every flight you should always have a place picked out that you could land in an emergency if you had to. The “where could I land now if I had to” game is one that experienced pilots play all the time that they are in the air.

Scott told me about an instructor he had, who used to pull the throttle off at odd times and without any warning and say, “Alright, where are you going to land?” If Scott took more than second to say where, the instructor would tell him that it was to long, that he should have already had a place selected for such an emergency at all times. *(His name wasn't by any chance, “Willis”, was it Scott?) (No, it was Diego – we used to call him “Diablo,” but he was the best. - Scott)*

Knowing where the prevailing wind is blowing from at all times is important as well. If you are going to make a forced landing you want to set it up to land as closely into the prevailing wind as possible, especially on blustery days. Just because the wind was blowing from 155 ° when you took off does not mean that it is still blowing from 155° now or from that direction where you are now. Clues like smoke and watertrails (lines of lighter colouring on the water) can be very useful in this regard. Particularly in a light airplane like the Cub, if there are no obvious clues, and you are not sure of the prevailing wind direction, just take a moment to observe your track over the ground, and see how the wind is affecting it. Acute awareness of the immediate situation, what the airplane is doing with reference to the ground, and what the weather is at all times, are the surest marks of an experienced pilot, and are things that pilots strive to be more diligent about over time.

Turning

Rudder control in the turn

The use of the rudder in, during and out of a turn is the most misunderstood and most often misused control in all of aviation. This is because of a thing called "adverse yaw" which we will discuss in some detail herein. There is no aileron differential (more up aileron than down) built into the Cub. At full lateral control the ailerons go up 18°, and down an equal amount. You will notice that if the rudder is left neutral when banking, the Cub exhibits a force which causes the the nose to move in the opposite direction of the change of bank angle and the airplane kind of sloppily wallows into the turn. This wallowing can be prevented by the correct application of rudder. This force is called "adverse yaw" and this is why it happens:

When one of those long ailerons comes down on the outside wing when you bank for a turn, it increases the angle of attack and camber of that part of the wing and accordingly creates an increase of lift , causing that wing to rise. This increase of lift also creates lots of drag, called "induced drag" that is always a by-product of lift. The induced drag now created on the outside wing in the turn is sufficient to pull the nose pretty hard in the opposite direction of the bank, unless you simultaneously apply rudder in the direction of the bank to counter the adverse yaw, and keep applying the rudder while the airplane is changing its angle of bank (that is, while the outside wing's aileron is still down and creating lift and drag). Once the angle of bank is established in the turn, the ailerons are neutral and there is, accordingly, no longer any change of angle of bank, the rudder should be returned to neutral since there is also no longer any adverse yaw acting on the airplane for the rudder to counter.

The use of rudder <u>when in a steep turn</u> is a little different (see below), but the principle is the same when entering and exiting the steep turn. The same rule as mentioned above regarding the use of the rudder applies when exiting a turn, that is when you are un-banking and returning to level flight on a new heading. Apply rudder in the direction of the bank when leveling off sufficient to keep the nose from wandering to either side of the new heading to which you have turned. When the nose moves only in the direction of the turn, does not lag behind or move ahead of the turn, and stays on the heading you have turned to, you have applied just the right amount of rudder and you have performed a "coordinated turn and recovery". Congrats.

More and more often in the years shortly after the Cub was designed, aircraft controls were being rigged so that the downward moving aileron would move to a lesser degree than the upward moving aileron. This is called "aileron differential" and is a staple of modern aircraft design. It doesn't always completely eliminate adverse yaw, but it reduces it to a large degree by limiting the induced drag of the outside wing in a turn.

Aileron control in the turn

You will also notice that you have to hold a little extra (inside) aileron in shallow turns (up to 30º) because the laterally stable Cub wants to decrease the bank if you don't. In turns between 30º and 40º you will not find that the Cub wants to increase to decrease the bank very much, and you can leave the stick at or near neutral. In a steep turn (45º or more) the Cub wants to increase the bank and you have to hold some opposite (outside) aileron during the turn to keep the bank from getting too steep. This is more pronounced in a steep, power-on turn to the left than to the right due to engine/propeller torque twisting the airplane around its longitudinal axis to the left and tending to increase the bank angle.

Pitch control in the turn

First of all, whenever the wings are not level, its ability to produce lift perpendicular to the ground is naturally reduced. Also, equally importantly, whenever you are in a banked turn, extra load is imposed on the wing due to increased G-forces (however slight or heavy) created by centrifugal force in the turn (see Newtons "Laws of Bodies in Motion" for a more detailed mathematical explanation of this phenomenon than you really probably want). This load is imposed on the wing at all times in the turn, whether you are maintaining altitude or even if you are descending, and more pronounced, of course, when in a climbing turn, as you are then asking the wing to do double duty - to both climb and turn simultaneously. The angle of bank from level and the extra load on the wing reduce the aircraft's ability to maintain altitude, maintain a given descent rate, or climb in the turn. Accordingly, because perpendicular lift is reduced when banked and/or turning, you will need to pull the stick or yoke back to create a certain amount of positive pitch in the turn which will increase the wing's angle of attack (AOA) and increase lift. The lift created by this increase of AOA permits a level turn (at a slower airspeed), or one in which the airplane does not descend faster or climb slower (given the power available) in a turn than you want it to. The amount of back-stick or yoke increasing AOA, (also called "alpha") which you will need to maintain altitude or a given descent or climb rate in a turn is usually moderate in the Cub; unless, however, the C.G. (center of gravity) is fairly far forward, such as when you have a particularly heavy passenger or heavy cargo in the front seat. In such a case you will need to pull more alpha to maintain altitude or rate of descent or climb in the turn. The steeper the turn, the more alpha you will need to maintain altitude, etc., as in all aircraft.

There is rarely any kind of turn indicator installed in a Cub. As mentioned before, at most you may find an inclinometer (essentially the "ball" part of a turn and ball instrument) on the panel. When flying in the real world your body can clearly feel a skid (sliding out and away from the direction of the turn) or a slip (sliding in and towards the direction of a turn) when making an uncoordinated turn, and you do not need an instrument to tell you how coordinated or un-coordinated the turn is. This is, unfortunately, not possible to replicate with a static flight simulator, even if you have the most sophisticated computer and peripherals available. There is no inclinometer installed in the Cub as you will receive it. Nevertheless, you may still want to know if the turn is coordinated. No problem, just look at the magnetic ("whiskey") compass during the turn; if it is tilted in the opposite direction from the turn, you are skidding outward, and if it is tilted toward the direction of the turn, you are slipping inward. Just apply whatever rudder is needed to more-or-less level the compass in the turn and you will be in a more-or-less coordinated turn. It's a little tricky, and not a precision thing; but then, as I said, not much about the Cub is a precision thing. This "whiskey compass" turn coordinator is, by the way, something that I never read about or heard an instructor tell me about. I discovered it, like others before me, quite accidentally. The Cub is that kind of airplane, and if you pay attention, it will lend itself to all kinds of discoveries.

Slow Flight

Slow-flight, stalls and spins are the heart and soul of the Cub. A cynic might say that the Cub can only fly in "slow flight", but we will not permit that kind of disrespectful blasphemy here. You can really slow the Cub down and still have excellent control in all axes, up to a point, of course. Indicated airspeeds of 40 MPH or less are easy to accomplish. You will have lots of warning before the stall- first, in the form of increasingly sloppy controls, and finally, a very mild elevator buffet, caused by the disturbed and turbulent air coming off the trialing edge of the almost-stalled wing (backwash) and flowing back onto the stabilizer and elevator (BTW, t-tails are designed to keep the stabilizer and elevator out of the wing's turbulent backwash, to reduce or eliminate that pre-stall buffet and to keep the elevator essentially working in "clean" air even when the wing is stalled). At its gross weight, the Cub's low wing-loading (total wing area/gross weight) of 6.84 lb/ft^2 (33.4 kg/m^2) is a major factor as to why the Cub has such a low stall speed and such gentle slow speed behavior.

There are no flaps on the Cub. One might think that with such good slow speed performance they are not necessary. Well, yes and no. You would be correct to opine that the Cub doesn't need flaps to slow down, as the airframe is draggy enough as it is and will slow down right readily when power is reduced and/or the nose is raised. However, despite the belief commonly held by some, flaps are not speed brakes. The application of flaps variably increases the camber along that part of the wing's trailing edge where the flaps are located; and, in some airplanes, increases the area of the wing as well (Fowler flaps). This increased camber/area creates more lift (higher coefficient of lift - Cd). However, the unwelcome, but ubiquitous by-product of lift ,which I mentioned before, is induced drag. Additionally, extended flaps also increase parasite drag (consisting of form, friction and interference drag). All of this drag (induced and parasite) acts like a brake and permits a steeper approach angle when landing without a concurrent gain of airspeed. However, unlike a speed brake, that is not all that flaps do. Up to around 25º of flaps, the increased AOA, camber and increased area when that is featured, increases lift and permits a lower speed of the onset of the stall, thereby also permitting slower approach, touchdown, and liftoff speeds. If the flaps are extended more than 25º, the proportionate amount of drag will begin to overtake the proportionate amount of lift being produced. That is why most aircraft pitch up when the flaps are first lowered and then pitch down as they extend beyond around 25º. Extended flaps also permit a flatter pitch attitude just before touchdown so that visibility over the nose is improved. Additionally, extended flaps create wash-out (higher local angle of attack at the inboard part of the wing as compared to the outboard part), which tends to diminish vicious wing tip stalls. All of this may be interesting (or not), but it's moot: there are no flaps, Jackson.

The Cub's stall speed at gross weight is already very low: 36-38 MPH or less in most instances. Lift-off occurs at around 40 MPH after a very short roll as mentioned before, and the speed at touchdown is also already very low (under 40 MPH if no wind). Accordingly, flaps do not appear to be needed. However, some people install them anyway. This is a very rare and expensive modification, and you may see hundreds of Cubs before you ever see one with flaps added, or you may never see one at all. What people who add flaps to the Cub are apparently looking for is an easy way to steepen the approach before landing. Yes, you can easily slip a Cub and produce a similar effect (see below); but lowering flaps allows a pilot to maintain a wings-level, straight-ahead flight attitude while doing this. For some it may be desirable to use flaps for a more precise and less demanding way to achieve the same result as a slip. I like slips, they're elegant and basic, and they promote good piloting skills. For me, flaps on a Cub are like…well, I think you get it.

As with many aircraft, when in the slow flight mode, lots of rudder will be needed to keep things coordinated, and you will need to add power to make even a gentle level turn at airspeeds around 40 MPH. The Cub trims out nicely for slow flight. You can just stooge around at 40 MPH; and in a sharp breeze you can hover and even fly "backwards" (the airplane isn't flying backwards, of course; it's just that the ground speed is negative). Practicing slow-flight figure eights across a road, or slow-flight constant radius circles around a point in a stiff breeze, are all challenging. These maneuvers will keep you busy even at normal cruise speed, due to the fact that the Cub is highly susceptible to cross winds. Its low weight and low wing-loading make it a particularly light and buoyant flier. At slow speeds you will certainly have your hands (and feet) full to perform these maneuvers while holding altitude. This is one reason why the Cub is the ideal trainer and excellent for acquiring and brushing up your flying skills.

Stalls

Stalls are almost non-events unless you really push them with power and a very high alpha (angle of attack). Remember to turn on the carburetor heat control before reducing the throttle when practicing power-off stalls and spins. A power-on stall in the Cub does not usually, but could turn into a spin if the break occurs while the airplane is banked or yawed to any significant amount. Snap rolls are not permitted in a Cub; but even if they were, you couldn't easily perform them, anyway. A snap roll is, after all, nothing but a forward, accelerated stall/spin, and the Cub's USA-35B airfoil just doesn't give it up very easily, certainly not without deliberate and determined provocation.

Even slightly beyond the normal stall alpha (approximately 18º), the wing will still continue to produce some lift, particularly if the front seat is empty and the fuel tank is not full (CG slightly aft of neutral). In this twilight-zone semi-stall, the Cub performs a kind of mushing descent. In fact, in the event of an engine failure and forced landing over water, rough country, or trees, a mushing semi-stall is the safest way to perform the final descent until contact. The airplane is resistant to deep stalls (alpha far beyond stall onset with tail blanketing negating elevator operation in some instances), and the wing has no tendency to tip-stall and thereby to cause one wing to drop precipitously at the stall break. The whole wing stalls evenly due to both the generous washout which is built into the wing geometry, and the constant chord planform of the wing. To lose altitude quickly without straining the aircraft, you can do a "falling leaf" maneuver by holding the Cub in the stall with the stick or yoke fully back, gently adding first left or right rudder, and then after a moment, the rudder to the other side. Care must be taken that when doing this maneuver that you do not accidentally precipitate a spin. If you do, you will lose altitude far faster (see spins below). The falling leaf is sometimes referred to as a ”checked spin”, which I think describes it well.

Stall recovery is very elementary, my dear Watson. After the stall “break”, release back pressure on the stick or yoke, turn off the carburetor heat control, open the throttle when the wing begins flying again, which will be immediately, and recover by gently pulling back on the stick or yoke, and level off. You will find that you actually do not have to open the throttle to recover from the stall; just neutral stick will do it. When back to level flight, remember to check to see that you have turned off the carburetor heat control.

Altitude loss in a controlled stall is generally in the range of 200-400’, depending upon how quickly you detect that the Cub has actually stalled and how quickly you recover from it. A common beginner’s mistake is to push the nose way down to recover from the stall. It isn’t necessary to do that. Just relax the back stick you were holding to stall the airplane. At most, ease the stick or yoke forward to neutral, open the throttle, and pull gently back to level. You will find that the level flight attitude of a Cub is distinctly nose down and the airfoil, more about which is mentioned below, has a negative angle of attack at its zero lift point.

Aside from a slight elevator buffet just before the stall, as mentioned before, the Cub has no stall warning device *per se.* It does have a unique little quirk though. If you fly at a high angle of attack with the bottom door open, and if the door’s hinges are well-oiled and not too tight, the bottom door will rise up as you approach the stall, and flop back down at the break. It’s a kind of pre-stall indicating device, and it’s pretty cool, I think.

Spins

Spins in the Cub are predictable and quickly recovered from using traditional methods: enter by applying rudder at the stall break. Because the rudder is so powerful, full rudder is not actually necessary to induce a spin (although it is the traditional method) unless the CG is fairly forward of neutral (front seat passenger and fairly full fuel tank). When I flew the Cub in my youth, I was taught always to use full rudder to enter a spin. This was not because it was absolutely necessary to do so to produce the desired result. The methods and procedures which were taught in Basic were intended to instill habits which would be applicable to flying heavier and less responsive aircraft than the Cub.

To recover from the spin, opposite rudder until the spin stops, then, just as in a normal stall recovery, release back pressure on the stick until the angle of attack has been normalized and lift is recovered, then power on and a gentle pull up to level flight. It is not advisable to recover from the stalled condition by releasing back pressure while still revolving in the spin. This will result in an immediate spiral dive with the nose very low. You will reach the red-line (Vne) very quickly, and beyond that is no man's (or woman’s) land from which there is not always a safe return. A word to the wise- **Don’t go there**.

Reversing direction in a spin is a very interesting, exciting and instructive maneuver. Doing it with precision (entry on a particular heading, a set number of turns in each direction and then recovery on the same heading) is difficult and will be a challenge to even the most experienced pilot. This Cub is modeled to permit and foster that kind of precision flying in this and in many other flight regimes.

It requires deliberate effort to induce a spin in a Cub as it is contrary to the tendency of this wing which was designed for maximum stability at low RE. As long as the center of gravity and gross weight are within normal parameters, spins in the Cub do not tend to flatten (nose at or near the horizon), and to thus create a longer, more dangerous and more difficult recovery. The Cub is an excellent stall/spin trainer, and in the real world, its gentle, predictable and reliable stall/spin characteristics enable neophyte pilots to practice stalls and spins, and to learn how to control and safely recover from them without undergoing a harrowing or potentially dangerous experience.

Cruise

Setting up a cruising condition in the Cub is straight-forward. The only thing to remember is that the nose will be lower on the horizon in level flight than you might expect (see analysis of the USA-35B airfoil above). The normal engine speed in cruise is 2,150 RPM. This will give you the best range. There is little to be gained by using higher power settings, due to the fact that the Cub's airspeed will not appreciably increase at higher RPM, and you just will burn more fuel per hour. Around 75 MPH IAS at sea level and at gross weight is about all you will get in level flight in a Cub. Just sit back and enjoy the scenery. Naturally, an un-super/turbo-charged engine like the Continental A-65-8 produces its maximum power at sea level. At any higher altitude it will start to lose power. Accordingly, there is not much advantage to flying the Cub at higher altitudes. The loss of power offsets any gain made from the advantage of 'slipping" the Cub's high-drag airframe through the thinner air up there, even if you had the patience to climb to anything approaching its service ceiling of 11,500 ft (3,500 m). The Cub's critical altitude is at and around sea level.

The Cub was made for low flying and sightseeing, not for high-speed, high-altitude, long-range transportation. You'll get between 3.5 and 4.5 gallons per hour consumption (about 3 hours duration, give or take with 12 U.S. gallons of fuel on board) from the A-65-8 engine at cruise settings depending upon many factors including the type of propeller installed, the density altitude you are flying at, the humidity of the air, the gross weight of the aircraft, the age and condition of the engine, etc. Each Cub and each Cub pilot is a completely separate and different individual.

Aerobatics

Safe, mild, low-G aerobatics in a Cub are possible and most enjoyable with the judicious application of skill, judgment and a good understanding of the capabilities and limitations of both the airplane and the pilot. The standard J-3 is not a powerful airplane, or one that was designed optimally for aerobatics. Maneuvers requiring clean airframes and great amounts of power such as knife-edge and long-line vertical aerobatics are, of course, not feasible in the Cub. There are plenty of aircraft that can do these things, but then again, those aircraft cannot do many of the things that a Cub can. In many instances when doing aerobatics in the Cub you will be fighting its inherent stability, drag and low power. If you can do the following maneuvers smoothly, consistently and well in a J-3, you may well and truly consider it to be a triumph and an accomplishment.

In general, as long as you have sufficient altitude and airspeed, you can, within limits, toss a Cub around pretty much as you please, due to its inherently low speed and gentle habits. The J-3 is rated for an absolute maximum load of +6.15 Gs, and an operational maximum load of +4.1 Gs. However, the J-3 not rated for very much negative G load, no more than - 2 Gs; so go easy with any maneuver that might incur negative G forces. Unless you are really wild, you will not get into much trouble; not so much trouble in any event that, with skill, you can't pull yourself out of it without bending the bird or yourself.

DISCLAIMER:
Although certain LIGHT aerobatics are possible and have been flown in a J-3 Cub, the J-3 is not certified under FAA regulation part 23 as an aerobatic airplane, and therefore A2A Simulations does NOT recommend aerobatics be flown in a Piper J3 outside the flight simulation environment. This manual is intended for simulation use only and not for flight.

Steep Turns

Steep turns are really fast in the Cub. The horizon whizzes right around at a dizzying rate. When banked more than 45°, the rudder and the elevator begin to switch functions. As mentioned before, you will also need to apply some opposite aileron to maintain the bank angle, as the Cub wants to increase the bank in a steep turn. When hauled right over, use “top” or “bottom” rudder to maintain the nose line around the horizon. You don’t need much top rudder either but you will need to add more throttle in a steep turn, particularly if you have an occupant in the front seat. Properly flown, the light and buoyant Cub holds altitude easily even in turns at extreme bank angles.

Loops

Loops require that you lower the nose about 20° with throttle opened until the airspeed is at least 100 MPH IAS. Be careful not to overspeed the engine. That is about the only way to break this hardy engine; but it is a sure way to do it. When you have obtained the necessary airspeed, begin the loop by gently pulling back on the stick or yoke until the airspeed is below 80 MPH to avoid over-stressing the airframe. At that point, you can haul back a bit harder. It is very difficult, if not impossible, to induce an accelerated stall in a Cub within its permissible airspeed parameters, for two good reasons: at normal airspeeds, the available elevator force produced is not sufficient to easily pull the wing into an accelerated stall, and as discussed above, the airfoil is not susceptible to it. When inverted at the top of the loop, relax the back pressure a bit so that the loop is not egg-shaped, but is round and even. In the real world, you can feel that the loop is correct by the fairly constant G-forces as you go up and over. When you can see the horizon appear at the top of the windshield, cut the throttle, and keep holding back pressure sufficient to bring the nose back up to the horizon in level flight before the airspeed gets too high. If the airspeed increases above 100 mph in the recovery, relax the back pressure a bit so as not to overstress the airframe, but do not exceed 122 mph at any time.

As the airspeed drops off in the climb up the loop, you will need to apply some right rudder and possibly some right aileron to keep the track straight. At this point, at low airspeed and with the engine at full throttle, precession, torque, and the P-effect of the propeller all want to roll and pull the airplane to the left. When the nose comes back down, the throttle is cut and the airspeed is increasing, neutralize or push just a little left rudder to offset any heading change that might have occurred. This is called “walking the rudder” and it is a necessary technique in most airplanes in a loop. A good loop is a precise and coordinated maneuver that tests the pilot’s skills in all axes.

In an airplane with limited power, like the Cub, it is required that you obtain as much energy (airspeed and/or power) as you can before commencing the loop, or any maneuver in the vertical plane, so that you will not fall out of the top if it. If (and when) this happens, don't panic. Don't madly pull the stick or yoke back or you'll stall, remain in a stalled condition and keep falling. In this situation, cut the throttle and let the nose fall through the vertical, when the airspeed starts to rise, gently recover to the horizon with gentle back stick or yoke. This situation occurred primarily because you didn't have enough energy for the weight of the airplane when you commenced the loop, and/or you didn't take proper advantage of what energy you had, failing to use the proper amount of back stick or yoke in the climb up the loop. Try it again and keep working on using just the right touch to make it happen. One of the best features of the Cub is that it is always teaching you about flying, so be an attentive pupil.

Rolls

Aileron rolls are big barrels, and while they can be an easy, leisurely affair in a high performance airplane, they are a challenge to do well in the Cub. At airspeeds below 70 mph, the roll rate becomes much reduced and a roll becomes increasingly difficult. Lower the nose at full throttle, watching your rpms so as not to overspeed the engine. When you see at least 100 MPH, quickly pull the nose up about 20-30° above the horizon and then immediately begin the roll with full aileron before the airspeed you just gained is lost in the climb. You can expect that the nose will drop considerably below the horizon as the airplane becomes inverted. Some forward stick or yoke when inverted may help alleviate this somewhat, but be careful not to incur any significant amount of negative Gs. Do not exceed -2Gs at any time. While the nose is greatly below the horizon you must be vigilantly aware of both the maximum permissible engine speed (2,300 rpm), and the maximum permissible airspeed. Vne is 122 MPH (106 k, 196 km/h). Don't exceed these at your peril. If necessary, reduce the throttle when the nose is below the horizon to avoid busting these limits and, accordingly, busting the airplane and/or your neck. Just continue to hold full aileron, and return the elevator to neutral or slightly positive as you pass the vertical plane when returning to upright. If you entered the roll correctly you will come around to upright in due course.

The application of some rudder in the direction of the roll will tighten the roll somewhat so that you can pull a little less pitch above the horizon before commencing the roll, and the pitch excursion below the horizon will be slightly diminished, but not entirely eliminated. Use of the rudder in the roll will not exactly (and not nearly) give you a point-roll; that is, one where the nose stays on a point as the airplane rotates. However, with the addition of some rudder, the roll rate will be a bit faster, and as mentioned before, the whole maneuver will not be quite so extreme in pitch. Be sure to neutralize the rudder when near recovery to upright so as not to incur a spin. To do a simple aileron roll in the J-3 takes a lot of skill and care not to exceed the limits of your engine and airframe. It is well-worth learning to do it, if you can.

Cuban Eights

Being a combination of two partial-loops and two rolls in one maneuver, the Cuban Eight is also a real challenge in a J-3 due to its low power and high drag, both of which which make primarily vertical maneuvers like this one more difficult to do.

How and why the "Cuban Eight" was created is somewhat unusual. In 1936, Len Povey, a Curtiss Aircraft demonstration pilot, flew a Curtiss Hawk II (Model 65), the export version of the U.S. Navy and Marines XF11C-2, at the "10th Annual All American Aerial Maneuvers" (1926-41), an aerobatic contest held at the former Glenn Curtiss Field (at that time called the "Miami Municipal Airport", re-named "Navy

Municipal" and "South Field #2" during World War II, and re-named "Amelia Earhart Field" in 1947) in Miami, Florida. Curtiss was very interested in selling export versions of its latest Hawk fighter to foreign nations, Cuba being one of its prospective customers with representatives of its Air Force present to observe the performance of the new Curtiss fighter.

Apparently, Povey wanted to do a spectacular surprise maneuver at the end of his sequence, and had planned to do three aileron rolls at the top of a loop. As Povey tells it, when he got to the top of the loop he was still going around 140 mph. This was too fast to do the three rolls he planned to do and still stay in the "box" allotted for the aerobatic routines, so he improvised a new maneuver on the spot. He continued to pull through the loop, and when he was inverted and on the 45º down-line, he rolled out and repeated the maneuver going the other way, drawing a big figure "eight" lying on its side in the sky. It was a sensation which impressed all who were there. As it turned out, one of the judges at this contest was none other than James "Jimmy" Doolittle, the same Jimmy Doolittle of the famous B-25 Tokyo Raid, and later, a General in the Army Air Forces. When Povey landed, Doolittle asked him what the devil that last maneuver was called. Povey, who was quite aware of the Cuban representatives there and anxious to curry their favor (and get a purchase order for Curtiss), is reported to have replied off the top of his head that it was called "A Cuban Eight". The story was widely reported in the aviation press and Curtiss ended up selling a lot of these Hawks to Cuba. I bet Povey got a raise.

A Cuban Eight (five-eighths of a loop to a 45º inverted dive, then a half-roll to wings level, followed by another five-eighths of a loop to another 45º inverted dive and another half-roll to wings level) can be properly performed in a Cub by a skilled pilot. The most common beginner's mistake is to let the nose get too steeply down past 45º in the inverted dive after the first half-loop. Care must be taken not to overspeed the engine or the airplane at this point in the maneuver. Commence the roll-out (which will be pretty slow at such a low airspeed) as soon as the nose meets, and is falling through the horizon when inverted, and let the airspeed build up again in the dive with the throttle as open as is safely possible in preparation for the next five-eighths of a loop. As mentioned, the roll out will be slow until the airspeed builds up again in the dive. A little opposite rudder on each rollout keeps things tracking straight. Remember not to dive for very long with the throttle open at any time and always watch, and never exceed the Cub's RPM and airspeed limits.

Begin the pull up into the second five-eighths of a loop as soon as airspeed increases to at least100 MPH, and complete the maneuver with a roll out as before. You will have to "walk the rudder" as in an ordinary loop to keep tracking straight. Performing this maneuver along a long, straight road, railroad, or coastline is a good way to see if you are tracking properly. Good luck.

The "Half-Cuban Eight", which is exactly what it sounds like, only the first partial-loop and roll-out, is a useful maneuver for changing direction in a hurry, and is often used by contestants in various air races, contests, etc. It is similar to, and does the same thing as the "Vertical Reversal", also called the "Crop Duster's Turn", except that in the"Half-Cuban Eight" the airplane becomes inverted while in the "Vertical Reversal" (which is a version of the wing-over), it does not. You can see a good Vertical Reversal done by a Curtiss F8C-5/O2C-1 "Helldiver" in the original "King Kong" during the airplane attack near the end of that great film.

The Split-S

You can Split-S (half-roll and half-loop downward to level flight) in a Cub, but only if the airspeed is low when you begin the maneuver. If it is too low, you may not have sufficient aileron force to roll over; if it is too high, you may surpass Vne in the recovery. It's a delicate balance. Unless you have a lot of experience with how the Cub handles and how much altitude you will safely need, do not try this or any aerobatic maneuver at anything less than 2,000 feet or higher; or, in the real world, where the consequences of a botched maneuver are far more than the inconvenience of a re-start, and can be deadly, without some dual from a qualified aerobatics instructor.

Wingovers, Hammerhead Turns, and Lazy Eights are fun, and are good coordination exercises. The Cub loves to do these maneuvers. An inclinometer in the panel, at least, is helpful to see if you are not skidding or slipping during these maneuvers in the cyber world. Your butt is a sufficient indicator in the real one.

Landing

Descending

Descending in a Cub can be done in a number of ways. If you have the time and patience, just cut the throttle (after turning on the carb heat) and trim the nose down so that the airspeed indicates about 85 MPH. You'll kind of float down at 600 to 800 feet per minute if at, or near, gross weight. Every few minutes or so open the throttle a bit to clear the plugs and to make sure that it will give you power if you need it. If you are in a hurry to "come on down", you can do a falling leaf maneuver as mentioned before. You can also simply stall or spin it down. The only limitations are engine speed and airspeed.

Once happily ensconced in the landing pattern, you can hold altitude on downwind at 1,800 rpm and leisurely cruise to base leg at 60 mph. Be sure that the carburetor heat is on before reducing power. On downwind when opposite your landing spot, depending upon how close in to the runway you are, either cut the throttle entirely, or reduce throttle to 1,200 RPM and trim for an airspeed of 55 MPH. In many instances you will probably need to completely cut the throttle on downwind so as not to come in too high over threshold. Most experienced Cub pilots tend to make curved and close-in patterns so as not to be caught too far out on final. In a stiff breeze, a long final approach can seem like a cross-county trip.

Gliding

Many pilots who fly the Cub for the first time are amazed at its excellent gliding characteristics. They shouldn't be. Its low wing-loading and slow-speed biased airfoil make it an excellent sailplane. In fact, there was a pure sailplane version of the J-3 that the Army Air Corps used during World War II which was designated the TG-8 and TG-8A. The U.S. Army Air Corps wanted a lightweight and inexpensive primary trainer for glider pilots. and they asked the Piper Aircraft Co. to modify the J-3/L4 for that purpose. Piper removed the engine, redesigned the nose to a streamline shape, and lengthened the cabin to provide for an instructor and two students. Piper reportedly built a total of 250 examples of the TG-8 and it is reported that it was an excellent glider trainer. I bet it was cozy in there for three. Most of the TG-8s which survived have been converted to J-3s by now. *Quel domage*.

You can actually thermal a J-3 and gain or maintain altitude with the engine off for as long as you remain in the thermal. This is a very good flying exercise and will teach you much about the value of well-coordinated turns and precise pitch control. Indicated airspeeds of 45-55 MPH work well as a starting point when engaging in endurance gliding in the Cub.

The Approach

Regarding approaches, you are really never too high in a Cub. This airplane is one of the best side and forward slipping airplanes ever made. It is easy and fun to perform these maneuvers, and something everyone should practice every so often. The Cub has a lot of rudder and aileron authority at low airspeeds and you can really get it keeled over and coming down like a loose elevator. This is a very good technique for safely coming in over those high trees and telephone wires at the approach end of the landing area. Because you sit in the center of the Cub, one side is as good as the other for a slip. Of course, you will want to slip with the nose towards any prevailing crosswind; however, if the prevailing wind is light, or on the nose, you can slip right, left, or both alternatively as you please.

The method for effective forward-slips is to lower one wing and to apply opposite rudder sufficient to maintain your original track. Such as when you are using the forward-slip to lose altitude in a landing approach over an obstacle proximate to the threshold of the runway. Since you are essentially flying sideways, and the side of the fuselage is now angled into the prevailing wind, there is much more drag produced in a forward-slip and the nose, which wants to rise in a slip, must be lowered to maintain airspeed. It is this extra drag and the offset wing that gives you that steep descent that you need to get over those high trees and such. You can vary the rate of descent in a forward-slip to suit what you want and need by banking slightly or extremely and compensating accordingly with the rudder to keep the airplane tracking straight ahead. The limit of how much you can slip is set by the amount of rudder authority the Cub has at low airspeeds, The ailerons will overpower the rudder at some point and the airplane will slip-turn towards the low wing (see “Another kind of side-slip” just below).

The side-slip is really the same as the forward-slip except that, typically, in a side slip you are slipping into a prevailing cross-wind by lowering the wing into the wind and keeping the aircraft in line with the runway centerline with the rudder so as not to put too much side-strain on the landing gear upon touchdown. The typical side-slip into a crosswind does not produce as much drag and a steep-descent as the forward-slip. It is essentially an effective crosswind-landing technique. (see “Crosswinds” below)

Another kind of side-sip is a really neat way to turn from base to final when you are too high, or when there are obstacles to get over. As you enter the turn from base to final, cross-control the turn so that the rudder is applied opposite the downward wing but not enough to prevent the airplane from making the turn. If you want to come down really fast, use full rudder and as much opposite aileron as you need to turn toward the low wing. The nose must be held pretty far down in this maneuver (it wants to rise when slipping) to counter all the drag that the slip produces and which will, naturally, really slow you down. The airspeed must be monitored carefully so as to prevent a stall. If you stall in a cross controlled configuration, you will most likely go into a spin. This will be the last spin you will ever do if you do this at a low altitude, such as on a landing approach. By carefully and skillfully balancing the amount of pitch, bank and opposite rudder, you can make a steep, smooth, turning descent onto final that is very impressive and professional as well as useful in many circumstances.

On ordinary, non-slipped approaches, a curved approach from downwind to final at 50-55 MPH, slowing to 50 MPH on final, makes it easier to see the runway, to gauge your height and how much you may need to slip or add throttle, as the case may be. You can vary the curve so as to make any further power adjustments unnecessary. Open the throttle to 1,800 RPM or so to clear the engine after a few minutes at idle to make sure it will accelerate if you need to go around; and, of course, you remembered to turn on the carburetor heat control before reducing power, right?

Crosswinds

Crosswinds play havoc on Cubs because the airplane is so light, and they spend so much time in them on that slow final. Since you sit on the centerline, it doesn't matter which side you have to compensate to. The visibility just improves regardless. Every pilot has his or her favorite way to do a crosswind approach and landing. I like the crabbed (offset nose into the wind, wings level) approach, which transitions to a banked upwind-wing with rudder correction to straighten out just before touchdown (see "slide-slips" above). I find it an elegant and effective maneuver that requires skill, while insuring a safe landing. Others prefer a low upwind-wing approach all the way down final approach. "Ya pays yer money and ya takes yer cherse".

Just before touchdown, bank into the prevailing wind as appropriate, holding opposite rudder so that you will stay straight in relation to the runway centerline when you flair and so that you touch down on the upwind main-wheel first. Hold the stick or yoke into the prevailing wind as you roll out. It is at this point of the landing when ground loops happen or are prevented. Be vigilant with regard to any tendency for the airplane to turn, and immediately correct it (but don't over-correct it) with rudder and/or brakes.

Flair and Touchdown

Books, songs, poems and epic curses could be written about the Cub during roundout and touchdown. Nothing is as satisfying in aviation as a smooth, safe three-point landing. Unfortunately, this is a rarity in a Cub; not an impossibility, just something that you will not experience every time, nor very often. The Cub sits at a fairly extreme angle on the ground. This means that in a three-point landing you have to get that nose up quickly and hold it at just the right angle and at just the right altitude and airspeed. If you fail to properly judge any of these factors you may flair too hard and fast and "balloon", making an immediate correction and recovery necessary with stick or yoke and throttle. If you misjudge your altitude by as little as two feet, you may stall and hit the runway with a bump that will cause your passenger, if you have one on board, to complain. Stalling in the flair at higher than two feet, if uncorrected, may cause the airplane to fall, bounce in on the main wheels and be thrown back into the air with insufficient airspeed. In such a situation you will have to correct in a hurry with stick or yoke and throttle. If you stall in the flair any higher than a few feet, the fall may damage only the airplane, if you're lucky. If (and when) you see that it is going really sour in the flair, **pour on the coal and go around**. A little hurt pride is preferable to a badly hurt airplane or body.

Three-point Landings

When I was first training in Cubs, I used to do that “balloon” thing in the flair all the time. My log book has an entry from Sgt. Willis which clearly indicates his frustration with my apparent inability to get the Cub back down to *terra firma* in a proper manner. The good Sergeant notes therein:

“Cadet makes a good approach and then…C!!!!!”

He finished his lesson remarks uncharacteristically, but very pointedly, and with a flourish, by drawing an angry little arrow angling upward. I must have really tried his patience; but, he eventually taught me how to do it. All I can say is, you learn how to land a Cub the same way you get to Carnegie Hall… practice, practice, practice. The basic technique for making a respectable three-point landing in a Cub is as follows:

- Keep the airspeed constant on the final approach, and do not let it get lower than 50 MPH until you break the glide and flare.
- If you have not already done so, once over the threshold of the runway, cut the throttle and start the initial flare higher than you think you have to, at about 10’. The Cub will slowly settle in ground-effect (commencing at a height above the surface approximately ½ the aircraft’s wing span) in this attitude. The J-3 is a high-wing airplane and, accordingly, the ground-effect bubble is small; but it is there. Under the right conditions, it will float you merrily, merrily, merrily, merrily down the runway quite a ways, especially when combined with a low-level thermal on a still, hot day over a black runway.
- In the initial flare, just bring the nose to level, no higher, until you are at about 5’. Remember that the level flight attitude in a Cub is actually quite nose down. It is this characteristic which brings many Cub pilots to grief when they misjudge the pitch and over-flare too high over the runway. Even with an empty front seat, you will completely lose sight of the runway straight ahead once you flare, and you must look out either side window or use your peripheral vision for reference and orientation to the runway.
- Begin to quickly (but not too quickly, Cadet) pull the nose up so that the horizon is at the same position that you noticed that it was at before the takeoff (you did remember to take notice of it, didn’t you?). Don’t delay the flair, but don’t it hurry either. Here is where the art of the thing lies. Poor, beleaguered Sgt. Willis wrote that frustrated arrow in my log book because I hurried the flare and zoomed. Sense the airplane. If you sense that you are gaining altitude (or, in the real world, if you feel pressure against your butt) when you pull back, you are zooming. In the simulation, you will have to use your Mark-I, Standard Issue Eyeballs. Immediately correct a zoom by lowering the nose to gain some airspeed, adding some throttle if necessary, flair again when the airplane is a the correct altitude, this time perhaps adding a little blast of power to cushion the decent. In a properly executed flare to a three-point landing, the Cub should ideally just rotate about its pitch axis and settle gently to the ground on all three wheels at the same time as it simultaneously stalls. Sure.

- If you over-flare, even at the correct altitude, you may strike the tailwheel first, and kind of buck down the runway like a recalcitrant horse as you pitch forward onto the main wheels, which strike the ground hard, bouncing you back onto the tail wheel, the whole sick thing repeating itself until it settles down like a dropped dinner plate clattering on a hard surface. Striking the tail-wheel first is a common error, and sometimes results in having to replace a cracked tailwheel assembly.
- If you under-flare, you will strike the main wheels first and bounce like a paycheck from Enron. The Cub will immediately bounce up to 5-10' with little airspeed. The correction for this is similar to what you did to correct the zoom: immediately lower the nose, adding throttle as needed, and re-flare with a little throttle to ease the descent. A really bad bounce, recovery, re-bounce and recovery, etc. may be logged as two or three landings (only kidding).

Wheel Landings

Landing on your main wheels first is easier, and is a better choice if the prevailing wind is kicking up a bit, or there is an appreciable crosswind. Also, if flying solo you will have better visibility during the entire landing until the tail comes down on its own. Pilots who are trying to impress their mothers/fathers-in-law, their bosses, their girl or boyfriends, or another pilot, will usually do a wheel landing when they know that they are being observed. It's a lot easier to look good when doing a wheel landing than when doing a 3-pointer, and the chance of embarrassing yourself is so much smaller.

In preparation for a wheel landing, maintain the final approach speed of 55 MPH right to the flare. Reduce or add throttle so as to maintain this airspeed as you descend to the runway. At about 5', raise the nose to level, and no more than that. If you are carrying any power at this point, slowly and smoothly reduce it, do not chop the throttle fast or you will surely bounce. Let the main wheels strike the ground first, and just subtly push the stick or yoke forward just a little bit as the main wheels touch to prevent a bounce. How much to push the stick or yoke at this point is, again, an art which requires practice and feel.

Rollout

Alright, you made it down in one piece, more-or- less, and the landing is over, right? All together now – **WRONG!** You have never finished flying a Cub or any airplane until the engines have stopped running and it is tied down. Upon touchdown, be ready to make fast corrections with the rudder and brakes. I prefer aggressively using the brakes (with stick or yoke fully back and into the wind) after the tail is down in a strong crosswind to stop the roll as quickly as possible before things get out of hand, as they so easily can. Vigilance and instant reaction with regard to the slightest lateral movement, and/or direction change during the roll-out, will pay big dividends in preventing the need for drastic corrections. Just don't create P.I.O. (pilot induced oscillation) by pushing first this rudder pedal and then that one, *ad nauseum*.

Just because the Cub has a tailwheel doesn't mean that you have to do a mad dance on roll out. Just relax, watch, and react quickly and appropriately. The occasional ground loop is a fact of life in a tail dragger, and is not usually too serious (except to your pride), as long as nothing strikes the ground other than the three wheels. As the Cub rolls out and comes to a stop, which takes, mercifully, a very short distance and time; I repeat, do not be tempted to push the rudder pedals willy-nilly because you think, "*after all, this is a taildragger and I have to do something.*"

Except for the crosswind situation I mentioned before, you don't usually need to use brakes to stop or to slow down enough to exit the runway, the Cub will slow down very quickly by itself. Hold the stick or yoke into any crosswind, and use the control positions for taxiing in the wind discussed earlier. Make any rudder corrections which may be necessary as soon as you perceive them. Again, I repeat, do not wait until there is a definite movement to either side, or it will probably be too late. The art of perceiving sideways movement early in the rollout is acquired, like most things of value, through experience. Remember to immediately turn off the carburetor heat when you exit the runway so that dirt, dust and other nasty things are not ingested into the carburetor. Many Cub pilots just push it closed with their right foot.

Shutdown

Turn on the oil dilution switch for at least four minutes at high idle, turn off the fuel pump, open the intercooler doors and oil cooler doors and open the cowl flaps…just kidding. There are none of these things to think about. TIAC (This Is A Cub). When you have taxied to where you will tie down the airplane, and have come to a stop, check to make sure the carburetor heat control is off. Raise the throttle to 1000 rpm while holding the brakes on for a few seconds to clear the engine, return the throttle to idle, and switch the magnetos off. It is some pilot's practice to run the engine on each separate magneto for 30 seconds before shutting down the engine. This is done to cool down the engine, to prevent overheating the spark pug insulators and to prevent backfiring when you shut the engine off. Piper advised that you do this, however I never did it, or saw anyone else do it. If you want to do this procedure you will certainly not do the engine any harm.

Shut the engine off **only** by turning the magneto switch to "OFF".

Some pilots like to shut off the fuel valve off after the engine has stopped running to prevent any fuel from inadvertently moving from the tank to the engine. **The engine should never be stopped by shutting off the fuel valve.** Doing this will deplete all of the fuel in the engine and fuel lines before the engine stops. It will also usually cause backfiring which is harmful to the engine. Shutting off the fuel valve before the engine stops will also make starting the engine the next time very laborious and long, as you will have to pump gas from the tank into the empty fuel lines and get it to the engine by much priming and by turning the prop over many times.

I have known Cub pilots who like to raise the throttle slightly right after they shut off the magnetos to prevent flooding the engine. No problem, it's your option.

Closing up and tying down

To close the doors, see “Cockpit Controls – Right Cockpit Wall” below.

A light airplane like a Cub must be tied down securely, as a brisk breeze can easily upset it. The tail and both wings must be secured to something heavy, or something which is solidly embedded in the ground. Some Cub owners tie down their Cubs to old truck tires. This is fine in weather that does not include very high prevailing winds. If the prevailing wind is just right (or just wrong, actually) the same properties that make the Cub float so gracefully in the air may cause it to float, but not so gracefully, off the ground and smash it, very un-gracefully, back down. Tie down posts that are made for the job of keeping airplanes connected to the ground when the four winds blow is what you want to tie that nice Cub down to. Better still, keep it in a hanger if you can. The fabric will last a lot longer out of the sun and rain and hail and…well you know.

Floatplane Operations

Basically, flying the Cub on floats is as easy and elementary as flying it on wheels. There are a few things you must be aware of when flying from and onto water, but I don't think that you will find them very strange or hard to master. In the real world, you must add a "single-engine seaplane" rating to your license which you obtain by taking about 4 hours of dual instruction and passing a flight test. Here in the cyber world, we can dispense with such formalities and just go and fly.

From the earliest days of flight, airplanes were designed and built to take off and land and on the water. The first seaplane flight was made by an airplane appropriately named “Le Canard”, French for “The Duck”, piloted by Henri Fabre on March 28, 1910. It flew 1,650'. Others, notably Gabriel and Charles Voisin using floats designed and built by Henri Fabre and installed on their airplane named the “Canard Voisin” (it appears that ducks were a popular aviation theme in France in those days) and, in October 1910, flew over the river Seine for the first time.

Glen Curtiss designed and flew the first seaplane to fly in the United States (a Curtiss Model “D”) on January 26 , 1911. He designed many successful seaplanes and flying boats, notably the Curtiss A-1 “Triad”, a seaplane with retractable wheels (!) which became the U.S. Navy’s first airplane in July of 1911. During the First World War, many different types of flying boats and floatplanes were developed and flown by many nations. In the years between the WW I and WWII floatplane and flying boat designs proliferated.

Many historical flights were made by floatplanes in these years, notably the circumnavigation of the globe in 1924, which was begun by four Douglas “World Cruiser”, convertible land/floatplanes, of which two completed the complete journey. The “*Coupe d' Aviation Maritime Jacques Schneider*”, better known as the Schneider Trophy Race, which was held each year from 1911 to 1931, was open to seaplanes only. Most of the aircraft which competed were floatplanes, and many illustrious designs were derived from those fabulous racers, perhaps the most famous of which was the Supermarine Spitfire.

Since 1925, when long, paved runways were few, and waterways plentiful for operating airplanes from, the EDO Aircraft Company has been the world’s oldest and foremost manufacturer of floats for aircraft. A pair very like these are installed on your A2A Cub.

In good, warm weather, floatplanes are often left in the water at a dock between flights. However, many floatplane facilities use a kind of tractor with a device similar to a forklift attached to it, which lifts the airplane up by the floats’ cross-struts, and carries it to and from its parking place on the land and the launching ramp. Once the Cub is in the water, most of the things you will do to prepare it for flight are the same as on land.

Walkaround

Obviously you can't easily walk around the Cub when it is in the water and at the dock. You can, however, inspect it while standing on the dock or on the floats. Most of the same items are looked at, wiggled and checked as when on land. A walkaround of sorts can be done when the Cub is parked on its floats on land; but the floats elevate the whole airplane so high when it is on land, that it is difficult to really inspect it there.

Starting the engine

This is also the same procedure as on land, except that the person starting the engine stands on the right float behind the propeller to pull it through (see "Engine Starting" above).

Untying

After the engine is running, and **never** before, remember to untie the airplane, or have someone untie it from the dock. We aviators do not always have the nautical instincts or experience that sailors do. Many pilots have been embarrassed to find themselves not getting very far from the dock, no matter how much throttle they may have applied, because the airplane was still tied to it (I have heard a rumor that sailors also sometimes do this, too). Before leaving the dock, it is necessary to know the direction of the prevailing wind, so you can plan where you are going to taxi to and takeoff from. In this regard, water operations are very different from land operations. On land the pilot almost always uses the active runway to take off from. On the water, except where there is a designated takeoff area, the decision from where, and in what direction you will takeoff is almost always entirely left up to the pilot.

Taxiing

I have always found the word "taxiing" (as well as "landing") to be somewhat inappropriate for seaplane operations. We could call it "sailing" as an alternative; but that doesn't seem quite right either, so taxiing it is. The same methods for taxiing in a strong prevailing wind apply to floatplanes (see "Taxiing" in the main section above), except that on the water, even the slightest wind and current will tend to move and turn the airplane.

Once in the airplane, with the engine running and untied from the dock, lower the water rudder. The control for this is a black handle on the left side of the cockpit floor just ahead of the left rear rudder pedals, which when pushed down, releases a cable to let the water rudder down, and when pulled up, retracts it. This control can be easily key mapped using the standard FSX menu (I mapped mine to "W"). Once away from the dock, the Cub, or any airplane on floats, is a combination airplane and boat. If you fly from waters populated with boat traffic, you will have to thread your way gingerly around and through the often heedlessly speeding, and blissfully oblivious weekend admirals and their overpowered toys…er, vessels.

You will have to know something about the buoys (no, I won't do it - a joke here would be too easy) and what they mean, so that you don't raise the ire of the Coast Guard or the local marine constabulary. The currents and the prevailing winds will all have to be noticed and accounted for. Control surface positions will have an influence on your progress through the water because the wing acts very like a sail. However, the same rules apply for strong quartering winds, etc, as on land. The only exception is that when making way on the water, you always hold the stick or yoke fully back to keep the nose up and the propeller out of the spray as much as possible, except in a strong prevailing tailwind where, as on land, you hold the stick or yoke forward to keep the tail down, and the nose up.

Forward visibility on floats will be pretty good when solo, as the Cub sits essentially level on its floats; however visibility is just as bad when there is someone in the front seat as it is on land. The same kind of S-turns as are done on land are necessary to clear the way ahead. Because there is no way to brake your forward motion with the engine running, the runup is usually done at the beginning of the takeoff run. After a while, when flying on floats, you will become very adept at doing quick mag and carburetor heat checks. Before takeoff, go through the CIGAR checklist, as usual.

Takeoff

Takeoffs from the water are entirely different from takeoffs on the land. They are not more difficult, they just require a basic understanding of how the floats work and what you must do to maximize their efficiency in the water. Understand from the first that water takeoffs will take a longer distance and take more time than land takeoffs, particularly when near gross weight as you usually are with a passenger and full fuel. Density altitude makes a big difference as well (see discussion below). Even at sea level, if it is too hot and the local pressure altitude is too high, you may not be able to takeoff from the water at all in the minimally powered J-3.

Turn into the prevailing wind and retract the water rudder. At takeoff speeds it is too sensitive when it is down, and it could become damaged. Knowing which way the prevailing wind is blowing is something of an art and an observational skill which you have to learn to fly safely on floats. Looking for smoke blowing on shore is one good clue. If the prevailing wind is fairly strong it will create trails in the water that will indicate that it is blowing across the water. The problem is that it does not always show which of the two possible directions it is blowing from. That is why you must be aware of the prevailing wind direction before leaving the dock if possible. Fortunately, when on the water, the prevailing wind will tend to weather-vane the airplane into it most of the time.

Hold the stick fully back and open the throttle as usual. The prop blast over the rudder will be sufficient to provide directional control in the initial takeoff run until you start picking up some speed. The prop blast over the fully raised elevator will cause the nose to ride fairly high above the horizon. This is good, as it transfers the weight back and keeps the front tips of the floats up so that they won't dig into the water. At this point you are mushing into the water and very slowly accelerating. This is normal. There is little P-factor when on floats, as there is only a slight tail-up rotation when getting up on the step. Accordingly, there is usually just a small amount of left turning tendency during the takeoff run due to prop blast on the left side of the fin and rudder. You will not usually have to think about crosswinds, because on most bodies of water, except on the narrowest of rivers and lakes, you can takeoff directly into the prevailing wind most of the time.

There is no runway to stay in the middle of and no center-line or other visual clues as to how straight you are progressing in the takeoff. Before opening the throttle, take notice of landmarks in the distance straight ahead and to both sides of the nose. Keep these things in their places with rudder so that you will takeoff in a straight line. As you pick up speed, gradually reduce the back pressure on the stick or yoke at around 15-20 MPH to lower the nose to just slightly below the horizon, no lower than that, and let the airplane come up on the “step”. This is not like setting a pitch attitude for efficient cruising in flight; there are real steps on the floats. The step is the lower, forward part of the float separated by a short vertical section from the rear, longer part. In the real world, when the airplane comes up on the step, you can feel the airplane actually climb up out of the water and acceleration increase. Also, when up on the step, the ride smooths out quite a bit and what you will hear changes from a mushing-through-the-water sound, to a sound more like a fast-moving speedboat gliding over the water with a slight amount of float “slapping” as the increasing lift begins to lighten the airplane. In the real world you can distinctly hear and feel these things when taking off.

In the simulator, you cannot, of course, actually “feel” anything like this. Accordingly, you may not be able to definitely tell when you are on the step. Look for a definite progressive increase in speed and listen to the water sound. If you are not sure, you may have to just estimate it from when you open the throttle. In the Cub, you will usually be up able to relax back pressure and get up on the step within 10-14 seconds , give or take, depending upon density-altitude, gross weight, and the prevailing wind. If you do not relax the back pressure at the appropriate time and let the floats come up on the step, the airplane will not be able to accelerate to takeoff speed and you will just continue to mush through the water in a high-drag condition. When rotating forward up onto the step, you do not want to let the nose come down as much as it does in a land takeoff. Lowering the nose too much when on the step is dangerous, as you can dig the front float tips into the water, causing the tail to flip up and the aircraft to nose over. Also, if the nose is at too low an angle when on the step you might “lose” the step and cause the floats to settle back into the water. If this happens, you will have to start the takeoff over with the stick or yoke fully back, etc.

On the step, neutral stick or yoke with the elevator trim neutral will usually suffice to keep you at the correct angle. Running on the step is matter of finding the “sweet spot” that allows you to accelerate fastest. If you have done everything properly, liftoff should occur at just over 40 MPH and approximately 10-12 seconds after you are on the step, depending upon gross weight, etc. As is much the case when flying the Cub, feel, not numbers, is key.

Here are some of the measured times for takeoff in the float-plane Cub, measured on a standard day, sea level, no wind:

At 1114 lbs. gross weight (full fuel, 170 lb. Pilot) - 8 -10 seconds to on step, 9-11 seconds run on step to liftoff.

At 1220 lbs. gross weight (full fuel, 136 lb. passenger, 170 lb. pilot) - 11-13 seconds to on step, 10-12 seconds on step to liftoff.

You may experience slightly different times under similar circumstances.

In the real world, when there are waves, you can time the wave troughs to rock the airplane up onto the step with the stick or yoke as you feel the waves lift the airplane. This is tricky in the simulator as the water in FSX is not as accurately modeled to behave as water does in real life. Also, this can easily be overdone, and if not done properly or if done too aggressively, you can actually increase your takeoff run. Subtlety, as in many things regarding good piloting, is the rule here.

Once accelerating nicely on the step, and you see at least 40 MPH on the airspeed indicator, apply a very small amount of back pressure on the stick or yoke. Little back stick or yoke is needed as the Cub will lift off the water in a slightly nose up attitude by itself. You may find the float-equipped Cub lifting off at a slightly higher airspeed than on land. All of the floatplane Cub’s performance numbers, particularly the cruise speed, will suffer a bit as compared to the wheeled Cub because the floats add weight and produce more parasite drag than the conventional landing gear and wheels.

You can hurry the takeoff when at high density altitude, when on glassy water, or if a short takeoff is necessary, with this next nice bit of flying and it’s required to know how to do this to get your seaplane rating: Once on the step, lift one float out of the water with a little aileron, and takeoff on the other float only. Floatplane pilots often raise the left float to counter the tendency of the airplane to turn to the left. You may need to add a little left rudder to keep the track straight when up on the right float. You can also do this by raising the right float as well, of course. This method is also good for getting out of glassy water, which creates a strong suction on the floats and make takeoffs longer than they have to be. Just as a little turbulence in the proximate flow on the wing is a good thing to promote lift, for different reasons, a little turbulence on the water is better than glassy smooth.

Curved takeoffs are the correct technique when there is a bend in a river, or if you need to make the most of a small lake. Floatplane flying is the first cousin to bush flying and often, after a while, many floatplane pilots begin to take on many of the dashing characteristics of those daring and highly skilled aviators.

Climb out and cruise

There is no fundamental difference between the float-equipped Cub and the wheeled Cub in the climb and cruise regimes, except that the climb rate will be pretty anemic, usually no more than 300-400 FPM at sea-level, at gross weight, and on a standard day.

Slow flight, stalls, spins and aerobatics

The floats actually produce some lift in flight, which counterbalances some of their weight, and still allows the Cub to fly at very slow speeds. You will still usually see 40 MPH or less IAS before the stall occurs. The stall break is sharper and takes more altitude to recover from. Spins are prohibited with floats, as are all aerobatic maneuvers except Wingovers, Lazy Eights and steep turns. The basic rule is that with floats it is not safe to perform inverted maneuvers, or to pull more than + or - 2.0 Gs. Just as it is with people, the less stress you put on the floats, the better it will be for them and for you.

Descent and approach

Nothing special here. The same Vne, and the same engine limits apply. You can still slip it into a cozy glade, or over those tall trees surrounding a lake in the same manner as you do in the land plane; better actually, because in a slip, the extra weight and drag of the floats brings you down even faster and at a greater angle. Just be sure before landing that you will be able to get out of whatever place you have gotten yourself into (that‘s actually pretty good advice regarding a whole lot of things). More than one all-too-adventurous soul has had to have his or her airplane dismantled and transported to a larger body of water at great expense and considerable embarrassment, or worse, because after landing in that nice-looking lake, he or she misjudged and underestimated the distance that would be needed to takeoff and climb out over the trees on the hills surrounding the lake.

Landing

Again nothing really special here. Be sure the water rudder is up as it still should be from when you took off. Use the same approach speeds as when landing on a runway, and flair a little higher since you are sitting higher over the water on floats than you do above the ground with wheels. Water landings are usually made in a fairly level, slightly nose high attitude, like a tail-low wheel landing. Judging your altitude over glassy water is difficult, so in that situation, hold a little extra power (1,200 RPM or so), flair a few feet higher than usual, and mush in with the nose just a little high, but not as high as a three-point attitude. All water landings must be straight, no crabbing. The floats and their struts will not abide much of a side load on them. Put the upwind wing down into the wind if you find that you are landing in a cross wind. Better still, just yaw the Cub a little and get directly into that wind.

Surface winds change direction and velocity all the time, and even more frequently on the open expanse of the water. Be vigilant. Actually, most of the time you will tend to make better landings on the water than on land, since the weight and drag of the floats will diminish the

Cub’s proclivity for ballooning and floating in ground effect. Remember, water is a fluid that does not compress. This means that if you strike it hard enough you will either bounce or break, or both, just like on land. The float-equipped Cub's higher wing-loading is a boon for good landings. Spitfire pilots discovered this when they flew the later, heavier Spits. Floating landings that were hard to judge and execute in the earlier Spit Marks, were much easier in the heavier Mark V, and easier still in the much heavier Mark IX and later Marks. As we see over and over: what is lost in one place usually results in a gain somewhere else.

Once in the water, the landing run will be very short, usually shorter than on land under similar conditions due to the fact that the drag of the floats in the water will slow you down in a hurry. This is particularly so because after touchdown the stick or yoke is held all the way back holding the nose up and keeping the front tips of the floats high so as not to dig into the water. This nose high attitude causes both hydraulic and aerodynamic drag, greatly foreshortening the landing run. When slowed to taxi speed, lower the water rudder and taxi as mentioned above.

Docking, tying up and shutting down

Or is it tying down and shutting up? Approach the dock slowly and at a gentle angle; you don’t have a reverse propeller capability to slow you, to stop you, or to reverse thrust as in a boat. Having a helper on the dock is a must. Cubs are awkward to get into and to get out of and unless you’re pretty spry, it’s difficult to just jump out of a Cub and tie it up to the dock before it floats away. If it’s windy, or if there is any current in the water, help will be necessary to keep the airplane at the dock until it is tied up. Once the helper has tied and secured the airplane, shut the engine down. Don’t shut down until this has been accomplished. You may have to go out and come back again if the current takes you away from the dock. If you are going to run up onto the shore to park the floatplane Cub, raise the water rudder while in the water as it could be damaged by contact with the land.

One more thing (there's always “one more thing isn't there?), it's no good having a floatplane without a place to operate it. If you use the link provided below, you will find a nice PDF site entitled *“Designated 'Water Runways' in Flight Simulator X”.* If you click onto it you will find just what the title says and the world of water will be yours.

http://www.fsinsider.com/freeflight/Documents/Designated%20Water%20Runways%20in%20FSX.pdf

Ski Operations

As with seaplanes, aircraft equipped with skis for landing gear go back to the earliest days of powered flight. The Wright Brothers' first airplane and the first powered airplane to successfully take off from the ground, the 1903 "Wright Flyer", had skids for operating on the sands of Kitty Hawk which were very like skis. Many other airplanes that followed had real skis, either as their only landing gear, or along with the wheels. Since the beginning of aviation, flying on and off of the snow was not an option for aviators in the far northern regions of the world.

The earliest aircraft built in Canada, Norway, Sweden, Finland and Russia all had skis as their only landing gear. Of course, all of the North and South Polar exploratory flights were made in aircraft with skis.

Retractable ski systems came into popular use after Sir Harry Wigley developed the first successful retractable skis in New Zealand in 1955. Sir Harry planned to fly Sir Edmund Hillary, of Mount Everest fame, and a fellow New Zealander, up to the Tasman Glacier in New Zealand's Southern Alps, and land there. Since Sir Harry planned to takeoff from a paved runway at the airport at Mt. Cook, he needed a retractable ski system on his Auster Aiglet so that he could land on the snow on the glacier. His home-made system apparently worked, and other aviators soon clamoured for such a system for their aircraft as well.

The Aero-Ski Company of Brooten, Minnesota is one of the largest and best known companies manufacturing skis and ski systems for aircraft. Skis similar to these are installed on your Cub.

There are three kinds of ski systems which can be installed on an airplane. The simplest, least expensive (around $3,500.00), and lightest, is the straight ski replacement for the wheels. In this installation, the wheels are removed and skis are installed in their place. This type of ski is installed on your Cub. The next and heavier system (approximately 87 lbs.), is the simple retractable ski system. With this system, the skis are extended on the ground and can be retracted in the air if a landing on a hard surface is desired. Once retracted, they cannot be extended in the air, only on the ground. This is not the most useful system, but it is not expensive (approximately $7,500.00) and weighs relatively little. The best and most versatile system is one which is similar to an amphibious float system, in which the wheels retract and extend from the floats. This is called the hydraulic ski system. In this installation, the skis can be retracted and extended as many time as one wishes by a hydraulic pump. This system is heavy (approximately 215 lbs.) and expensive (approximately $20,000.00). Because of its weight and complexity, this system is rarely installed on a Cub. The systems that Cub owners prefer and use most are the simple retractable system or the straight ski /wheel replacement.

Note: There are many aircraft ski manufacturers, Landes Airglas Skis, Trick Air Snow Skis, and others. All produce excellent products.

Pre-Takeoff

Before starting the engine, be sure that the airplane is secured and will not move once the engine starts. The Cub will start to move as soon as the throttle is opened slightly (1,000-1,200 RPM) if the skis are free and have not frozen in place. However, the skis often freeze to the surface when the airplane sits in one place for any length of time, and the solution for this is to rock the airplane forward and aft to loosen them. As it is with floats, there are no brakes. I should hardly have to say that particularly in extreme cold weather, letting the engine and the oil warm up before taking off is a must.

Taxiing

Much of the time, you will take off from where you start the engine; so taxiing will not be a problem. If you have to taxi for any distance, it will be more like regular skiing or snow-boarding than any thing else, especially if the snow is icy. Expect to slip and slide a good deal. The prop blast on the rudder is your primary means of directional control as the tail ski is not very effective to steer with. Fortunately, the rudder in a Cub is sensitive. Be careful to keep the stick or yoke back when taxiing, as the tips of the skis must be kept up and clear of the snow. The skis will tend to drag or dig into deeper snow banks, and nose-overs are possible if you are not cautious. In a stiff wind, the control surface positions while taxiing, as mentioned before, are the same. Plan ahead, when on skis you have no brakes, and you are sliding a heavy mass on a slippery surface.

Takeoff

Once untied and ready to go, the run-up will be in the early part of the takeoff run, as it is on floats. In fact, ski operations are very similar to float operations in many aspects.

The tail-ski, in particular, tends to stick and re-stick to the snow fairly readily. Some back and forth rocking with the stick or yoke will usually un-stick it. Because of its tendency to stick, get the tail up and out of the snow as soon as possible, and be ready to apply some right rudder as the tail comes up, just like when on wheels. The skis do not have a definite “step” like floats do, but there is a definite angle at which the ski runs on the snow most efficiently. The best acceleration will be found when running at this angle. You can find this angle by subtly changing the pitch on takeoff until it feels right. This a very Cub-like operation - more feel than numbers.

Crosswind takeoffs are similar to those made when on wheels, except that the wind might tend push you sideways since the skis can slide in any direction and provide none of the traction of tires. When possible, takeoff directly into the wind.

Once at the best angle for takeoff, the Cub will be only seconds away from liftoff. A little back pressure on the stick or yoke is all that is needed, just as on land or water. The overall takeoff run will usually be longer, possibly double that of a takeoff run on wheels, depending upon the snow conditions. Ski takeoffs require a long, straight and unobstructed area ahead.

In the air

There is no difference between flying the ski-equipped Cub and the wheel-equipped Cub. There is almost no substantial drag increase as there is with floats, and no limitations with regard to maneuvers with the straight ski/wheel replacement. While I have seen no published figures regarding this, it makes sense that skis probably produce less drag than do unfaired wheels. The ski replacement for the wheels adds no substantial weight. However, the basic retractable and full hydraulic ski systems add a good deal of weight, particularly the latter, and may not be compatible with extreme aerobatics. When anything more complex than the basic replacement skis are installed, it is a good idea to keep the airplane right-side up and within +3 and -2 Gs. Of course, loops and rolls, if done skillfully, should not exceed these limits; but it is pushing your luck, and perhaps your skill, to do aerobatics with retractable ski systems installed. I wouldn’t suggest doing fast, multiple-turn spins, or any kind of violent maneuver with any kind of skis on the airplane, either.

Decent and approach

There is nothing remarkable or different here either. The main difference between ski operations and all other flying is in choosing and settling on a landing area. Whether the Cub is on wheels, floats or skis, you must be careful not to get into a field, body of water, or onto a snowy or frozen surface that you cannot get out of. While the Cub can get into some pretty small places, it's not exactly a powerhouse that can blast out of these small places as easily as it got into them. As I mentioned before, skis require much longer takeoff runs, so be wary and don't get trapped.

Landing

Prudent ski pilots landing on large, open snowfields in the wild, approach them carefully and do not land on the first pass. A big, white, featureless field can trick the eyes as to your altitude above it, and as to its length, etc. Depth perception over such a field is tricky and, just like when approaching a glassy water surface, a slow and careful approach, holding a little extra power, is required.

Hidden objects such as brush, bushes and logs can really mess up your landing and your airplane; so a low, slow pass, with a careful perusal of the intended landing area is important. Sudden dips and rises in the snow are often signs that something is hiding under there, or at least that there is a deep snow bank or drift that might upset the landing if you hit it.

Like most waterways, many snow fields are large enough so that you can land directly into the wind, so crosswind landings are not usually a problem. Unlike with floats, if you do find yourself slightly crosswind upon touching down, the skis permit some amount of crosswind sliding sideways on the snow. In fact, you should be prepared to slide around after touchdown a bit anyway, even after a perfectly straight landing.

A test landing, where you just touch down softly and lift off again, but do not let the skis completely sink into the snow for the first pass, is a good idea when landing out in the wilderness. This is a test of the condition of the snow as to its texture and depth. The final descent and landing should be gentle and gradual, holding about 1,200 rpm, settling lightly into the snow with the nose very slightly up. Once committed to the landing, a level wheel-landing style is preferred, and is the usual method. Keep the tail out of the snow as long as possible, using gentle blasts of power with the rudder for directional control.

Deceleration after touchdown is gradual if the snow is wet or icy. This is to say that you'll slide helplessly along for a while after touchdown; so be sure there are no objects ahead that you cannot avoid. If the snow is powdery, deep and/or dry, you'll come to stop much quicker. Remember to plan ahead carefully – you have no brakes. If, after touchdown, you find yourself rushing headlong towards something you would rather not make contact with, and there is no room to go around, you can, in such an emergency, slide sideways holding opposite aileron to the turn, in a kind of skier's maneuver, to dig in the outside edges of the skis, and to present the ski faces to the snow as a plow, sort of a "parallel" stop. You could possibly damage your skis this way, but that's better than a nose-on crash into a tree or some such thing.

One more real world note - I would strongly suggest that you have at least a hand-held communications radio with a good battery, or a charged cell phone with you (and hope you can get a call out on it) when landing in the wilderness, for obvious reasons: A word to the wise, and all that.

Tundra Tires

Tundra tires are large, soft tires which enable an airplane so equipped with them to operate from very rough, irregular and/or soft, even flooded surfaces. They add utility but at a cost to performance in the air, thus dutifully obeying that pesky law of nature about gains and losses that we have seen in operation before.

The tundra tires and wheels are not much heavier, but are much larger in all dimensions than standard tires; accordingly, they typically add a small amount of weight and lots of drag to the aircraft. A pair of 29” Airstream tundra tires weigh around 52 lbs. Two standard 8.00 x 4 tires and their wheels weigh around 42-44 lbs., so the added weight of the tires themselves is only around 10-12 lbs. Special extra-heavy duty brakes, which are required by an FAA STC (Supplementary Type Certificate) which is required to be obtained when tundra tires are installed, will add approximately another 8-10 lbs. The slightly increased wing loading, power loading and the increased parasite drag below the center of lift and gravity will decrease performance across a broad band of parameters.

As with any aircraft, the useful load of the Cub will be reduced by the amount of additional empty weight added by the replacement of the standard wheels/tires with tundra units. As always, carefully calculate your gross weight before you take a passenger or cargo on board. In the air, mostly due to the increased drag, Cubs with tundra tires experience climb and cruise performance reductions of 5- 10%. Stall speeds increase about 5%. As they say, your mileage may vary.

It has been reported that turns at slow airspeeds may result in an incipient stall at much higher indicated airspeeds than usually seen with ordinary wheels and tires. Attempts to keep the nose up during such turns with top rudder often causes the typical, and often fatal cross-controlled stall and over-the-top break into a spin, so be forewarned. At low altitudes this can cause a fatal crash, as this kind of spin which puts the aircraft into an inverted stall before spinning, requires lots of altitude and skill to quickly recover from, neither of which you may have in sufficient quantities when it suddenly occurs.

While tundra tires certainly make takeoffs and landings easier and safer on gravel, rocks, sand and, well…tundra, they cause problems that you need to know about when using them on paved surfaces. There is a marked tendency for the nose to strongly pitch down upon touchdown on pavement, sometimes causing propeller strikes. There have been reports of tundra tire-equipped aircraft having flipped over on their backs when landing on pavement, particularly during a wheel landing (main wheels first). This is because the soft and wide tread of the tundra tire tends to stick to the pavement upon impact and does not begin to roll immediately, causing the airplane to decelerate very quickly, flipping the tail up and over. Three-point or tail-low wheel landings are, therefore, the better choice when you have the big wheels on.

Taxiing with tundra tires feels strange. The airplane wobbles, feels unstable, and dips hard to the outside of even a slow turn. It feels as if the airplane is going to turn over. This is because the sides of the tundras are soft, and they do flex a lot, causing a kind of seasick motion even during ordinary taxiing.

All in all, tundra tires have their uses, and they permit airplanes which have them to go where other airplanes fear to tread, so to speak. They do this, though, at a substantial penalty in performance, which the Cub can ill afford. Still, if you have to operate out there and in and out of such god-awful places, then you have to have tundra tires, and take the performance penalty with good grace as being the cost of doing business.

Instruments

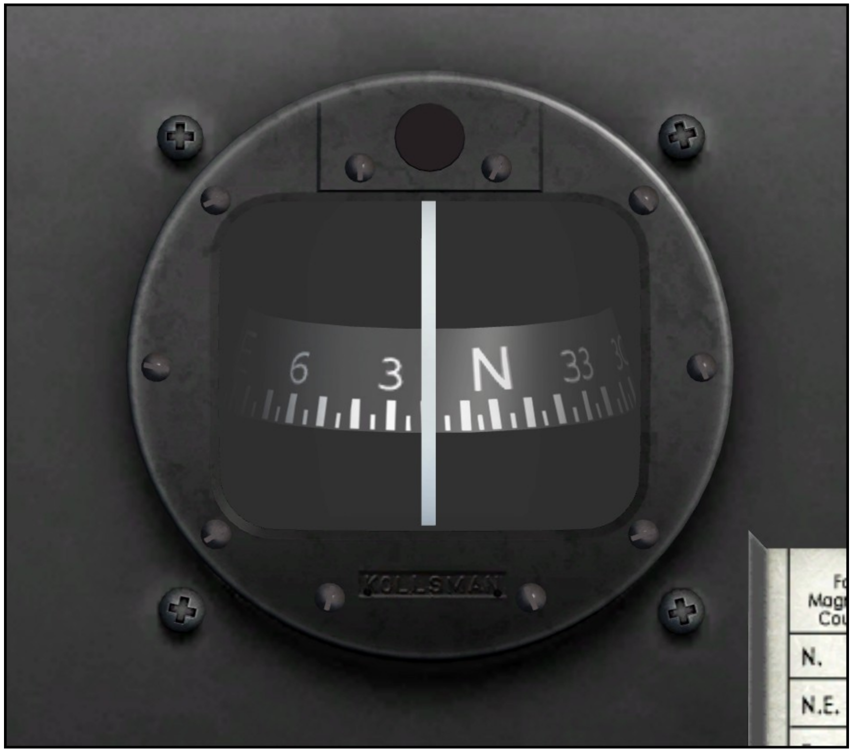
This part is about the gauges in the Cub, not guitars or pianos and such. If you want to know how to play keyboards, ask Scott: he's good at it.

Most Cubs have six instruments on the panel: three flight instruments - altimeter, airspeed indicator and magnetic compass, and three engine instruments – tachometer and oil temperature and oil pressure gauges (in one combination unit). That is all, and that is all you need for flying VFR (Visual Flight Rules, not Very Fine Recreation, or some other silly thing) according to the FAA, who are surprisingly correct in at least this one instance. What follows is a description of these instruments and how to use them.

Flight Instruments

Magnetic Compass

(NOTE: Accu-Sim is required for advanced compass physics)



General Description

The only compass you will find in most Cubs is the Magnetic Compass. Gyroscopically driven instruments require an electrical system and other complicated interfaces which were never installed in any J-3 Cub at the factory. Certainly, some owners have retro-fitted gyros and such, but the stock, unmodified and un-modernized Piper J-3 Cub that A2A has supplied has none of these amenities. The magnetic compass is, at once, the simplest and the most complicated instrument on the panel, so we'll look at it first while you're fresh and still paying attention.

The Magnetic Compass (MC) is usually located smack in or near the middle of the instrument panel. It is the old-style liquid-suspension type of compass, a design that goes back to the earliest days of aviation. The circular compass card which rotates horizontally, is balanced on a pivot needle with an iron-ferrite magnet attached. The compass card is actually an inverted bowl contained in a sealed housing filled with acid-free, white kerosene which damps the movement of the compass card and continually lubricates the needle. It is often called a "whiskey compass", possibly because when looking through the often yellow-tinted front glass of these compasses, the clear kerosene behind it looks, temptingly to some, like a shot of whiskey, or some such thing. Vibrations which might interfere with the free movement of the compass are further damped by the spring mounted on the pivot needle. The needle and floating design of the magnetic compass enables it to move freely and with minimum friction, preventing the compass from sticking and binding and allowing it to immediately turn in response to even the slightest and most subtle change of direction of the airplane. This is both a blessing and a curse, as we shall see.

It's a simple and effective instrument, but, as is so with most designs, it also has its negative side. The very arrangement that allows it to be so sensitive also makes it tilt and turn very easily, and become quite erratic at times. The MC will not display the correct magnetic heading under certain conditions, such as when the airplane is turning, accelerating or decelerating. In fact, it is only when the airplane is flying straight and level, and at a constant speed that the MC is reasonably reliable and useful. However, there are rules and methods which allow the pilot to use the MC at all times. Still, you will likely find the MC to be a trying and sometimes willfully inconvenient instrument to use. One exception to this is it's unintended, but convenient use as an ad hoc turn-coordination device, which is mentioned in "Turning" above.

The magnetic compass does not require an electrical, hydraulic (well, there is fluid in it, so maybe it is technically "hydraulic") or any other kind of system. It is not interfaced with or connected to any other instrument, and it operates completely independently of and without the need for power of any kind. It is a genuine compass, operating within and responding to the magnetic field of the earth. For this reason it is the primary reference for setting the gyro compass, if there is one installed, and is a reliable backup directional reference when all else fails. In the Cub, it is your primary and only on-board directional reference.

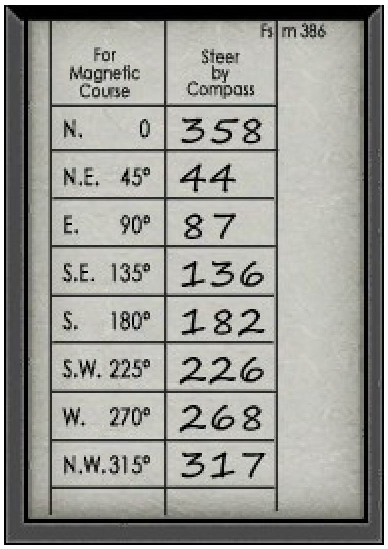
Variation

The magnetic compass is designed to respond to the magnetic field of the earth which is generated at each pole, and which flows around the earth in a continuous band of magnetic energy. In the Northern Hemisphere, all magnetic compasses align with, and point to Magnetic North (MN). MN is not actually, as many people think, at the North Pole, which a purely geographical point, and which is called True North (TN). In North America, MN is actually somewhere in Hudson's Bay, Canada. MN is located in different places in different parts of the world. A similar situation occurs in the Southern Hemisphere, where it is called Magnetic South (MS).

The angular difference between MT and TN is called "variation", measured by the isogonic anomaly which causes compasses to point not to TN but to MN. You can read the amount of "variation" to calculate into your navigation on any FAA Sectional and IFR Aeronautical Chart by looking for the "Isogonic Line". An isogonic line is an imaginary line or a line on a map joining points on the earth's surface at which the magnetic declination from TN is the same. Look for a red-dashed line with a number at the top and bottom of it on the chart. This indicates areas of equal isogonic variation, and averages it in a local area. Depending upon where you are, it will indicate some number of degrees east or west from TN. For Easterly variation, subtract the number on the chart to your course; for Westerly variation, add it – “East is least and West is best” is how I learned how to remember it.

Your magnetic compass reads only MN. You must correct this to calculate your chosen course with reference to TN, by first adding or subtracting the amount of “variation”. By the way, all runway headings, omni-range stations, and omni-range roses on aeronautical charts, as well as all surface and winds aloft reports are corrected for local isogonic variation. That’s why those all those compass roses on the charts are tilted.

Deviation



Fs m 386

For Magnetic Course	Steer by Compass
N. 0	358
N.E. 45°	44
E. 90°	87
S.E. 135°	136
S. 180°	182
S.W. 225°	226
W. 270°	268
N.W. 315°	317

The Compass Deviation Correction Card as it appears in your Cub

All airplanes have metal parts, motors, and such which pull on the magnetic compass, causing it to read incorrectly. A large factor which pulls the compass away from MN is the rotating of the propeller shaft and the propeller itself if it is metal. To compensate for this, the compass housing has two small magnets in it which can be moved closer or further away from the rotating compass card, and thus fine tune it to read MN more accurately. These adjustments are usually made at the cardinal directions, N, E, S, and W. Even with this adjustment, most magnetic compasses will still not read absolutely correctly. The difference between the correct magnetic direction and what the compass is actually reading is called “deviation”. A card mounted below the compass, appropriately called the “Compass Deviation Correction Card”, indicates the proper heading to take for each 30º heading indicated on the compass card. This is done during a procedure called “swinging the compass”, whereby the airplane is taxied to a compass rose painted on the ground somewhere on the airport grounds away from magnetic interference, showing the accurate local magnetic headings in 30º increments.

The airplane is placed at the center of the rose and is literally “swung”, that is, turned from one heading to another, with note taken as to what the compass in the airplane is reading compared to the actual magnetic heading indicated by the painted compass rose. Deviation must also be calculated in your navigation planning. You will find the Compass Deviation Correction Card beneath the magnetic compass, and you must refer to it in order to use the magnetic compass accurately.

Acceleration Error

When you accelerate, the floating compass card tilts back on the pivot needle and turns in a northerly direction. When you decelerate, the compass card tilts forward and turns in a southerly direction. This phenomenon is most pronounced when flying on easterly or westerly courses. Just remember the acronym: ANDS – accelerate north, decelerate south.

Northern (Southern)Turning Error

The magnetic compass aligns with the poles of the earth. That is how it maintains its equilibrium to the north in the Northern Hemisphere, and to the south in the Southern Hemisphere. At or near the Equator, the magnetic compass tends to remain relatively level; however, as you move towards each pole, due to the phenomenon of “Polar Dip”, wherein the earth’s magnetic field dips down towards the earth at the poles, the magnetic compass likewise tilts and dips toward the pole it is nearest to. This phenomenon causes the magnetic compass to behave strangely during turns from either northerly or southerly courses, and is more pronounced the closer your latitude is to either pole.

The following refers to flights in the Northern Hemisphere; the effect is reversed in the Southern Hemisphere:

When turning away from a northerly, or near northerly heading, the magnetic compass will briefly turn in the opposite direction of your turn, and lag behind it for a while.

When turning away from a southerly, or near southerly heading, the magnetic compass will turn faster than the turn, and lead the turn for a while.

As a young Cadet, I was taught a bewildering series of mnemonic acronyms for all kinds of flying rules, some of which I actually remember, and some which are still useful. Here is another one: SI/NO. It works like this:

When turning away from north toward a southerly heading, the compass lags behind the turn; so, we say “si” (Spanish for “yes”), meaning we are to say “yes” to passing our desired heading on the compass card before stopping the turn. “Yes”, we have seen our course appear. The “S” in “si” stands for turns to the south.

When we turn away from the south toward a northerly heading, the compass speeds up ahead of the turn; so, we say “no”, meaning we are to stop the turn before the compass card gets to our desired heading. “No”, we have not yet seen our course appear. The “N” in “no” stands for turns to the north.

I know it’s a bit confusing, but we like challenges, right? If we didn’t, we wouldn’t fly airplanes in the first place. In either situation, by the time you have turned 90° to the east or west, the compass will be indicating fairly correctly again. Now all you have to worry about is acceleration or deceleration, mentioned before screwing up the compass reading. Some fun, eh boss?

As you can see, the magnetic compass is fraught with accuracy problems, and no matter what direction you are flying in, some problem will rear up. As I mentioned before, this makes the magnetic compass only really useful when you are flying straight and level, and not accelerating or decelerating. That is why the gyroscopic compass was invented, and why in airplanes which have them, the magnetic compass is purely a backup emergency instrument, and is only regularly used to initially set and to re-set the gyro compass when it drifts.

Airspeed Indicator

The airspeed indicator (ASI) is an essential instrument for safely flying an airplane. A pilot must always know what the airspeed is in order to properly fly the airplane. Modern ASIs often have true airspeed calculators built into them, are usually calibrated in knots (nautical miles per hour = mph x 1.15), and have various markings for the different areas of safe operational speeds, “Vne” (never exceed), “Vno” (normal operating), “Vsi” (stall with flaps and gear retracted), “Vso” (minimum steady flight with flaps and gear extended), and “Vfe” (maximum speed for extending flaps). The ASI installed in the Cub is a replica of the more primitive kind of ASI which was commonly installed in light airplanes from the 1930s and well into the 1960s. It has only a red line (Vne), and is calibrated in Miles per Hour just like an automobile (in the U.S.A. that it is).

The ASI shows the “indicated airspeed” (IAS) of the airplane. This is different from the “calibrated airspeed” (CAS), the “true airspeed” (TAS) or the “ground speed” (GS). All of these airspeeds may be different, sometimes greatly so, for the same airplane at any given time.

The ASI is a part of the pitot-static system in the airplane, and receives information from outside air entering the pitot tube installed (on the Cub) on the jury strut under the left wing and static air as measured at the static port, an opening strategically placed on the airplane to be out of the air stream. The ASI measures the difference between the pressure of the static air and the stagnation pressure created by the ram-air that enters the pitot tube. This is why the static port and the pitot tube must always be clear and free of obstructions.

<u>Indicated airspeed</u> (IAS)

This is what the airspeed indicator in the instrument panel reads at any given time. It is uncorrected for position error, density attitude, etc. At sea level on a standard day, and in level flight, IAS is the actual airspeed of the airplane. At all other altitudes, temperatures, barometric pressures and attitudes the actual airspeed will be different from that which is read on the instrument (see CAS and TAS below). All operating speeds regarding the Cub mentioned in this manual are IAS.

<u>Calibrated airspeed</u> (CAS)

This is the indicated airspeed corrected for position error. The static port and pitot tube only accurately sense air pressure at certain pitch and yaw attitudes, usually fairly straight and level with no slip or crosswind. The difference between IAS and CAS is very small with regard to relatively slow airplanes like the Cub, and is not an important factor in flying the airplane. In high-speed aircraft, the differences can be large, and must be calculated for proper operations. In the Cub, at high alpha near or at the stall, the ASI will drop off to zero, even though the actual airspeed is around 35-38 MPH. This is because of position error which inhibits the airflow sensed by the pitot/static system and which prevents it from accurately reading the aircraft’s airspeed.

<u>Equivalent airspeed</u> (EAS)

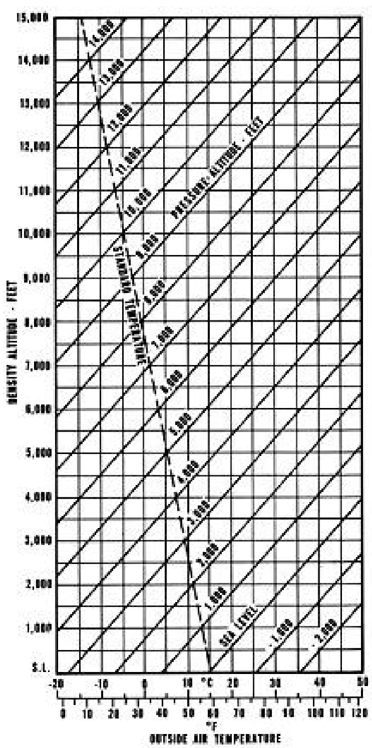
This is a factor of compressibility effects at altitude. Below 10,000’ and 230 MPH, EAS is of little consequence; accordingly it is of no concern to a Cub pilot. CAS actually accounts for this error as well, but only at standard sea level pressure.

<u>True airspeed</u> (TAS)

This is the actual airspeed at which the airplane is flying, taking density attitude into consideration (see below). It is the same as IAS at sea level (SL), and is always higher than the IAS above that, as this formula shows: TAS = IAS + 2% per 1000’ (300 m)

Ground speed (GS)

This is not a speed that you read on any instrument installed in a Cub. Some HUDs (heads-up displays) show ground speed, but don’t look for a HUD or a MFD (multi-function display) in a Cub. Your ground speed is determined by a vector which is calculated by your TAS, plus or minus the force and angle to your heading of the prevailing wind at your altitude. If your TAS is 75 MPH and you are flying directly into a headwind of 20 MPH, your ground speed is… come on, you can figure it out. Of course, you add the force of the prevailing wind to the TAS for tailwinds, and do a vector calculation (the measure of a force from a particular direction) for cross winds, right? You see, it really was a good idea to pay attention in math class after all. The old E6-B calculator has a crosswind grid on it for this purpose, and modern electronic E6-Bs do the same thing by electronic calculation, except that it needs batteries to power a calculator which can go dead or fail on you just when you need it most. Sometimes old school is the best school, and any school is better than no school. Your ground speed is important to know because it is what you need to derive to determine you rate of travel over the ground and, accordingly how long it will take to arrive at the next waypoint, and ultimately, your destination.



Density altitude

While we’re talking about TAS, I think a discussion of density altitude is in order. This is one of the most important factors for calculating the expected performance and operational limits of an airplane. It affects lift, engine performance, propeller performance, climb, stall, the length of the runway you need to takeoff or land, your TAS, service ceiling, and other things that you must be aware of to safely and predictably operate an airplane. To the left is a Density Altitude (DENALT) chart. Learn how to use it, or any other kind of DENALT calculator, and always refer to it to determine your airplane’s performance and operational limits, especially when flying to or from airfields which are higher than sea level or on a hot day from any field. It’s not only a good idea, it’s the law: see FAR (Federal Aviation Regulation) 91.116.

There is also a fairly easy formula for calculating density altitude, which is really only an approximation, but which will serve if you don’t have a DENALT chart handy. However, you have to know your pressure altitude for it to work:

Density altitude in feet = pressure altitude in feet + (120 x (OAT – ISA temperature))

Where:

OAT = Outside air temperature in °C

ISA (international standard atmosphere) temperature = 15 °C - (1.98 °C/1000 ft × pressure altitude in feet)

When flying the Cub with a passenger in the front seat, depending upon the width of that person, the pilot may not easily be able to read the airspeed indicator. This does not mean that the pilot must therefore be entirely ignorant of the airspeed, however. Most early aircraft, and many which were flown during the First World War, did not have an airspeed indicator installed in them. This may partially explain why there were so many accidents in those aircraft; however, the vast majority of the pilots of that era were able to fly these airplanes quite well using their ears and the feel of the controls to tell them how fast they were flying. You can do this as well in the Cub.

The sound of the wind is quite audible at all times in a Cub. Exposed cables, struts, the engine cylinders and shrouds, and all kinds of protuberances, all of which impede forward speed, also give the pilot definite audible clues of the Cub's current approximate airspeed. A good Cub pilot can tell the airspeed within plus or minus a few MPH solely from the sound of the wind in flight. You can learn to do this very easily. Practice by setting cruising power (2150 RPM) at level flight, looking at the ASI and listening to the sounds all around you. Speed up (well, as much as you can), and listen. Then slow down and listen again. Do this at various power settings, including power off. It will be easier to hear to hear wind sounds with the power off, of course. Do this exercise every time you fly the airplane, and in a short while, you should be able to "hear" the airspeed fairly accurately.

It has been well said that a great deal of success and happiness in life can be derived from merely paying attention. This goes double for successfully flying the Cub, or, in fact, any airplane.

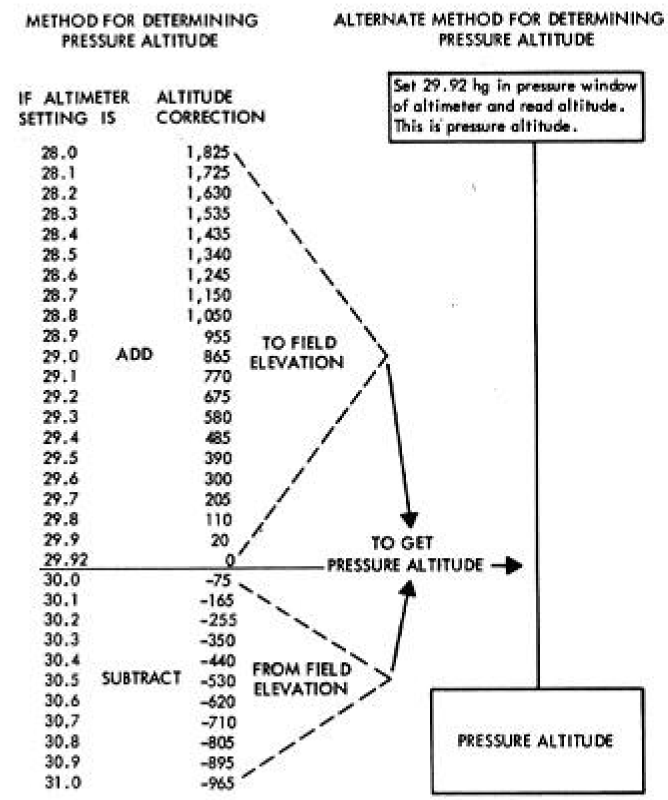


Figure 17–71 Field Elevation Versus Pressure Altitude

Trapped on an Island – A Cautionary Tale About Density Altitude

I was hanging around at my local airport one nice, hot and humid, sultry summer day, just schmoozing with the other pilots, exchanging ever increasingly dramatic narratives of past glories, both real and gently embellished for effect, when the Chief Pilot came over to me and asked me if I would help him out. It seems that a pilot who had rented a Piper Cherokee Arrow II that morning with full tanks, had flown it, with his wife and their two teenage boys on board, to a small airport located on a small island about 120 miles away. They had spent the day swimming and picnicking, as many local pilots and their families like to do on that island in the summer. The problem was that the longest runway, 30-12, was only 1,850' long at that field with 50' trees very near all of the departure ends of the runways. To make matters worse, the prevailing wind that afternoon was blowing steadily from 338°, but at a meager 3-5 knots.

That was not the real problem, however. The little island was located, as at least some part of most islands are, at sea level, the airport on it being located at 10' ASL, not far from the beach. That was the good news. The bad news was that the local barometric pressure was a steady 28.90 in. Hg - very low pressure, as a storm was due that evening, and the low trough had already come into the area. This meant that even if the temperature had been the standard 59° F, the field would have been at 964' pressure altitude that day. The news gets worse- it was a blood boiling 98° F at 4:00 p.m., and it was oppressively humid all day. It had become even more humid in the afternoon, as it sometimes does just before a storm arrives. The dew point was 88° F and rising. The air was almost totally saturated, and the visibility in the haze had become marginal VFR. What this meant was that our nice little island airport was sitting, that beastly afternoon, more than a mile high, at a density-altitude (DA) of 5,395'.

More to the point, what this meant to our aquatically inclined pilot and his family, was that the 1,850' runway in that slight 3-5 knot, 38º right crosswind at DA 5,395' was of insufficient length for the Piper Arrow to takeoff and climb safely over the 50' trees at the end of the runway with the load of fuel and passengers it had to carry. Oh, it had been fine getting into that field that morning; and, it would have been safe to get back out of under closer to normal atmospheric conditions; other pilots in similar aircraft did it all the time. However, the increase in temperature and the lowering of the barometer during the day had kicked the airport up to the top of a virtual mountain. The wind vector was no help either, it calculated to less than 1 knot on the Arrow's nose for takeoff. It might as well have been zero. The pilot, fortunately realizing his dilemma, had called where he had rented the airplane from to ask what to do, as he knew that he could not get the plane back that afternoon under the current weather conditions, which were forecast to worsen by the hour.

After speaking to the trapped pilot on the phone, the Chief Pilot asked me if I would fly to the island with him in their Piper Dakota, rescue this hapless fellow and his family, and fly the Arrow back to the base. I said that I would do it if it was possible. We consulted the performance charts in the Arrow's and the Dakota's Pilot's Manuals to determine what these airplanes' performance would be under the daunting conditions of that afternoon. We were satisfied that we would have a reasonable margin to get both airplanes off that little runway with the load spread out between the two of them.

We also discussed having the trapped pilot ask the field operator to de-fuel the Arrow somewhat to lessen the gross weight. He had burned off a little more than a quarter of his total fuel on board getting to the island, but he still had much more fuel remaining in those wings than he needed to get home, even with a good safety margin. We both agreed that it was a good idea to de-fuel the Arrow a bit before takeoff, and we discussed just telling the trapped pilot to do it and to fly out himself. However, since he was more than a bit frazzled and nervous, and still might not be able to safely fly the almost fully-loaded Arrow out safely, even somewhat de-fueled, we decided that we would just have to go and help him. There were the lives of two parents and their children at risk - end of discussion.

The fixed-gear Dakota has a remarkable useful load of 1,392 lbs., and its 235 horsepower Lycoming engine gets it off in a reasonably short distance even at gross weight. Although it has no turbocharger, it performs well even at high density-altitudes due to its light power-loading. The Arrow, with a respectable useful load of 1,120 lbs., was not nearly as good a performer in that regard, it's engine producing the power of only 200 equally un-turbocharged horses. Carrying among other things the extra weight of a retractable gear system, the wing-loading of the Arrow II was fairly high.

We took off right away and soon landed at the island airport. Along the way, noticing the poor visibility, which was not getting better, we commented to each other that this was not a good day for low-time pilots, or anyone who really did not have to be flying. We flew to the island without incident. The trapped pilot was very relieved to see us land, to say the least. The Dakota would carry the Chief Pilot, the pilot’s wife and the two teenage boys, and the Arrow just the other pilot and me. Both aircraft were now relatively lightly loaded. When the Chief Pilot and me left for the island, we had taken off with the Dakota's fuel tanks approximately 1/2 full. To give us a little extra margin of safety, as we had previously discussed, before we took off we had the local operator at the island airport de-fuel the Arrow to a little less than 1/2 full.

The Chief Pilot took me aside and asked me to show the trapped pilot how to do a short-field takeoff on the way out and to make him feel as foolish as reasonably possible on the way home about getting himself trapped like he did. I said that I would. Given the poor visibility of the day, we agreed that he would takeoff first and fly a straight course back home and I, in the faster airplane which might catch up to him, would fly a slight curving course so that we avoid accidentally flying in close proximity without seeing each other clearly. We also agreed to fly at different altitudes, he at 2,270”, me 500’ higher, and to maintain communications on the Unicom frequency of 123.000 MHz.

We boarded our respective airplanes and the Chief Pilot and I started our engines. The now formerly-trapped pilot and I watched as the Dakota containing his precious family easily lifted off, climbed out over trees and headed for home. Now it was our turn.

I called the Chief Pilot on the radio and told him we were about to take off and he acknowledged my message. At the end of the runway I lowered 20° of flaps, leaned the engine out a bit because of our "high" altitude, held the brakes and revved the 200 horsepower Lycoming (rated at sea level) as high as it would go, to about 2,600 rpm. Releasing the brakes, I held the yoke all the way back until the nose wheel lifted off at about 50 knots IAS. I then reduced the back pressure on the yoke a little. The Arrow reluctantly came off the hot, sticky macadam, "way up there" at 5,395', with the stall warning intermittently buzzing away, at 56-58 knots IAS after a pretty lethargic roll of about 900'. I lowered the nose slightly and retracted the gear when I saw that we had a positive rate of climb. Letting the airspeed build up to 74 knots for a high performance, best angle climb (Vx), we cleared the tall trees at the far end of the runway by a not overly large margin. Safely off, and with the hot little island receding behind us, at 100' I reduced the throttle to 2,500 rpm, enriched the mixture a little to help cool the engine, slowly retracted the flaps and lowered the nose further to let the airspeed come up to 110 k IAS to give the hard-working engine a nice flow of air so that it would not fry on that tepid, sultry day.

The VFR altitude rule is that if you are flying at 3,000' or more, on a magnetic course of 0° - 179°, you must fly at odd thousands plus 500 feet; and if you are flying on a magnetic course of 180° - 359°, you must fly at even thousands plus 500 feet. Since we were so close to home, I flew under 3,000', and the altitude/mag. course rule therefore did not apply. I also kept it low to keep the ground in good sight in all that haze. I cruise climbed the Arrow at 110k IAS to the altitude the Chief Pilot and I had agreed that I would fly at: 2,770'. For safety, I don't like to cruise at altitudes that most pilots tend to choose, like 2,500', 3,500', and such. While it was still legally VFR, the air was as thick as Kelly's broth.

We flew home without further incident in the thick haze, mostly with reference to instruments, as the horizon was fairly obscured. Just because it's officially VFR doesn't always meant that it's safe to fly without some current instrument flying experience. It was so bad out there that I contemplated calling in an in-flight IFR flight plan, and proceeding under Instrument Flight Rules. As that would have probably meant a much longer flight with the usual detours and airway intersection interceptions as per ATC, I was reluctant to do it as long as I could see something of the horizon and the ground.

As we flew on, I was able to pick out some ground references, so I continued as we were. After a while, the Chief Pilot called me on the radio and said that our home airport was VFR, a t least for now, and that he was about to enter the landing pattern in preparation for landing. Now that I knew exactly where he was, I took a direct course for home. We were now fairly close to home, and as I descended, the ground became much clearer, so I decided that filing an IFR flight plan was unnecessary. Of course, to be prudent, right after takeoff, I had called the local ATC (Air Traffic Control) Center for a local weather update, and requested Flight Following, also called "VFR Radar Advisory Service".

After I dialed in and "squawked" the transponder code number that the controller at ATC Center had requested, and he had "painted" us on his radar screen, the controller informed us of any other traffic in our vicinity at proximate altitudes to us, all the way home. It was such a bad weather day that except for the Piper Dakota just ahead of us flying in our general direction, they reported no other traffic. Apparently, the Chief Pilot and I were the only fools flying VFR in that muck. I was glad to have ATC's "radar eyes" on the situation.

As the Chief Pilot had requested, on the way back, I asked the formerly trapped pilot just enough embarrassing questions about his inadequate flight-planning routine that morning to make him feel uncomfortable, and hopefully, to encourage him to be more vigilant in the future about the weather and how it affects the performance of an airplane. We landed a few minutes after the Dakota, and as the Chief Pilot and I tied down the airplanes, the trapped pilot had a moving reunion with his family.

The confluence of events that afternoon had made it unsafe to operate the Arrow from that island airfield at anything approaching its gross weight, something that the trapped pilot should have foreseen and planned to avoid, even if it meant altering his plans and going somewhere else -- or even staying home altogether. The temperature, dew point and low pressure, all of which were forecast earlier that morning, had elevated that little sea-level airport to over a mile; and, if that weren't enough, the ultra-high humidity had the effect of further robbing the engine and the wing of a good deal of their efficiency as well. Had the pilot "toughed it out" and tried to takeoff in the heavily loaded Arrow with his family that afternoon, a horrible tragedy would most likely have occurred. He had become trapped on that island by density altitude. Fortunately, he understood that the weather had overtaken the capability of his airplane's performance; and exercising good judgment, he did the right thing to call for help.

By the way, those conditions, as bad as they were, would not have been a problem for a fully-loaded Cub getting out of that field - but only two could have taken that ride.

The FAA publishes charts, copies of which are included herein, which are used to determine pressure and density altitude. Also there are a number of excellent free DENALT calculators which you can use on-line. Learn how to use them and don't get trapped or "lost" on an island somewhere, or someday someone may do an interesting, but confusing TV show about you.

Altimeter

The altimeter is another essential instrument which the pilot needs to safely operate an aircraft. The altimeter tells the pilot the distance the airplane is above sea level, not the distance above the ground (to do that you need a radar altimeter, definitely not standard equipment in a Cub). This is obviously a crucial distinction. You may be flying in an area where the ground level is at 3,000' ASL (Above Sea Level) and your altimeter reads 3,100' . You are technically flying at 3,100' ASL more or less, based upon density-altitude, but you are really only approximately 100' above the ground. In low-visibility conditions, this could be a very dangerous situation, as I am sure you realize.

The altimeter in airplanes is also called a "barometric altimeter" because, like a barometer, it measures the pressure of the air as the airplane rises and descends, indicating the altitude ASL on the face of the instrument in feet of altitude. Altimeters are calibrated according to standards defined by the ISA, which were mentioned above.

The oldest aircraft altimeters were just direct reading barometers. There was one needle which read from “0 feet” to whatever that particular model altimeter’s maximum altitude was. In time, some refinement was made to these simple instruments by the addition of a small knob, which looks similar to the knob on a modern altimeter. The difference is that the knob on these old-style altimeters did not turn the needle; it turned the whole face of the instrument so that the pilot could pre-set the altimeter for the altitude of the field he was taking off from or landing at. This biasing of the instrument face was a rough sort of “calibration”; but there was no Kollsman window in which the pilot could read and set the local atmospheric pressure so that the altimeter was calibrated to indicate the correct altitude (see more about this function and how it is used below). Given that the kind of aircraft that sported these fairly crude altimeters also usually had no radio or, in many cases, even an elementary electrical system, there was no way to find out what the local pressure was en-route or at one's destination before landing anyway, so it really didn’t matter. It is this kind of altimeter which is installed in your J-3 as you have received it from A2A.

Later, the “sensitive altimeter” (this is does not mean that you can easily hurt its feelings) was designed. There are three needles on a sensitive altimeter. The longest one indicates multiples of tens and hundreds of feet, and makes a full revolution every one thousand feet. The smallest one indicates multiples of hundreds and thousands of feet, and makes a full revolution every ten-thousand feet. The long thin needle with the little inverted triangle at its tip indicates multiples of tens of thousands of feet (in any event, not a needle you would need to be concerned with in the Cub).

As mentioned before, there is a knob to set the sensitive altimeter to field level or to the local barometric pressure in the “Kollsman window”, so named for a popular manufacturer of altimeters. This is useful to keep the instrument accurately indicting the altitude in the area where you may be flying. The local barometric pressure is always changing, and it is also different from place to place over time. This change of pressure will naturally affect the reading of the altimeter, and if it is not corrected for the correct new pressure, it will not display the accurate altitude. You can find out what the current local pressure is where you are from automated weather reports, control towers, unicoms or air traffic controllers. The sensitive altimeter is quite intuitive to use, and is easy to interpret in short order. Most pilots are quite familiar with this kind of altimeter, and have been using them from their first flights.

Always check your sectional chart for the local ground elevation of the area into which you are flying so that you will not find the ground rising to smite you as you fly blissfully along. The highest local obstacles and structures (towers, antennae, buildings, etc.) will also be indicated by large numbers in the middle of each square division on your sectional charts. This number, as well as the local elevation, is given in altitude ASL, so you can use your altimeter to gauge your distance above the ground and these objects. High individual obstructions and structures are also indicated by various symbols on the sectional chart. You should always be aware of where they are relative to your flight path. Many of these are very difficult to see from the airplane until you are right on them. Hitting one in the air will ruin your whole day.

Engine Instruments

Tachometer

This instrument informs you how many revolutions per minute (RPM) the propeller is turning. The Continental A-65-8 engine installed in the A2A J-3 Cub is direct drive, that is, there are no gears to slow or speed the propeller with regard to the speed of the engine. Accordingly, the tachometer indicates the speed at which the engine is turning, as well as the speed of the propeller. There is nothing much to say about this instrument, except to note that the highest number of RPM you can safely turn the engine and propeller in a Cub with Continental A-65-8 installed, is 2,300. Full throttle in level flight gives you just about 2,300 RPM, give or take a few RPM, depending upon density-altitude, the state of your engine, and what kind of propeller (cruise or climb) you have. The propeller modeled in this simulation is a “cruise” propeller, as were most of the propellers installed in Cubs over the years. In vertical country, and/or when operating at high elevations, a “climb” prop is recommended. If you had a “climb” prop installed, you would notice a number of changes in the Cub’s performance, as you might expect, such as an increased climb rate, and reduced cruise speeds.

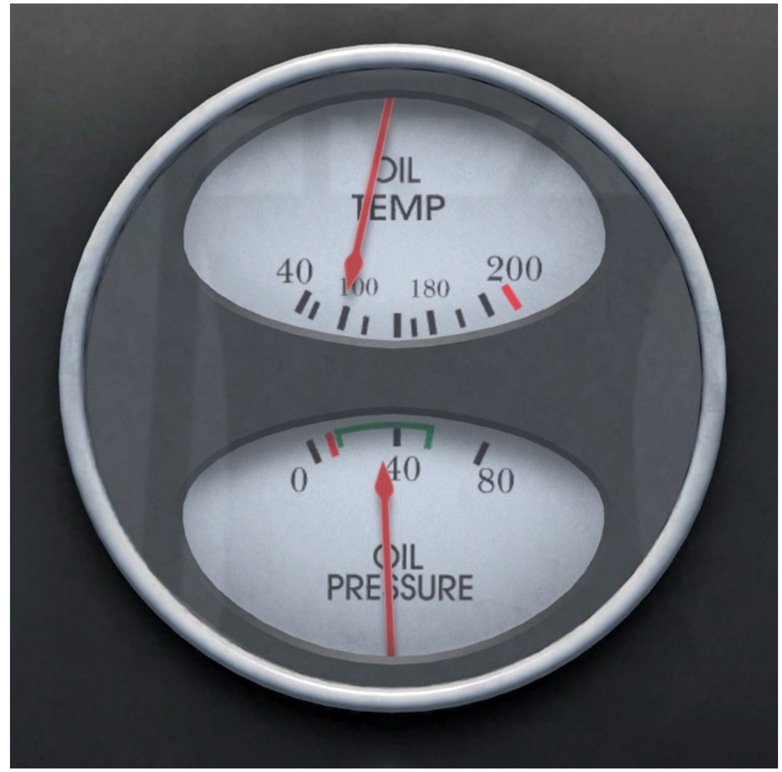
The wooden propeller installed on your J-3 is modeled after the kind made and used for many decades and is still manufactured by Sensenich. It is a classic propeller which will enable the J-3 to deliver “classic” (read “modest”) performance numbers. Metal propellers are more efficient than wooden ones, and are a common up-grade for J-3s. You can get as much as another 5-8 MPH and maybe another 50 FPM in a climb with a metal propeller. This may not sound like much, but these numbers are a hefty percentage of the overall performance range of the J-3. For me, the J-3 just looks, well...right with a wooden propeller. That’s just my opinion; and just like some other parts of the body, everybody has one.

As mentioned before, the J-3's propeller is a fixed-pitch type. This is so whether it is wood or metal, it always turns at the same speed as the engine relative to the throttle setting. The propeller’s and the engine’s speed is also influenced by the airspeed of the airplane. In a dive, the airflow will increase the speed of the propeller, which will, in turn, increase the speed of the engine. If you are not careful, the propeller (and, accordingly, the engine), can be pushed to turn faster than 2,300 RPM if the throttle is held open for too long while the nose is down. Excessive engine speed will overstress and overheat the bearings, piston rod connectors, valve lifters, and lots of other important things in your engine in a big hurry, and will wreck it as sure as Kansas is flat and full of corn. If you’re not interested in suddenly and irrevocably finding out how well the Cub glides without power, and how much it costs to fix or replace a Continental A-65-8, watch your tachometer, and be judicious with the throttle in a dive.

Level cruise is 2,150 RPM. More RPM than that will not, repeat **not**, make your Cub fly very much faster, and you will just burn a lot more fuel for very little, if any, gain in airspeed. If you have to travel somewhere faster than 75 mph, take your car.

Oil Temperature Gauge

This is self-explanatory. Normal oil temperatures are 120º – 180º F. Grade No. 80 aviation or S.A.E. 40 oils are recommended. S.A.E. 30 oils are recommended for operating oil temperatures below 120° F. Don't worry too much about the exact oil temperature. If the oil temperature gauge is reading in the green band or below the red line, depending upon how your particular instrument is marked, all will be well with you. On cold days, let the engine idle for a while until you see some movement on this instrument, then you can go flying. You may experience higher than normal oil temperatures during a flight, particularly during a long climb on a hot and humid day. If this happens, level off and throttle back immediately. There is no other remedy for high oil temperatures, no oil cooler doors, or anything fancy like that in the Cub.



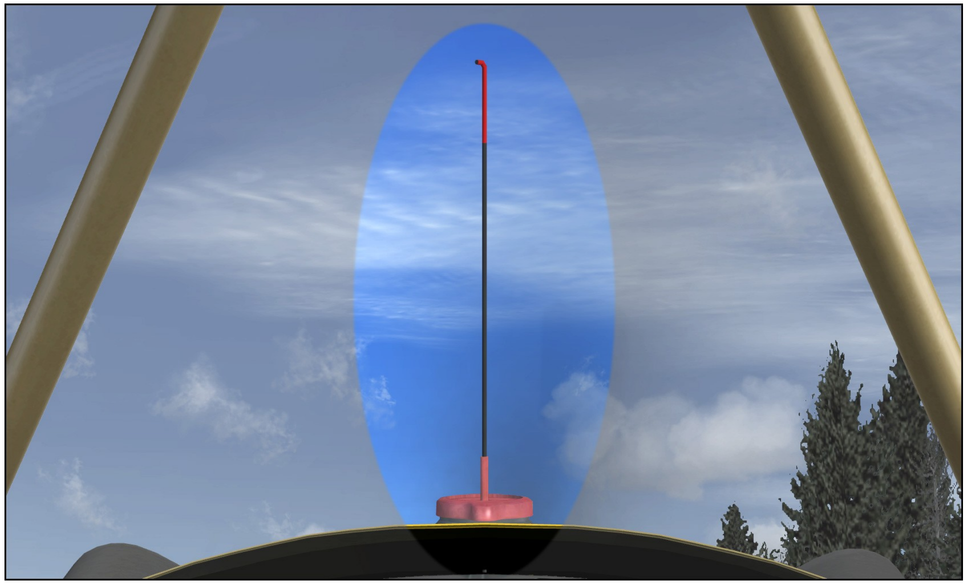
If the oil temperature does not get back to the green band or under the red line, land as soon as possible and check the oil. If you discover that the oil is very dark and grimy, or the reading on the oil dip stick is low, shame on you. You should have checked this before starting the engine and taken care of it then. Of course, there may be an oil leak, which will cost you plenty to fix. If the oil level is good, the oil is clean, and the temperature has still been reading high during the flight, have an A&P mechanic (aircraft and powerplant, not the old food store) check the engine out.

Oil Pressure Gauge

This one is also a no-brainer. Operating oil pressures are: Minimum idling - 10 lbs. per sq. in., Normal - 30 to 35 lbs. per sq. in. In any piston-engine powered airplane, always look at this instrument immediately after starting the engine to see that it is reading in the normal range. If there is no reading at all, or if it is too high or low, stop the engine at once, and have an A&P mechanic check the engine. Constantly higher or lower than normal oil pressure during a flight is cause for alarm, and if this is happening, land immediately and have the engine checked.

That’s it as far as the instruments are concerned. The Cub is not an instrument type of airplane. Experienced Cub pilots listen to the sound of the wind and sense the feel of the controls to determine the airspeed, they listen to the hum and note of the engine to determine RPM and how well it is running, and they look down to see how high they are. Cub pilots are Aviators. After a while, it won’t matter if your passenger is totally obscuring the instrument panel; you won’t need to see it very often anyway.

Fuel Rod



Not really an “instrument”, but a rough kind of indicator, the fuel rod is self-evident, so now, unlike the host who says, “And now I'd like to present someone who needs no introduction”, and proceeds to introduce the person anyway, I'll shut up about the fuel rod.

Oh, just one thing though, the fuel rod bobs around in turbulence and when you are doing pitchy things, so you can't rely on it to tell you anything useful when it's doing that. It also reads funny when the airplane is inverted because the cork floats to the ”top” of the fuel which is now at the top of the tank...never mind.

Cockpit Controls

There are very few actual switches, handles and knobs in a J-3 so this will, mercifully, be a fairly short section.

Instrument Panel

Cabin Heat

On the far left side near the bottom of the panel is found a knob which, when pulled out, shunts hot, filtered air from the engine compartment into the cabin. This is not factory installed in early-year Cubs; however, in places where it gets cold, from time-to-time, in one season or another, it is a nice thing to have. Piper has always been a Pennsylvania company ("PA" can be considered to refer to both Piper Aircraft and the State), and I can tell you from personal experience that all of Pennsylvania gets pretty cold by the late autumn, and stays pretty cold through early spring. Where do you think Valley Forge is? (It's just a little ways northwest of Philadelphia). One might think that an airplane designed and built by PA in PA would have not only a heater, but a jolly good heater as standard equipment. However, the cold facts (I can hear you groaning) are that this was not the case until almost the end of the production of the Cub in 1947. In any event, A2A has providentially installed a heater for your, and particularly your passenger's comfort, from whom you will hear much if the cabin becomes too cold or hot!

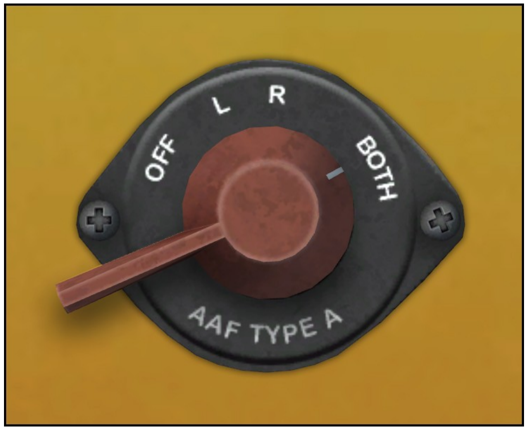
Primer

Moving back up and to the lower right hand part of the panel, you will find the primer. This is the typical silver metal unit that unlocks with a counterclockwise half-turn and springs out a bit when you unlock it. It only works if the fuel control is on, which we will get to in a moment. Unlock it, pull it out all the way, and wait a second or so for the primer tube to fill with fuel. Then firmly push it in, injecting fuel into the cylinders. There should be some pressure and a squeaky noise when you push it in if the fuel has properly accumulated in the system when you pulled it out. Refer to “Engine Starting” above for the proper priming technique and methods. It locks closed by pushing it in, and turning it one half turn clockwise. Always check that it is locked closed before proceeding with your flight.

Left Cockpit Wall

This area is absolutely filled with stuff by Cub standards. Let's take a tour.

Magneto Switch



High up above, on the left wing root is the Magneto Switch. In L-4's and other military versions of the J-3, it may be on the right wing root. This switch is the old Army Air Force Type "A" (I never heard of or saw a type "B" BTW), a big solid looking piece of ironmongery that feels satisfyingly substantial in the hand. I suppose that pilots have been turning a magneto switch like this for many, many decades, and it's a little piece of aviation history in itself. It is marked: "OFF", "L" (left), "R" (right), and "BOTH", referring to the particular magneto(s) which it turns on and off. There is also a very nice audible click, kind of a thump, and a nice, sold, palpable feel to it when you move it from position to position. Some owners have replaced this great old switch with a key unit like you find in modern GA aircraft. I understand the need and desire for security that this grants, and there may even be a provision in the owner's insurance policy that requires this "upgrade", but I really like the big old clunky mag switch best because I'm just that kind of a guy.

Throttle

At the rear and the front seat positions, just ahead of the seats, and in a very convenient place at the top of the left cockpit wall, are the throttles, one for each occupant, which are mechanically connected to work simultaneously. They usually are black with black or red knobs that work intuitively – forward is more power and back is less. I understand that this arrangement is not at all intuitive to Italian pilots and some others, because the throttles in their native aircraft operate in reverse. Go figure. The throttle in the Cub has a fairly short throw, so a little movement goes a long way. This is important to remember when setting it before starting. A half-inch forward from the off position in that situation is enough.

Fuel Shut-off Control (Fuel Valve)

Down around the middle of the left wall and between the rear and front seats, closer to the front seat, placed so it can be reached by either occupant, is the fuel shut-off control or fuel valve. An optimist might prefer to call it the “fuel turn-on control,” but no matter. It sits in a little recessed black metal cup. When it is pushed forward (in), it is on, and the fuel will run from the fuel tank to the engine. Pull it back (out), and it is off, and no fuel runs to the engine. **Do not** stop the engine by turning off the fuel control, as I mentioned before in the “shutdown” sub-section of the “Landing” section, use the magneto switch. That’s all there is to say about that.

Pitch Trim Crank

Lower on the left cockpit wall and slightly to the rear of the Fuel Shut-off Control is the Pitch Trim Crank. It's sensible enough; crank it forward to lower the nose and back to raise it. The crank handle connects to the clever, all-moving stabilizer by cables which extend to the rear of the fuselage, and which turn a jack-screw mechanism that raises and lowers the leading edge of the stabilizer, thus providing pitch trim. The pitch-trim crank can be reached by either occupant. Before takeoff, trim a little nose down if flying solo and a little nose up if the front seat is occupied.

Okay, if your head has stopped spinning, let’s take a deep breath and it’s on to the right cockpit wall. Walk this way, please.

Right Cockpit Wall

Doors and Door Handle

The doors in a Cub are somewhat unique for a light airplane; they open up and down. The top half is actually the right side window hinged at the top. The bottom half is solid, hinged at the bottom, and has a spring-loaded wire handle. In the simulation, to open and close the doors you can use keystroke Shift+E, or left click your mouse on the door handle to open them from inside the airplane. There is no outside door handle, which is the common situation in a J-3.

The operation of the doors was stated before in “Opening it Up and Checking it Out” above, but I'll repeat it here and add a bit, too.

To open the doors from the outside in the real world, if there us an outdoor handle, (not found on all Cubs) you would push down on the wire handle in the bottom door, freeing the bottom door from its locked position, pulling the bottom door toward you and letting it fall. Now the top door is free of the bottom door channel that it was sitting in, allowing you to swing the top door up, and to latch it to wire holder on the bottom of the wing.

If there is no outside door handle, you first walk around to the other side of the airplane, unlock (if there’s a lock on it) and slide the side window down. You then reach into and across the cockpit and unlatch the door from the inside, pushing on it so that it falls open, then walk around and lift and latch the top door to the wire holder as mentioned before.

To open the doors from the inside in the real world, you would push down on the wire handle on the inside of the bottom door and push open the doors, letting the bottom door fall, then pushing the top door up to the bottom of the wing and latching it with the wire holder.

In the real world, it is a little trickier to close the door(s) from the inside and it takes a little practice to get the hang of it. First, reach out and unlatch the top door from the wire holder on the bottom of the wing that holds it up and out of the way, and let it swing down. Then swing the bottom door up so that it is almost but not quite closed. With one hand on the bottom door's handle, pull the bottom door almost, but not quite closed with one hand. Then pull the top door by its little wire handle almost, but not quite closed, and capture the top door's bottom flange in the bottom door's top channel, while simultaneously pushing down on the bottom door's handle, which is spring-loaded, thereby retracting the locking pins at the top of the front and back of the bottom door. Using the top and bottom door handles, pull the whole thing inward so that the top door's flange sits in and is captured in the bottom door's channel, and so that both doors join together and are flush with the fuselage. When you are satisfied that everything lines up correctly, release the spring-loaded bottom door handle so that the locking pins will extend and go into the little holes in the front and back of the door opening securing the whole thing closed - and you're done.

If there is no outside door handle, closing up is made easier with another person to help. One person pushes closed the doors, carefully engaging the top flange in the bottom door's channel as described above, while simultaneously the other person reaches in through the opposite-side sliding window, grabs the door handle, turns it downward to retract the locking pins in the door, and pulls the whole thing inward, releasing the door handle so that the pins will engage the holes at the front and back of the door frame. You can do this alone, but I don't recommend it if you have a tendency towards impatience and high blood pressure.

With regard to all of above procedures, you may think that now I'm going to say "only kidding", but I'm not.

You can open the doors in flight, and fly with them open all of the time. This is a great way to fly the Cub and it's a particularly nice feature of this airplane. The view with the doors open is magnificent - don't miss it. Of course, there may come a time when you want to close the doors again, particularly if, after a while, it gets a bit brisk with the wind blowing in on you. You will then have to do the above-described closing operation with both hands, all while flying the airplane with your third hand if you are flying solo! It's a lot of fun. Actually it's not as hard as it sounds: it's harder.

The video of Scott flying in the Cub with pilot Nick Ziroli, Jr. in the back seat shows Nick closing the doors in flight. He makes it look easy; but don't believe it.

Carburetor Heat Control

In front of the forward part of the bottom door, and way up ahead of the rear seat on the right, is the Carburetor Heat Control. Like the Fuel Shut-Off Control, it also sits in a little recessed black metal cup. Pull the knob all the way back (out) to turn it on and push it all the way forward (in) to shut it off. Done. **Turn on the carburetor heat without fail every time you substantially reduce power, no matter what the outside temperature is.** Don't argue, just do it, or good old Sgt. Willis will not let you forget it or get away with it, and you'll have to police the base parade grounds for two hours - in the rain -bareheaded. I know all about it.

“Oh, I forgot; just one more thing”, as Lt. Colombo says: it’s a bloody long reach to the Carburetor Heat Control from the rear seat. The second paragraph of “In Flight Notes” above, contains a short discussion of ways around this problem. Thicker-around-the-middle people like me will have a tough time reaching it from the back seat, although one’s somewhat expansive size will tend to prevent one from being able to actually enter the airplane to begin with; but that’s a story for another day.

Well, that’s all there is with regard to controls and such. As you can see, the Cub is an airplane you actually fly all the time, and not a set of knobs, handles and switches to fiddle with endlessly (not that there's anything wrong with that). It’s actually quite refreshing, challenging, and deceptively simple.

Final Word

Just one word of warning, a bit grim perhaps, but true: Over the many years of pilots flying the J-3 and other Cubs, the accident and pilot attrition rate for these airplanes has been markedly higher than that for many other general aviation types. This is thought to be because the Cub's remarkable and seemingly easy to obtain performance at slow airspeeds is so excellent that it invites pilots to take chances and therefore to push the envelope too far. Don't let yourself become a statistic because you unwittingly joined that unfortunate cadre of those who fell too deeply for and into the charms of this so-very-charming airplane. It is surely one of the great airplanes of all time, but it is still a flying machine which, although it sometimes seems to laughingly defy them, absolutely, strictly and without exception is subject to and obeys all of the laws of physics and of nature that every other airplane must obey. With this in mind, have fun with it, and fly it well so that you can do it again another time.

That's all folks. No greater or more original example of a "plug-and-play" airplane exists today. The Cub was meant to be, and is a useful, satisfying and enjoyable airplane which, as a side benefit, challenges you to really fly it, and in return always teaches you something of value. I hope that I have passed on some useful information about flying the J-3 Cub, and that you spend many happy hours flying it as so many others do and have before you.

Enjoy, and happy trails to you.

Mitchell Glicksman

P.S. I would like to leave you with one of my favorite poems. I hope you like it, too.

High Flight

Oh! I have slipped the surly bonds of Earth
And danced the skies on laughter-silvered wings;
Sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds, — and done a hundred things
You have not dreamed of — wheeled and soared and swung
High in the sunlit silence. Hov'ring there,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air. . . .
Up, up the long, delirious burning blue
I've topped the wind-swept heights with easy grace
Where never lark, or ever eagle flew —
And, while with silent, lifting mind I've trod
The high untrespassed sanctity of space,
Put out my hand, and touched the face of God.

John Gillespie Magee, Jr

Credits

Microsoft: Creators of Microsoft Flight Simulator X

Project Management: Scott Gentile

Lead Artist (3D modeling, texturing, gauges): Robert Rogalski

Original aircraft 3D artwork and texturing: Marcelo Da Silva

Passenger 3D Artwork and Texturing: J. Anderson

Passenger Stylist: Kendall Farr

Systems Programming: Robert Rogalski, Scott Gentile

C++ Programming: Michal Krawczyk, Robert Rogalski

Flight Dynamics Programming: Scott Gentile

Visual Effects and Audio: Scott Gentile

Public Relations, Web Design: Lewis Bloomfield

Pilot's Manual: Mitchell Glicksman

Photography and Illustrations: Scott Gentile

Manual Proofreading and Formatting: Larry Green and the Beta Team

Quality Control: Cody Bergland

Beta Testing: The world's best best beta team, including Martin "ICDP" Catney, Ian "PistonPilot" Chase, Forest "FAC257" Crooke, Glenn "GlennC" Cummings, Ryan "Hog Driver" Gann, Mitchell Glicksman, Captain Jakey, Larry "Tako_Kichi" Green, Dudley Henriques, Günter "guenseli" Steiner, and Oskar "Lonewulf" Wagner.

Special Thanks to: Mitchell Glicksman for his knowledge and dedication to doing it right, Tim Gallagher for his unwavering support, Dudley Henriques for his care and expertise, Oskar Wagner for his knowledge and experience, and to our superb members of our team who each bring their own individual strength that results in a better product.

Very Special Thanks to our friends and families who stuck by us and worked hard to support our efforts

Thank you for choosing A2A Simulations.