PREDESTINATION? OR GOD'S PLAN?

SOME EXPERIENCES AND OBSERVATIONS OF AN OX5 AVIATION PIONEER

FORWARD

A few words about the author. Frank J. "Chilli" Miller, having been conceived on or about the third aniversary of man's first flight in a heavier-than-air powered machine, was born on September the 17th, 1907 on a farm located about three-and-a-half miles east/northeast of Chillicothe, Missouri.

The youngest of four children he started to school at the age of four only a couple of weeks before his fifth birthday. The school was a typical one room country school with a single teacher assigned to teach all eight grades. It was heated by a single potbellied stove fired primarily by chunks of wood and supplemented with coal on real cold days. Two outdoor toilets completed the accouterments of this installation. During Chilli's first year of attendance at this Jones school the entire student population numbered only nine and included his older sister and older brother.

The schoolhouse was located a half a mile west and a half a mile south of Chilli's home. Walking the distance was not too difficult in good weather, but snow and spring rains which changed the dirt roads into mud made the trip quite difficult. It was the responsibility of the teacher to perform janitorial work as well as to teach. Most teachers boarded with near neighbors, but one year a teacher lived.

about three miles away and normally drove a horse hitched to a buggy; but when the roads were really bad she rode the horse, and during these trips she wore a riding skirt which was real full and reached to her ankles. It was sort of a modified culotte.

Upon completion of the fourth grade Chilli and his older brother Raymond bid adieu to the Jones school and started the 5th and 8th grades respectively at St. Columban's Parochial School in Chillicothe. It was staffed by the Sisters of St. Joseph of Carondelet which was a small town and has since been surrounded by St. Louis, Missouri.

During this year transportation and good weather was by way of one bicycle, Chilli riding cross-wise on the frame and his brother furnishing the motor power. Both walked uphill when it was too steep to be negotiated with the double load.

The next year Chilli was presented a bicycle on his birthday and in good weather rode it. When the roads were bad he rode with neighbors who drove a team of horses hitched to a two seated carriage and they had six children in school. The oldest attended St. Joseph's Academy, a high school located across the fence from St. Columban's. This school was a girls boarding school which also accommodated day students for both sexes and was staffed and owned by the

Sisters of St. Joseph. Chilli walked a half mile west to catch the ride.

By the next school term these people moved away and in bad weather Chilli rode his own horse; however, in good weather he now rode a motorbike having obtained a single cylinder Shaw four-stroke cycle engine which he installed in his bicycle. This worked well except the bumpy dirt roads caused fuel leakage at the carburetor separation joint. Vellumoid and similar gasket material had not yet appeared; or, if so, Chilli had no knowledge of it and he made gaskets from a section of old discarded tire tubes. Exposed to gasoline, this material expanded and soon leaked badly, the wind driving back the leakage on Chilli's pants. During the last two years in grade school one could detect his presence in the classroom by a strong odor of gasoline.

As Chilli was growing up few antiseptics or antibiotics were known and those that were in use were too expensive when home remedies would suffice. When one suffered a severe cut not requiring stitches the wound was carefully cleansed and washed lightly with turpentine. Next a piece of pork fat was applied and bandaged with a strip torn from a discarded bed sheet and tied with string carefully saved from some previous use. No cough syrup could equal that composed of rock candy dissolved in whiskey. A chest cold was treated with a mixture

of skunk grease and turpentine covered with a piece of old woolen blanket. The turpentine warmed the chest increasing blood circulation while the skunk grease prevented blistering and people survived.

Upon graduation Chilli's teacher told his mother that she should send him to a good school. A few of the local boys were attending St. Benedict's College in Atchison, Kansas. This was a two year college with a four year high school.

Having finished a rather distasteful eight grades Chilli decided he did not want to go any further in school. World War I was over and his older brother Joe had returned from the service and had taken a course in automotive mechanics at Sweeney's in Kansas City. The textbook which he brought home was entitled Dyke's Automotive Encyclopedia. Therein Chilli found a section dealing with aircraft engines; namely, the Liberty, the Halls-Scott and the Curtiss OX5. The only airplane mentioned was the Curtiss JN4-D2 later known only as the Jenny. He read and reread this section until it was practically memorized.

When the school term began Chilli found himself en route to St. Benedict's but not before extracting a solemn promise from his mother that if by Christmas vacation he didn't like it there he would not have to return. Christmas came and Chilli held his mother to her promise. It wasn't so

much that he didn't like it at St. Benedict's; the main problem was that he didn't like school. So he didn't go back. Instead he spent the remainder of his school year hunting rabbits, trapping fur bearers like skunks and oppossums, and when spring came, worked at whatever there was to do about the farm, happy but ignorant.

As another school term approached Chilli was forced to enroll in the freshman class of St. Joseph's Academy. No amount of excuses would provide otherwise. Oh, well, it wasn't so bad. There was only about five or six boys and 60 or so girls. By the time he reached his senior year there was some dropouts of boys. So being the only boy in a class with 14 girls has some advantages like no competition, being elected class president and perhaps even being selected as class valedictorian.

It was in such an era and under such circumstances that constituted Chilli's background and may have exerted some influence in his later life.

CHAPTER I

PREPARATION FOR A CAREER

I wish to dedicate this book to Sister Mary Kevin Rooney, ASC, who induced me to write it; to the Sisters of St. Joseph of Carondelet who provided me with my basic education; and to Jane McConnell who transposed it from tape to type.

Following my graduation from high school in June of 1925 the urge to get into aviation greatly increased. Perhaps the sudden absence of so many girls prompted me to devote my thoughts to a career. My parents objected as they both thought and expressed themselves as aviation being too dangerous. About that time I encountered a famous quote: "Boys of a fighting, reckless disposition need an occupation full of danger to keep them good." Not that I was necessarily of such a disposition, but I guess I was somewhat reckless in fighting with my older brother Raymond who always won.

About a month after graduation my mother became very ill and spent most of the time in bed prior to admission to a local hospital. She had acquired a case of extremely high blood pressure. During this period it fell to my lot to become the homemaker. Under my mother's guidance I learned to cook by simple recipes, however, ironing was an art I could never master. My favorite cousin Ruth Pfaff, many years

deceased, would come out to the farm and iron our dress shirts. The rest of the clothing was worn as is, wrinkled or not.

I don't remember how long my mother was hospitalized, but after a series of strokes she expired while I held one hand in mine on September 5, 1925. My oldest brother Joe from California was present, but my older sister Sister Mary Louis had joined the Benedictine Nuns at Atchison some three or four years previous and was not permitted to attend the funeral.

Sometime afterward when things settled down to normal I again spoke to my dad about getting into aviation. I told him that I was going to learn to fly somehow, that farming was not for me; and if I did not have his permission to leave home before age 21, I would leave the day after.

During the winter of 1925-26 a break in my favor occurred. My dad and I were visiting his sister-in-law who had been widowed a second time and a son of her late husband was also present. As luck would have it he also happened to be a naval aviator. He talked to my dad and almost convinced him that aviation was not so dangerous after all, but that it like the sea was terribly unforgiving of any ignorance, carelessness or neglect. He also added that in time it could develop into a major transportation industry and that people who entered early would enjoy a successful career.

Not long after that encounter an ad appeared in a farm

3 magazine placed there by Heath Airplane Company in Chicago outlining a 13 week flight and mechanical course for $190.00. The course consisted of eight hours of flight instruction and three months shop training on construction, repair and maintenance of airplanes and engines.

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CHAPTER II

BEGINNING OF A CAREER

Finally in early March my dad relented and after taking out a life insurance policy he gave me $300.00, his blessing and on March the 15, 1926 I found myself aboard a train headed for Chicago.

When I arrived I took a taxi to the Heath Airplane Company which was located at 2856 Broadway. I was expecting to find a separate building located on an open field large enough to accommodate airplane and takeoffs and landings. What I found was quite different; buildings all around and at the foot of a stairway there was a sign Heath Airplane Company. I climbed the stairs which led to an office some 10 or 15 feet square occupied by a secretary and the barest of furniture which did include a desk and telephone, a file cabinet and a couple of chairs.

I introduced myself and the secretary called for Mr. Heath. They did have a loud speaker in the shop. Soon a little guy about five feet one or two inches tall dressed in leather breeches and wearing a leather coat came in. The secretary introduced us and Eddie Heath took me out to the shop, his classroom. It was about 150 feet long with windows all along the street side, one end having a 30 foot workbench along the window side, a couple of Curtiss OX5 engines and a

Hispano-Suiza, commonly known as a Hisso. On the other end was a stock of wood and plywood with woodworking machinery and a trap door through which an airplane fuselage as well as wings could be lowered to the space off the street below.

There was some ten or twelve people working at different tasks throughout the area. One uncovered airplane fuselage was midway between the woodworking area and the engine section. Upon inquiry I learned that it was a Bristol fighter that someone owned and had cracked it up after which it had been brought in for repairs.

The Heath Company existed mainly on repairing aircraft performed by students under supervision. At this time I met the shop foreman Clare Lindstedt and later Otto Klein, the other member of the office staff, besides the secretary.

Mr. Lindstedt took me around to meet those in charge of the different areas; Al Meyer and Joe Szakacs in the propeller area and Elwood "Shorty" Cole and another whose name I can't recall in the engine department.

There were no divisions of the shop to designate departments or areas. It sort of faded from one department into the other. Adjacent to the door to the office was a time clock and a rack for time cards. All students and employees punched their time cards on all arrivals and departures. Students who attended eight hours per day for five days a week were given five minutes extra flying time per week. If they

wished to work on Saturdays, which was optional, they were given 20 cents per hour.

Prior to departure for Chicago I was advised that in the vicinity there existed a boarding house for gentlemen where room and meals were available or rooms only. This was known as the Kolping House and was operated by Germans or persons of that descent. It was only about three blocks away on Halsted Street. One of the students escorted me there where I checked in. I don't remember the rate but it was quite reasonable.

After a change of clothes I went back to the shop where the shop foreman gave me my first assignment. It was to cut a piece of wood, I don't remember the exact dimensions, but it was something like 1/4 of an inch by 1/4 of an inch by three inches long. After being checked out on the small band saw, the table saw and the wood planer and shown where the stock of wood was stored I went to work. I was given a wooden rule with which to check measurements.

With the table saw I cut a piece of wood from a one inch board and ran it through the planer several times to get it down to 1/4 by 1/4 of an inch. I measured it as carefully as I could and cut it to where I thought was three inches in length. I took it to the shop foreman who measured it with his steel rule and promptly rejected it. At this time I did not notice that the graduations on his rule were on 1/64 inch

4 intervals while on my rule they were 1/16 inch.

I went back and tried again and again. I failed. It took five or six tries before I presented a piece that passed. The number of rejections was done to make me aware of the precision required in aviation and to reject items that were not perfect. That was explained to me when the final piece was accepted.

By that time I noticed that the lines on my rule were about 1/64 inch wide. So if I use one side of the line for a measurement and the other side for another measurement that could throw me off 1/64 of an inch. Since I finally passed the test I was assigned to the propeller department.

Through much work, study and experimentation Eddie Heath had developed a propeller for an OX5 engine that was slightly self-adjustable in pitch. He had obtained a number of World War I surplus propellers made in Canada. These oak wooden props were eight foot in diameter with a five foot pitch. To the uninitiated pitch is the distance a propeller or any other body would travel forward in a solid medium in each revolution.

The blade was something like a butcher knife and the tip was covered with a copper sheet for some twelve inches of the leading edge.

Heath's design called for glueing on about a foot of birch wood with about an eight inch lap. This increased the

diameter by eight inches, however, the finished product had a diameter of eight foot, six inches. The blade shape was changed to what was known as the toothpick design. The blade was narrowed with both leading and tracking edges having approximately the same curvature ending with a rounded tip about two and a half inches wide. Removal of the excess wood was done by hand using draw knife, spoke shave and sandpaper. The shape and the thickness of the blade was attained by the use of templates having the correct thickness and curvature and slipped on from the tip. Wood was removed from the blade until the template fit the blade a certain distance from the center of the hub. The pitch was controlled by the angle between the back side of the blade and the flat side of the hub and was accomplished by use of a bubble protractor. When the wood work was completed the tip was encased in linen, lapped at the leading edge to a distance of about 16 inches. Several coats of nitrate dope were applied to the linen until the finish was smooth.

The tip and the leading edge was then covered with a sheet of monel metal. At the very thin area the metal was secured by rivets and covered then with solder. Toward the center brass screws were used and covered with solder. Many times during construction the prop was balanced on the stand containing frictionless knife edges. It had to balance in eight positions, vertically, horizontally and 45 degrees to

each position.

If the prop was properly cut, in operation the point of support was ahead of the center of pressure of the blade. Turning up on the blocks the pitch would be slightly reduced as the blade would twist. This also occurred in the early stages of takeoff. Reduced pitch allowed the engine to turn up faster and deliver more power. As the airplane gained speed and became airborne the blade tended to untwist increasing the pitch and thus increasing the speed of the airplane.

Once in awhile the wood would not be removed in the precise area resulting in the center of pressure being ahead of the point of support. Turning up on the blocks would increase the pitch, the wood would untwist, the pitch would increase again and these rapid cycles would cause a buzzing sound, and the engine speed would be sharply and suddenly reduced. This condition was called flutter and the propeller would have to be scrapped.

One day I noticed Joe Szakacs removing a little bit of wood from a propeller he was carving, then running his hand back and forth taking off some more shavings and feeling the blade. I asked him, "Just how should a prop feel?" He replied, "Smooth, just like a woman's leg." I didn't question him any more.

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CHAPTER III

A LESSON IN ECONOMICS

After a couple of weeks it became quite plain to me that the $110.00 left from the $300.00 after paying Heath would not last for three months. I confided my problem to my supervisor Al Meyer. He said that he worked evenings from about 5:30 to 9:30 in a cafeteria and was rewarded with $1.25 per day in meals, and that if I was interested, he would speak to the management and he would recommend me if they could use another person. I gladly accepted his proposal. He in turn spoke to the owners who agreed to give me a week's trial.

For the first week I cleared tables taking the dishes back to an ante-room where the flatware was washed, cleared dishes of scraps and passed them into the kitchen window from where two dish washers (human, not mechanical) retrieved them and washed and dried them. The Stewarts were so pleased with my work that they gave me the job, even working on Sunday afternoons for some cash. That coupled with the 20 cents per hour overtime on Saturdays at Heath's took care of my room rent as long as I stayed at the Kolping House through 1926 to January 1927.

During this period I did about everything there was to do from washing dishes in the kitchen to making salads, slicing bread, cutting butter and placing the little squares

on the small individual porcelain dishes, working behind the steam table, printing out charge checks and occasionally carrying cash and checks to a night depository of a local bank. Two items were off limits, cooking and taking payments at the cash register.

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CHAPTER IV

BACK TO THE SCHOOL

I learned a lot about Eddie Heath from Joe Szakacs. He told me that Mr. Heath had built an airplane and taught himself to fly in 1907. In 1925 Heath flew an airplane which he built powered by a 90 horsepower OX5 engine carrying two passengers from Chicago to St. Louis. He called this airplane "The Heath Favorite". Joe said that he went to extremes to save weight. Even the fuselage (longevous) were split and then routed out between stations, then glued back together. (Cotton) pins were cut as short as possible. On the wing trailing edges he used a 1/16 inch cable which produced a scalloped effect as the fabric shrank between the ribs. This necessitated some metal reinforcements on the rib trailing edges to prevent the cable from cutting into the wood.

I never saw the Favorite, only a picture. About this time he also built a little racer about ten feet long with a wing span of about 15 feet. I think he was the only one to fly it as the cockpit squeezed his scant 145 pounds. Powered by a 45 horsepower Bristol (Cherub) engine he attained a speed of 109 miles per hour on a triangular closed course. I can remember one of his famous sayings, "When in trouble or in doubt nose her down and kick her out." When a heavy job appeared like lowering the fuselage or wing down the trap door

5 one could hear Heath call out, "Many hands make heavy work light."

After a couple of weeks in the shop I was taught a good lesson in diplomacy although it was not part of the curriculum.

Everybody called Mr. Heath and referred to him as "The Boss". I think he liked that but he didn't like what happened one day. Several of us were gathered around him discussing aviation terms like angle of incidence, angle of attack, stagger, dihedral, spin and stall. I posed the question, "Since dihedral is the angle between the horizontal and the amount the wing tips are above, what is a term when the wing tips are lower than the horizontal like a wild duck's wings are when they come sailing in an approach to the water?" The Boss said, "Duck's wings are above the horizontal on their approach." I said again, "I mean back maybe 50 or 60 feet from the landing." He said again, "A duck's wing tips are never below the horizontal." At that I blurted out, "Hell, Boss, you never saw a wild duck."

The meeting broke up and not long after the shop foreman approached me and noticed how dark it was in the shop. The windows had suddenly become very dirty, also the floor had accumulated an extraordinary amount of wood chips and shavings and the broom was right over there. Well, I was assigned to washing windows and sweeping the floor for a week. The Boss

5 also appeared somewhat cool to me for awhile.

When Heath started his shop and flight operation the word airplane had not yet been coined. His facility was therefore known as the Heath Air Vehicle Works. Consequently, Joe often referred to the current operation as The Vehicle Works. It seemed the term aeroplane developed overseas and was used in the country for awhile before it developed into airplane. In 1926 we often referred to them as ships, shortened from airships. Later that term was used to classify lighter-than-air powered crafts such as the dirigibles.

On April 9 I received my first introduction to an airplane. Transportation to the field at the southwest intersection of (Touby) Avenue and River Road close to Des Plaines was in the Heath House-A-Ford. This was a Ford Model T truck with built up wooden sides with (front) ending at the windshield. The floor extended outward on each side bearing support on which to stack wings and tie them on. It also extended to the rear so that the tail end of a fuselage could be tied down and towed to the field. Inside on each side were wooden benches minus cushions provided accommodations for students to relax while traveling to and fro.

The airplane was essentially a Standard J-1 but the nose was modified to resemble a Jenny. The original Standard was powered by a Hall-Scott 100 horsepower engine. The carburetor on this engine was located high on the side.

Since fuel pumps had not yet been invented but engine driven air pumps were available from the automotive industry, it was so equipped. Air pressure to the top of the gasoline tank forced the fuel uphill to the carburetor. For engine cooling a narrow tall radiator was installed just aft of the engine and it extended to the center section. The pressurized fuel tank was a dangerous design. Nearly every time a Standard crashed, the tank would rupture and air pressure sprayed fuel on the hot engine which immediately caught fire. This caused the Standard to be called the unenviable name of the Flaming Coffin.

On the other hand, the carburetor on the OX5 was in the rear and low on the engine. This permitted the use of gravity feed in its installation. The Jenny radiator fit on the nose, it being provided with a large hole for the front part of the engine to pass through far enough for the rear of the propeller to clear the face of the radiator. This eliminated the old vertical radiator thus greatly improving forward visibility.

Now to get back to our trainer, the modified Standard J-1. It had been cracked up and repaired so many times that it was affectionately known as the Splice. My instructor Clifford Condit explained the simple controls, the stick and rudder. The movements of the stick were natural. For example, if the nose was too low pull it back. If it was too

high push it down. If a bump caused the right wing to come up push it down and the left wing will be pulled up at the same time.

The rudder however was something else. For one thing, the rudder bar looked to me as if it had been made for a Flexible Flyer and accidentally found its way in the airplane. For those who grew up in other than hilly country covered with snow in the winter, a Flexible Flyer was a steerable coaster sled. They were the Rolls Royce of coaster sleds accommodating at times kids two or even three deep kids while coasting down hills. If you wanted to go left, pull on the left end of the bar and push on the right. This bent the steel runners to the left and the sled went in that direction. However, this thing in an airplane was just the opposite. Instead of pushing the nose around in a turn, you had to lead it around. This gave me a lot of trouble since the opposite had been ingrained in me for so long.

One early flier, Clyde Cessna crossed the rudder cables and could not fly an airplane without so changing them. To overcome my problem I spent many hours on my back at night before retiring imagining I was flying coordinating controls; for example, night stick, right rudder; left stick, left rudder. Eventually my memory of the Flexible Flyer faded into history and rudder action became automatic.

Another problem I had was maintaining altitude. I kept

going up and down. Clifford Condit kept saying, "Keep the rocker arms on the horizon." After a couple of lessons I built up enough nerve to ask him, "Just what part of this cotton picking airplane do you call rocker arms?" He appeared amazed at such a stupid question. When he pointed them out I felt rather stupid myself. I had never encountered any engine having valves in the cylinder head. They had to be opened by push rods up the side of the cylinder to objects pivoting at the center on top and rocked up and down at the pivot with the engine in operation, thus opening the valves and closing them at the proper time. Quite naturally they were called rocker arms. When I found out what the rocker arms were, I soon mastered keeping them on the horizon.

We didn't have a lot of instruments, gauges, lights, etc., to watch, thus taking our attention away from actual flying. There was an oil pressure gauge which measured the pressure in psi (pounds per square inch) being applied to the camshaft bearings from which it passed to the main bearings thence through a drilled crankshaft to the connecting rod bearings. A loss of oil pressure if not caused by a broken gauge or oil line meant that the engine would soon fail. So this gauge was checked quite frequently. There was a water temperature gauge to indicate the engine operating temperature. Loss of water would cause a high temperature and soon engine failure. So this gauge was also frequently

checked.

Next in importance was the tachometer which showed how many rpm (revolutions per minute) the engine was turning. The OX5 developed 90 horsepower at 1400 rpm but few ever ran that fast on the ground. After takeoff and climb to cruising altitude one could throttle the engine back to about 1325 or 1350 rpm. There was also an ignition switch to control the magneto for stopping or starting and continuing operation of the engine. The remaining instrument was an altimeter, an anevoid barometer having a dial some five or six inches in diameter with a single hand which moved about 1/8 of an inch for 100 feet change in altitude. The initial setting was adjustable so it could be set at zero to compensate for variations in local air pressure caused by movements of high and low air pressure, air masses moving across the country.

I have seen variations in settings approaching 1,000 feet when several days elapsed between flights. In other words, if the last flight was made when the air mass was one of high pressure and the altimeter was zeroed on the ground and a very low pressure air mass moved in at the next flight, the (?) altitude could be as much as 1,000 feet.

One evening returning from the field, Cliff in an excited manner said, "Look there, he's spinning." Our route passed close to the field of the Chicago Flying Club and we often saw an airplane circling probably practicing landings.

Cliff speeded up as fast as the old Model T would go and detoured from our regular route to reach the scene of the accident. Sure enough, the airplane, a Curtiss JN4, had spun all the way in, but by the grace of God had struck the side of a big oak tree shearing all limbs off one side cushioning the impact so that the occupants had only a bloody mark on the crowns of their noses where they struck the cowling on impact. The wings were shattered and pieces were scattered but the fuselage appeared intact. (Insert on Page 28?) We helped them gather up the pieces and pile them near the tree with the rest of the wreck and proceeded home.

Near the center of our field there was a marshy spot surrounded by trees which provided a wind break and afforded an excellent anchor which to tie the airplanes to. One day the Splice engine didn't seem to be turning up to its normal speed. The tachometer normally registering rpm was inoperative. So Cliff was attempting to determine the engine power by raising the tail with the propeller blast against the elevators. In those days airplanes had no brakes. So the wheels were well blocked with a good sized log and headed away from the trees.

A Mexican by the name of Jaun Perez observed the procedure and it looked like fun to him. He untied his airplane, a Jenny, and backed it away from the trees but still headed toward them. He chocked the wheels and someone gave

him a pull on the prop. The engine started readily and after a brief warm up period he applied power and attempted to raise the tail. It didn't come up so he gave it more throttle. This time the tail did come up but the wheels jumped chocks and Jaun went into the trees. Splinters flew from the propeller and some of the trees ate into the wings. Poor Jaun was dumbfounded but now realized that "aviation like the sea is terribly unforgiving of any ignorance, carelessness or neglect."

On my second lesson April 14 I was introduced to turns. Turns are a lot more complicated. Let's stop and analyze a proper turn. A proper turn requires a degree of bank depending both on the speed of the airplane or rate of turn. A turn at high speed requires a steeper bank. To start a turn requires considerable rudder to start the turn as well as to counter the increased drag on the outer wing caused by lowering the aileron to raise the wing.

Now, as the turn is started a slight reduction in rudder control is required. As the turn progresses when the proper degree of bank is assumed, the outer wing is traveling faster than the inner wing and it therefore creates more lift, and the degree of bank has a tendency to increase. At this stage of the turn it becomes necessary to lower the aileron on the inner wing. This increases the drag and thus requires a slight bit of outer rudder to prevent the rate of turn from

increasing. To assume straight and level flight it requires rudder toward the outer wing coordinated with reducing the degree of bank in proportion. If a turn is made with too much bank for the speed and rate of turn, the airplane will slip toward the inside of the turn, losing altitude but little speed. On the other hand, if the rate of turn is greater than that warranted by the degree of bank, the airplane will skid outward from the turn. This kills speed rapidly and if sufficiently severe can cause a stall and a subsequent spin.

Many young fliers have lost their lives in a downwind turn, that is, from flying into the wind and then turning to fly with the wind. I have determined that in the course of the turn, the wind blows them inward toward the center of the turn drifting sideways causes them to think they are slipping into the turn and they apply more rudder which causes a skid and a subsequent loss of flying speed and a spin quickly follows. This downwind turn is normally made soon after takeoff and consequently at low altitude which affords little time to recover.

On the 23rd of May, 1926, after ten more lessons averaging in time from 15 to 30 minutes I soloed on the 13th lesson after 15 minutes spent in making three good takeoffs and landings. My total instructional time was four hours and 30 minutes. This was not counting the time spent in imagining flying sitting on my bunk learning to coordinate stick and

rudder. Additional flying time was spent with an instructor as Mr. Heath no longer trusted the embryo pilots with his airplane.

As my instructor warned, the airplane took off noticeably earlier and climbed faster due to the lack of his weight. It also landed slower and tended to float a little longer before losing flying speed. With a perfect attendance I was awarded the extra five minutes per week bringing my total dual time to nine hours and five minutes with five minutes solo.

Some may wonder how an engine change was accomplished in the field without the benefit of a mechanical hoist. The replacement engine, newly overhauled, was hauled to the field aboard a stand in the House-A-Ford with a half dozen or more students. Upon arrival at the field the "Splice" was untied and rolled back from the trees. Next the wheels were soundly chocked both fore and aft. Water and oil were drained from the system. Top and side engine cowling were removed. The propeller and nose radiator were also taken off. The gas line at the carburetor was disconnected. A long rope was tied to the tail skid. Two men were assigned to the rope, one man on each lower wing tip and two more to the fuselage to lift it higher and higher until the center of gravity passed in front of the wheels. The men on the rope gently released more rope until the nose rested on the ground gently. The men at the

4 wing tips prevented the airplane from tilting sideways.

Four of the group then proceeded to the nose, and using the exhaust manifolds or short stacks as handles lifted the engine out and carried it out of the way and set it on the ground. The replacement engine having been unloaded was likewise lifted from the stand and carried to the airplane and settled into position where it was bolted to the engine mount. The dry weight of the engine, that is, without oil and water wsa 375 pounds. Thus, four men couldhandle it but six made it easier. Remember? "Many hands make heavy work light."

To right the airplane it was a simple matter to reverse the procedure, that is, pull the tail down with the rope and catch the fuselage as it descended.

After reinstalling the radiator, propeller and cowling together with reconnecting the water and gas lines, the oil pressure gauge line, the (reader) wires and filling the system with water and three gallons of oil the engine was ready to go. This engine had been previously tested and run in for several hours in the shop on a test stand equipped with a club propeller which created little air flow but there was plenty of noise from the exhaust. Nobody seemed to worry about carbon monoxide poisoning, but when the fumes became strong the windows were opened and the place aired out. To my knowledge no one ever became sick from inhaling the carbon

monoxide exposure.

While working in the shop I observed two extreme opposites in nervous makeup or whatever in two individuals. One student was making cap strips on a circular table saw. These were wooden strips about one-half inch wide by 3/16 inch thick and about six feet in length. They also had a center groove about 1/8 inch wide and 1/8 inch deep on one side. Cap strips were made to fit the top and bottom rib webs and were glued into position from leading to trailing edge of the rib. The depth of the groove was regulated by the amount the saw blade protruded above the table.

After running several of the strips over the saw blade I noticed that he was using his thumb to hold the strip down on the saw instead of using a piece of wood that approached the end. Well, before I could get over to him and warn him about the dangerous practice he was using, he had put a thumb near the end of the strip and drew it across the saw. At the end of the strip he failed to withdraw his thumb soon enough to avoid the whirling blade. The saw cut its way into his thumb and he looked at it in surprise. He even opened the wound with his other hand as if looking for the bone. I escorted him to the office from which he was rushed to a doctor.

The other case involved a student who failed to place a wrench properly on a nut he was preparing to turn. When he

applied pressure the wrench slipped off the nut and he barked a knuckle. He looked at the joint and as a drop of blood appeared he collapsed in a dead faint. Others nearby stretched him out on the floor, one raised his feet and he soon recovered. One went to a first aid kit, obtained a bandage and bound up the finger. Band-Aids or similar adhesive bandages had not yet come along. The poor fellow apologized profusely but the other fellow students realized his shortcoming and just laughed it off.

I experienced a very embarrassing situation, luckily before the 13th week of the course was completed. A newly covered fuselage was being prepared to lower it to the street below. We were installing the landing gear. On the top of each leg there was a flat plate with four bolt holes. On the fuselage there were matching fittings. On the two forward legs the inner aft holes were inside the front cockpit, thus requiring attaching bolts to be inserted from the inside of the fuselage. I was assigned to get in the front cockpit and insert the two bolts.

Well, with bolts in hand and a wrench to hold them while nuts were tightened on the outside, I climbed in and got down on the floorboard. I eased forward past the gas tank and reached to the corner, found the hole and inserted the bolt. A fellow student on the outside screwed on the nut which he tightened while I held the bolt on the inside. I found the

hole on the other side and inserted the bolt. I was quite cramped up in close quarters and suddenly developed a severe cramp in one of my legs. That leg just had to straighten out regardless of where my foot was located and that just happened to be the side of the fuselage. Bong! The toe of my shoe went through the linen covering. Did I ever get a dressing down. The Boss was furious. If my course had been completed I'm sure I would have been fired on the spot. At any rate, I received additional training in installing patches on fabric covering.

In those days all wings, fuselage and tail surfaces were covered with linen. Cotton fabric of adequate tensile strength had not yet been developed. Soon thereafter long staple cotton from Egypt was found and woven into cotton fabric having a tensile strength of 80 pounds per inch in both the warp and the width. This was tightly woven having 80 threads per inch in each direction.

We had two types of dope. Dope, incidentally, was the liquid applied to the fabric to shrink it tight and to make it airtight also. I guess the reason it was called dope is because in a confined condition breathing the fumes would give you a high.

So we had two types of dope, as I said, nitrate and acetate. Nitrate dope shrank the fabric tighter than acetate but was very flammable. When cured and dried out it became

like celluloid. On the other hand, fabric on which acetate dope was brushed did not shrink so tightly but burned somewhat slower. A spark from the exhaust of an engine would not set fire to it if it landed on one of the wings; whereas, I have heard of nitrate doped finished wings of catching fire from a spark from the exhaust landing on it.

In those days, both nitrate and acetate dopes were clear. Later, of course, after acetate was discontinued nitrate dope was obtained in a great variety of colors. At Heath's everything that we turned out was colored silver. Usually it required five or six coats of dope applied with a brush in order to tighten and fill the fabric to a smooth finish. Light sanding was usually done after about the third, fourth and fifth coats. When the sixth coat was dry to a slight tacky feel a quantity of aluminum powder was dumped on the surface and spread by lightly brushing.

June 15, my graduation date, was fast approaching and I had not been assigned to the engine department. I had been mostly occupied in carving propellers. Under the tutelage of Al Meyer and Joe Szakacs I became I became rather adept at making a spruce wood propeller in diameters of four to five feet from glueing several boards together to the finished product. They were all laminated rather than cut from a solid block, mainly to reduce the tendency to warp. If the order specified a thickness, diameter and pitch I could

4 produce a propeller with a true screw pitch checking the blade angle at three inch intervals with a metal protractor. The blade angle on a true screw pitch is relatively shallow at the tip and increases to the verticle at the center of the hub. This is because the tip travels at a greater speed than the area around the center and is most efficient to secure an equal thrust at all points on the propeller blade. Consequently, the angle near the hub must be greater than that at the tip.

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It turned out that the occupants were an instructor and student of the Chicago Flying Club. On the turn to final approach for a landing the instructor had allowed the student to slow down too much so that in the turn an additional air speed was lost, the airplane stalled and subsequently fell into a spin. We helped them gather up the pieces and piled them near the tree with the rest of the wreck and proceeded home.