TAC ATTACK

SEPTEMBER 1972

for efficient tactical air power

TAC ATTACK

SEPTEMBER 1972

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COMMANDER

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ACKNOWLEDGEMENTS

In the course of putting together a special commemorative issue, one peeks into dusty, little-used archives, talks to many people, and scours many sources. Not all of the people and places can be listed because of space limitations, but I would like to acknowledge a few. First and foremost, I would like to give credit to those who had the foresight to establish the Air University Library at Maxwell Air Force Base. From the volumes on the third floor came the articles, "How We Made the First Flight," "Jet Journey," and several quotes from THE SCIENTIFIC AMERICAN and THE LITERARY DIGEST. A special thanks goes to Brigadier General (M/G selectee) C. A. Pattillo, TAC/Asst DCS/O, for the loan of his personal copy of "Down to Earth," a WWII fighter tactics manual, from which two of the stories in the WWII section were taken. From the July 1962 issue of AIR POWER HISTORIAN (now AEROSPACE HISTORIAN) facts from two articles, "Jet Aircraft of World War II," by Hugh Smith, and "Every Inch a Fighter," by Robert A. Hasskarl, Jr., were used to write "Dawning of the Jet Age." In addition, the AEROSPACE HISTORIAN granted permission to reprint "A War Diary" from the January 1957 issue of THE AIR POWER HISTORIAN. Also, I would like to thank the TAC Office of Information for providing the material necessary for the article entitled "History of the Air Force." And a final note of appreciation goes to the AAVS Library, Hq USAF for providing most of the photos which appear in this issue. Ed.

TACRP 127-1

HAPPY ANNIVERSARY

It's a pleasure to introduce the 25th Anniversary of the Air Force commemorative issue of TAC ATTACK. In this special issue, we have moved away from the total safety oriented format and instead have devoted the magazine to a look at some interesting aspects of aviation history.

In keeping with the history theme and at the same time inserting a word for safety, an item from the December 19, 1903, issue of SCIENTIFIC AMERICAN is worthy of note.

". . . the Langley Aerodrome was again launched over the Potomac River on December 8, with the result that it darted upward, described a circle, and plunged into the river, striking bottom and being afterward pulled with difficulty out of the mud, whence it came in a demolished condition. Mr. Manly, the operator, fortunately escaped with a wetting. The accident was laid to the failure of the launching apparatus to work properly; but as the reports state that the machine shot straight forward some yards before darting upward and turning a somersault, it would seem as if the launching apparatus was not so much at fault as that the operator was unable to control the aeroplanes, or, at any rate, to control them quickly enough to avoid disaster."

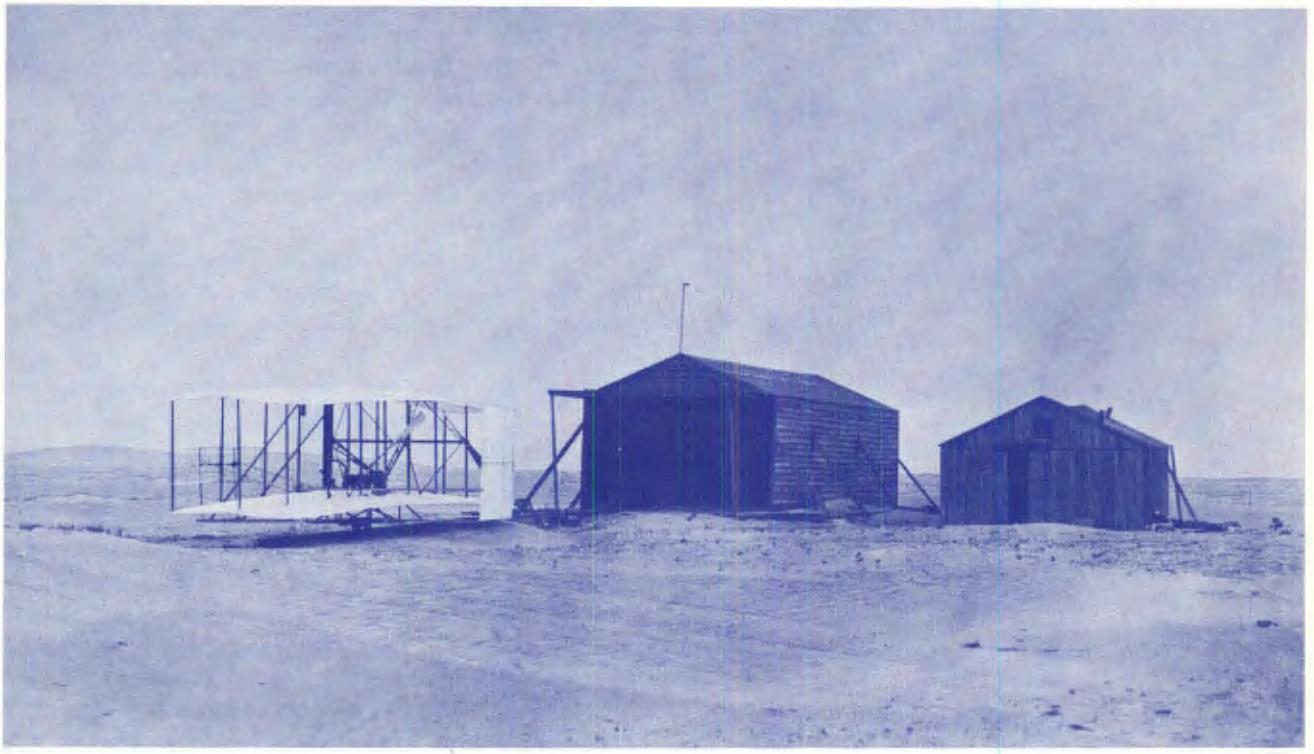
Although the Langley Aerodrome was not the first airplane to fly, these comments may reflect the first time that a reviewing authority overturned an "accident board's" findings. Observe that "materiel factor" was changed to "operator factor."

Safety and flying have been partners since the beginning of aviation. In keeping with that thought, we dedicate this issue to all Air Force men who have flown during these 25 years, to those who flew in the Corps before that, and to the aviation pioneers who made it all possible.

E. HILLDING, Colonel, USAF
Chief of Safety

how we made the first flight

The month was December; the year, 1903. The U.S. Congress was furiously debating the relative worth of a grandiose scheme that President Teddy Roosevelt was pushing, construction of the Panama Canal. On the other side of the Atlantic, Kaiser Bill was debating his European stronghold, and his neighbor to the East, Tsar Nicholas II of Russia, was debating the possibility of war with the impudent and quickly emerging nation, Japan. Around the world the motorcar was grinding and coughing its way into society, and on a windswept stretch of land in North Carolina, two brothers participated in an event that received little notoriety, yet was to change the world. The date was December 17, 1903, the event was man's first powered flight in a heavier than air machine, and the men were Orville and Wilbur Wright.



by ORVILLE WRIGHT

The flights of the 1902 glider had demonstrated the efficiency of our system of maintaining equilibrium, and also the accuracy of the laboratory work upon which the design of the glider was based. We then felt that we were prepared to calculate in advance the performance of machines with a degree of accuracy that had never been possible with the data and tables possessed by our predecessors. Before leaving camp in 1902, we were already at work on the general design of a new machine which we proposed to propel with a motor.

Immediately upon our return to Dayton, we wrote to a number of automobile and motor builders, stating the purpose for which we desired a motor, and asked whether they could furnish one that would develop eight-brake horsepower, with a weight complete not exceeding 200 pounds. Most of the companies answered that they were too busy with their regular business to undertake the building of such a motor for us; but one company replied that they had motors rated at

8 horsepower, according to the French system of ratings, which weighed only 135 pounds, and that if WE THOUGHT this motor would develop enough power for our purpose, they would be glad to sell us one. After an examination of the particulars of this motor, from which we learned that it had but a single cylinder of 4-inch bore and 5-inch stroke, we were afraid that it was much overrated. Unless the motor would develop a full 8-brake horsepower, it would be useless for our purpose.

Finally we decided to undertake the building of the motor ourselves. We estimated that we could make one of four cylinders with 4-inch bore and 4-inch stroke, weighing not over two hundred pounds, including all accessories. Our only experience up to that time in the building of gasoline motors had been in the construction of an air-cooled motor, 5-inch bore and 7-inch stroke, which was used to run the machinery of our small workshop. To be certain that four cylinders of the size we had adopted (4" x 4") would develop the necessary 8 horsepower, we first fitted them into a temporary frame of simple and cheap construction. In just six weeks from the time the design was started, we had the motor on the block testing its power. The ability to do this so quickly was largely due to the enthusiastic and efficient services of Mr. C. E. Taylor, who did all the machine work in our shop for the first as well as the succeeding experimental machines. There was no provision for lubricating either cylinders or bearings while this motor was running. For that reason it was not possible to run it more than a minute or two at a time. In these short tests, the motor developed about nine horsepower. We were then satisfied that, with proper lubrication and better adjustments, a little more power could be expected. The completion of the motor according to drawing was, therefore, proceeded with at once.

While Mr. Taylor was engaged with this work, Wilbur and I were busy in completing the design of the machine itself. The preliminary tests of the motor having convinced us that more than 8 horsepower would be secured, we felt free to add enough weight to build a more substantial machine than we had originally contemplated.

Our tables of air pressures and our experience in flying with the 1902 glider enabled us, we thought, to calculate exactly the thrust necessary to sustain the machine in flight. But to design a propeller that would give this thrust with the power we had at our command, was a matter we had not as yet seriously considered. No data on air propellers was available, but we had always understood that it was not a difficult matter to secure an efficiency of 50% with marine propellers. All that would be necessary would be to learn the theory of the operation of marine propellers from books on marine engineering and then substitute air pressures for water pressures. Accordingly, we secured several such books from the Dayton Public Library. Much to our surprise, all the formulae on propellers contained in these books were of an empirical nature. There was no way of adapting them to calculations of aerial propellers. As we could afford neither the time nor expense of a long series of experiments to find by trial a propeller suitable for our machine, we decided to rely more on theory than was the practice with marine engineers.

It was apparent that a propeller was simply an aeroplane traveling in a spiral course. As we could calculate the effect of an aeroplane traveling in a straight course, why should we not be able to calculate the effect of one traveling in a spiral course? At first glance this does not appear difficult, but on further consideration it is hard to find even a point from which to make a start; for nothing about a propeller, or the medium in which it acts, stands still for a moment. The thrust depends upon the speed and the angle at which the blade strikes the air; the angle at which the blade strikes the air depends upon the speed at which the propeller is turning, the speed the machine is traveling forward, and the speed at which the air is slipping backward; the slip of the air backwards depends upon the thrust exerted by the propeller, and the amount of air acted upon. When any one of these changes, it changes all the rest, as they are all interdependent upon one another. But these are only a few of the many factors that must be considered and determined in calculating and designing propellers. Our minds became so obsessed with it that we could do little other work. We engaged in innumerable discussions, and often after an hour or so of heated argument, we would discover that we were as far from agreement as when we started, but that both had changed to the other's original position in the discussion. After a couple of months of this study and discussion, we were able to follow the various reactions in their intricate relations long enough to begin to understand them. We realized that the thrust generated by a propeller when standing stationary was no indication of the thrust when in motion. The only way to really test the efficiency of a propeller would be to actually try it on the machine.

For two reasons, we decided to use two propellers. In the first place we could, by the use of two propellers, secure a reaction against a greater quantity of air, and at the same time use a larger pitch angle than was possible with one propeller; and in the second place by having the propellers turn in opposite directions, the gyroscopic action of one would neutralize that of the other. The method we adopted of driving the propellers in opposite directions by means of chains is now too well known to need description here. We decided to place

how we made the first flight

the motor to one side of the man, so that in case of a plunge headfirst, the motor could not fall upon him. In our gliding experiments we had had a number of experiences in which we had landed upon one wing, but the crushing of the wing had absorbed the shock, so that we were not uneasy about the motor in case of a landing of that kind. To provide against the machine rolling over forward in landing, we designed skids like sled runners, extending out in front of the main surfaces. Otherwise the general construction and operation of the machine was to be similar to that of the 1902 glider.

When the motor was completed and tested, we found that it would develop sixteen horsepower for a few seconds, but the power rapidly dropped till, at the end of a minute, it was only 12 horsepower. Ignorant of what a motor of this size ought to develop, we were greatly pleased with its performance. More experience showed us that we did not get one-half of the power we should have had.

With twelve horsepower at our command, we considered that we could permit the weight of the machine with operator to rise to 750 or 800 pounds, and still have as much surplus power as we had originally allowed for in the first estimate of 550 pounds.

Before leaving for our camp at Kitty Hawk, we tested the chain drive for the propellers in our shop at Dayton, and found it satisfactory. We found, however, that our first propeller shafts, which were constructed of heavy gauge steel tubing, were not strong enough to stand the shocks received from a gasoline motor with light fly wheel, although they would have been able to transmit three or four times the power uniformly applied. We therefore built a new set of shafts of heavier tubing, which we tested and found to be abundantly strong.

We left Dayton September 23 and arrived at our camp at Kill Devil Hill on Friday, the 25th. We found there provisions and tools, which had been shipped by freight several weeks in advance. The building, erected in 1901 and enlarged in 1902, was found to have been blown by a storm from its foundation posts a few months previously. While we were awaiting the arrival of the shipment of machinery and parts from Dayton, we were busy putting the old building in repair, and erecting a new building to serve as a workshop for assembling and housing the new machine.

Wilbur Wright in the Wright Glider at Kitty Hawk, North Carolina-1903.

Just as the building was being completed, the parts and material for the machines arrived simultaneously with one of the worst storms that had visited Kitty Hawk in years. The storm came on suddenly, blowing 30 to 40 miles an hour. It increased during the night, and the next day was blowing over seventy-five miles an hour. In order to save the tarpaper roof, we decided it would be necessary to get out in this wind and nail down more securely certain parts that were especially exposed. When I ascended the ladder and reached the edge of the roof, the wind caught under my large coat, blew it up around my head and bound my arms till I was perfectly helpless. Wilbur came to my assistance and held down my coat while I tried to drive the nails. But the wind was so strong I could not guide the hammer, and succeeded in striking my fingers as often as the nails.

The next three weeks were spent in setting the motor-machine togeth-

er. On days with more favorable winds, we gained additional experience in handling a flyer by gliding with the 1902 machine, which we had found in pretty fair condition in the old building, where we had left it the year before.

Mr. Chanute and Dr. Spratt, who had been guests in our camp in 1901 and 1902, spent some time with us, but neither one was able to remain to see the test of the motor-machine, on account of the delays caused by trouble which developed in the propeller shafts.

While Mr. Chanute was with us, a good deal of time was spent in discussion of the mathematical calculations upon which we had based our machine. He informed us that, in designing machinery, about 20 percent was usually allowed for the loss in the transmission of power. As we had allowed only 5 percent, a figure we had arrived at by some crude measurements of the friction of one of the chains when carrying only a very light load, we were much alarmed. More than the whole surplus in power allowed in our calculations would, according to Mr. Chanute's estimate, be consumed in friction in the driving chains. After Mr. Chanute's departure, we suspended one of the drive chains over a sprocket, hanging bags of sand on either side of the sprocket of a weight approximately equal to the pull that would be exerted on the chains when driving the propellers. By measuring the extra amount of weight needed on one side to lift the weight on the other, we calculated the loss in transmission. This indicated that the loss of power from this source would be only 5 percent, as we originally estimated. But while we could see no serious error in this method of determining the loss, we were very uneasy until we had a chance to run the propellers with the motor to see whether we could get the estimated number of turns.

The first run of the motor on the machine developed a flaw in one of the propeller shafts which had not been discovered in the test at Dayton. The shafts were sent at once to Dayton for repair and were not received again until November 20, having been gone two weeks. We immediately put them in the machine and made another test. A new trouble developed. The sprockets which were screwed on the shafts, and locked with nuts of opposite thread, persisted in coming loose. After many futile attempts to get them fast, we had to give it up and went to bed much discouraged. After a night's rest, we got up in better spirits and resolved to try again.

While in the bicycle business, we had become well acquainted with the use of hard tire cement for fastening tires on the rims. We had once used it successfully in repairing a stop watch after several watchsmiths had told us it could not be repaired. If tire cement was good for fastening the hands on a stop watch, why should it not be good for fastening the sprockets on the propeller shaft of a flying machine? We heated the shafts and sprockets, melted cement into the threads, and screwed them together again. This trouble was over. The sprockets stayed fast.

Just as the machine was ready for test, bad weather set in. It had been disagreeably cold for several weeks, so cold that we could scarcely work on the machine some days. But now we began to have rain and snow, and a wind of 25 to 30 miles blew for several days from the north. While we were being delayed by the weather, we arranged a mechanism to measure automatically the duration of a flight from the time the machine started to move forward to the time it stopped, the distance traveled through the air in that time, and the number of revolutions made by the motor and propeller. A stop watch took the time; an anemometer measured the air traveled through; and a counter took the number of revolutions made by the propellers. The watch, anemometer and revolution counter were all automatically started and stopped simultaneously. From data thus obtained, we expected to prove or disprove the accuracy of our propeller calculations.

On November 28, while giving the motor a run indoors, we thought we again saw something wrong with one of the propeller shafts. On stopping the motor, we discovered that one of the tubular shafts had cracked!

Immediate preparation was made for returning to Dayton to build another set of shafts. We decided to abandon the use of tubes, as they did not afford enough spring to take up the shocks of premature or missed explosions of the motor. Solid tool-steel shafts of smaller diameter than the tubes previously used were decided upon. These would allow a certain amount of spring. The tubular shafts were many times stronger than would have been necessary to transmit the power of our motor if the strains upon them had been uniform. But the large hollow shafts had no spring in them to absorb the unequal strains.

Wilbur remained in camp while I went to get the new shafts. I did not get back to camp again till Friday, the 11th of December. Saturday afternoon the machine was again ready for trial, but the wind was so light, a start could not have been made from level ground with the run of only sixty feet permitted by our monorail track. Nor was there enough time before dark to take the machine to one of the hills, where, by placing the track on a steep incline, sufficient speed could be secured for starting in calm air.

Monday, December 14, was a beautiful day, but there was not enough wind to enable a start to be made from the level ground about camp. We therefore decided to attempt a flight from the side of the big Kill Devil Hill. We had arranged with

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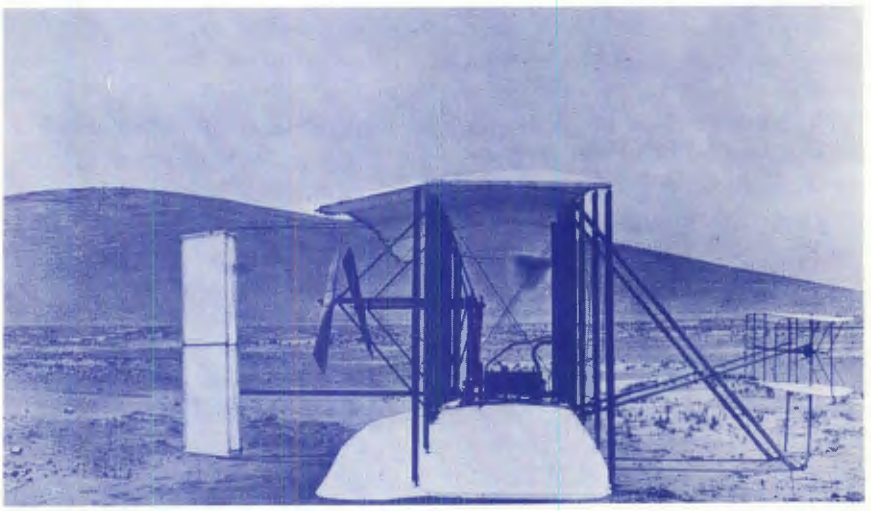
the members of the Kill Devil Life Saving Station, which was located a little over a mile from our camp, to inform them when we were ready to make the first trial of the machine. We were soon joined by J. T. Daniels, Robert Westcott, Thomas Beachem, W. S. Dough, and Uncle Benny O'Neal, of the Station, who helped us to get the machine to the hill, a quarter mile away. We laid the track 150 feet up the side of the hill on a 9-degree slope. With the slope of the track, the thrust of the propellers and the machine starting directly into the wind, we did not anticipate any trouble in getting up flying speed on the 60-foot monorail track. But we did not feel certain the operator could keep the machine balanced on the track.

When the machine had been fastened with a wire to the track, so that it could not start until released by the operator, and the motor had been run to make sure that it was in condition, we tossed up a coin to decide who should have the first trial. Wilbur won. I took a position at one of the wings, intending to help balance the machine as it ran down the track. But when the restraining wire was slipped, the machine started off so quickly I could stay with it only a few feet. After a 35 to 40-foot run, it lifted from the rail. But it was allowed to turn up too much. It climbed a few feet, stalled, and then settled to the ground near the foot of the hill, 105 feet below. My stop watch showed that it had been in the air just 3½ seconds. In landing the left wing touched first. The machine swung around, dug the skids into the sand and broke one of them. Several other parts were also broken, but the damage to the machine was not serious. While the test had shown nothing as to whether the power of the motor was sufficient to keep the machine up, since the landing was made many feet below the starting point, the experiment had demonstrated that the method adopted for launching the machine was a safe and practical one. On the whole, we were much pleased.

Two days were consumed in making repairs, and the machine was not ready again till late in the afternoon of the 16th. While we had it out on the track in front of the building, making the final adjustments, a stranger came along. After looking at the machine a few seconds, he inquired what it was. When we told him it was a flying machine, he asked whether we intended to fly it. We said we did, as soon as we had a suitable wind. He looked at it several minutes longer and then, wishing to be courteous, remarked that it looked as if it would fly, if it had a "suitable wind." We were much amused, for, no doubt, he had in mind the recent 75-mile gale when he repeated our words, "a suitable wind!"

During the night of December 16, 1903, a strong cold wind blew from the north. When we arose on the morning of the 17th, the puddles of water, which had been standing about camp since the recent rains, were covered with ice. The wind had a velocity of 10 to 12 meters per second (22 to 27 miles an hour). We thought it would die down before long, and so remained indoors the early part of the morning. But when ten o'clock arrived, and the wind was as brisk as ever, we decided that we had better get the machine out and attempt a flight. We hung out the signal for the men of the Life Saving Station. We thought that by facing the flyer into a strong wind, there ought to be no trouble in launching it from the level ground about camp. We realized the difficulties of flying in so high a wind, but estimated that the added dangers in flight would be partly compensated for by the slower speed in landing.



Side view of the original Wright Aeroplane-1903

We laid the track on a smooth stretch of ground about one hundred feet north of the new building. The biting cold wind made work difficult, and we had to warm up frequently in our living room, where we had a good fire in an improvised stove made of a large carbide can. By the time all was ready, J. T. Daniels, W. S. Dough and A. D. Etheridge, members of the Kill Devil Hill Life Saving Station; W. C. Brinkley, of Manteo, and Johnny Moore, a boy from Nags Head, had arrived.

We had a "Richard" hand anemometer with which we measured the velocity of the wind. Measurements made just before starting the first flight showed velocities of 11 to 12 meters per second, or 24 to 27 miles per hour. Measurements made just before the last flight gave between 9 to 10 miles per second. One made just after showed a little over 8 meters. The records of the Government Weather Bureau at Kitty Hawk gave the velocity of the wind between the hours of 10:30 and 12 o'clock, the time during which the four flights were made, as averaging 27 miles at the time of the first flight and 24 miles at the time of the last.

With all the knowledge and skill acquired in thousands of flights in the last ten years, I would hardly think today of making my first flight on a strange machine in a twenty-seven-mile wind, even if I knew that the machine had already been flown and was safe. After these years of experience, I look with amazement upon our audacity in attempting flights with a new and untried machine under such circumstances. Yet faith in our calculations and the design of this first machine, based upon our tables of air pressures, secured by months of careful laboratory work, and confidence in our system of control developed by three years of actual experience in balancing gliders in the air, had convinced us that the machine was capable of lifting and maintaining itself in the air, and that, with a little practice, it could be safely flown.

Wilbur having used his turn in the unsuccessful attempt on the 14th, the right to the first trial now belonged to me. After running the motor a few minutes to heat it up, I released the wire that held the machine to the track, and the machine started forward into the wind. Wilbur ran at the side of the machine, holding the wing to balance it on the track. Unlike the start on the 14th, made in a calm, the machine, facing a 27-mile wind, started very slowly. Wilbur was able to stay with it till it lifted from the track after a forty-foot run. One of the Life Saving men snapped the camera for us, taking a picture just as the machine had reached the end of the track and had risen to a height of about two feet. The slow forward speed of the machine over the ground is clearly shown in the picture by Wilbur's attitude. He stayed along beside the machine without any effort.

The course of the flight up and down was exceedingly erratic, partly due to the irregularity of the air, and partly to lack of experience in handling this machine. The control of the front rudder was difficult on account of its being balanced too near the center. This gave it a tendency to turn itself when started; so that it turned too far on one side and then too far on the other. As a result, the machine would rise suddenly to about ten feet, and then as suddenly dart for the ground. A sudden dart when a little over a hundred feet from the end of the track, or a little over 120 feet from the point at which it rose into the air, ended the flight. As the velocity of the wind was over 35 feet per second and the speed of the machine over the ground against this wind ten feet per second, the speed of the machine relative to the air was over 45 feet per second, and the length of the flight was equivalent to a flight of 540 feet made in calm air. This flight lasted only 12 seconds, but it was nevertheless the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in full flight, had sailed forward without reduction of speed, and had finally landed at a point as high as that from which it started.

Orville Wright

Wilbur Wright

This article was written by Orville Wright especially for and originally published in the December 1918 issue of FLYING Magazine, the title of which was later changed to AERIAL AGE. With the decline of American interest in aviation following World War I, AERIAL AGE finally succumbed to this disinterest and ceased publication in 1923.

WORLD WAR 1 AND BEYOND

In 1907 the Army issued specifications to the Wright brothers for a military airplane. With that act, the United States became the first nation in the world to recognize the military value of airplanes. However, the U.S. quickly fell behind other nations in the development of military aircraft and at the outbreak of war in Europe in 1914 we were woefully lagging. From the beginning of the war until America's entry in 1917, rapid advancements were being made by all adversaries in airplane design, construction, reliability, and performance. These advancements were the result of a quickly emerging view that the airplane was a formidable weapon rather than just a reconnaissance platform, and that control of the air was becoming increasingly advantageous to the outcome of the battle.

Military aviation visionaries in this country were loudly proclaiming the necessity of military aircraft to a deaf audience before the beginning of World War I and, with the outbreak of the war, their shouts became intensified. Typical of their statements of the day was one that appeared in the November 21, 1914 issue of THE LITERARY DIGEST: "Aircraft is not only the most modern of weapons, but . . . is the most necessary weapon for America to have and improve, and the sooner America understands this little fact, and acts upon it, the better it will be for the protection of the American people in the future." Still only meager aviation advances were made in this country and when the United States entered the war on April 6, 1917, we possessed less than 250 aircraft and just over 100 pilots.

While no American designed aircraft fought in World War I, American pilots, flying French Spads, Nieuports, British DH-4s, and other aircraft, began a chapter in aviation history that will live in the hearts of American people for all time. Names such as Rickenbacker, Luke, Billy Mitchell, and many more blazed across newspaper headlines. By the end of the war, American pilots had destroyed 926 enemy airplanes while losing only 265.

Although American engineering produced no war planes, some 5000 British DH-4s were mass produced in this country, powered by our most significant technical contribution to the war effort, the twelve cylinder Liberty engine.

When the war ended, there were 740 American built airplanes at the front, in addition to a number of Curtiss Jennys (used as training planes) in the states. With the decay of interest in aviation in this country following the war to end wars (the philosophy that prevailed), most of these airplances were sold to individuals at a fraction of their original cost. In the time that followed, mail carrier pilots and barnstormers carried aviation's banner. Lindbergh's historic flight in 1927 boosted aviation interest and progress in this country, and in the next few years advancements occurred in sporatic spurts.

While many aviation achievements were being recorded, military aircraft progress and strength suffered until a series of small wars in the thirties waged by the Japanese in China, the Spanish in their own country (using German airplanes and tactics), and Italians in Ethiopia aptly demonstrated the vital use of air power. To those holding the reins of power in this country, the military necessity of air power became slowly obvious and, finally, late in 1938 an expansion of the U. S. Air Corps began . . . but as with the first World War, this country was relatively weak in air power at the onset of World War II.

• • •

Within days after Hitler effectively closed his back door by negotiating a non-aggression treaty with the Soviet Union, he began the lightning invasion of Poland. The date was September 1, 1939. England and France, honoring their treaties with Poland, declared war on Germany. Russia invaded Poland and two months later attacked Finland, and the race was on. It was to be two years before the United States would officially enter World War II. On December 7, 1941, Japan launched its brand of the Blitzkrieg against Pearl Harbor. The next day the U.S. declared war on Japan. Because of the mutual protection pacts signed by Germany, Italy and Japan, both Germany and Italy declared war on the United States. On December 11, the U.S. officially returned the gesture and in a period of four days plunged from an uneasy peace into war on both sides of the globe.

Two articles have been chosen in order to capture the mood of the pilots and aircrewmen who fought in both global arenas during World War II. The first article is a war diary of a pilot who was caught up in America's unpreparedness for war in the Pacific. It was copyrighted in the January 1957 issue of THE AIR POWER HISTORIAN and reprinted with permission of this excellent periodical which now bears the title, THE AEROSPACE HISTORIAN. The article points out the frustrations experienced by our combat airmen who were

engaging in a valiant struggle from an early inferior position of air strength.

Next comes a series of two related articles taken from a World War II fighter tactics manual published by the 8th Fighter Command on 30 August 1944. In these articles you'll notice the mood has changed; it's now scented with the smell of victory that has come from vigorous pursuit of the German enemy into his own homeland. It's also indicative of the successes being scored not only in the European theatre, but also in the Pacific theatre of combat.

WORLD WAR 2 "a war diary"

By LIEUTENANT ROLAND R. BIRNN

Lt. Birnn recorded in diary form some of his impressions of the hectic activities, and frustrations endured, following the Japanese attack on the Philippines in December of 1941, and during the improvisation period in northern Australia in early 1942.

14 February 1942

Brisbane

Got to Charleville, gassed up and took off. Engine started missing, — Cut the throttle and landed. Had no brakes, — almost went through a fence. Engine was using excess oil and fouled up plugs. Wrong type plugs anyway. Am left behind.

20 February 1942

Charleville, Australia

Seventeenth Squadron arrived yesterday. Am going North with them today. Next stop, Cloncurry.

Arrived Cloncurry after flying over the worst country I've ever seen, — all desert with no check points. Lost two planes on the way up. Dengue fever is bad here — Hope I don't catch it.

21 February 1942

Daily Waters

Arrived here today. More desert but worse. Think we'll stay here a while, — they're having daily bombing raids at Darwin. Three days ago they almost wiped out Darwin with heavy raids — 50 bombers at a time. They caught B-24s, P-40s and Hudsons on the ground. They know how to shoot down B-17s, — make frontal attacks.

22 February 1942

Daily Waters

This place is really a hole. Hasn't rained in months and the ground is baked. I'm sleeping on it. The temperature is always above 100°. The flies are horrible, — they don't bite, just cover you and crawl. Have to wear a face net, — but can't put that over my food. No messing facilities, — food is bad. These Aussies just don't know how to eat, — no vegetables, no eggs, no taste.

We're losing our A-24s fast. Of the original 53 we now have only 22 that are flyable, — and this before we've had a day of combat.

24 February 1942

Daily Waters

Got a report the 91st Squadron

a war diary

(dive bombers) went out from Java and sank five ships — good score, lost two planes. Other bombers sank lots more.

C.O. of our Squadron went to India to take charge of light bombardment. Wish I could have gone. We're doing no good sitting here without planes. Heard they have some B-25s in Melbourne.

3 March 1942

Bachelor, Australia

Was flown here in an O-47A today. Living here a little better than what we left. Still would take a lot of improvement to make it good.

Here's a laugh. Headquarters at Darwin sent all A-24s out on a patrol mission. If they had met any Zeros, which were all around the place, a slow underarmed ship like the A-24 wouldn't have had a chance.

6 March 1942

Bachelor

We were ordered out of Bachelor, — feared a Jap raid. Went South to Katherine. We are being rationed with 808th Engineers. First good food we've had for weeks. Same rations as the Australians, —but it's prepared for eating.

Have a nice clear river nearby that we spend all day in, — nothing else to do, — we have no planes.

9 March 1942

Katherine

Left Katherine this morning. Arrived Bachelor and then told to go to Daily Waters. Wish they could make up their minds, — trouble is we get orders from three different sources.

10 March 1942

Daily Waters

Have a water famine here, — food just as bad. Our A24 s are going out fast, — now only 11 out of 53 fit for combat. Only one-half of a Squadron ever got in combat. Wish they'd do something with us, — we can't win a war sitting in Daily Waters.

Our morale is really shot, — we're losing interest in everything. With three times as many pilots as planes, and those planes not good for combat, it's hard to keep our interest up.

Colonel Davies and four others went South to get some more dive bombers, — they're no good. Why don't they send us some planes we can fight with?

Heard the 3rd Group is in Australia with new planes. They always got the breaks. And to think I used to belong to that group, — sure wish I were still with them. Here in the 27th, with 80% of our pilots qualified to fly fast bi-motored planes, we're assigned this antiquated trainer. Been in Zone of Combat since war declared and haven't flown a combat mission yet.

14 March 1942

Daily Waters

Still at Daily Waters. A B-17 just came over and crashed, — it had three engines out. Crew were lucky to get out alive, — not much of the ship was left for salvage.

Yesterday three B-17s flew up from Melbourne. All three flew over the field but couldn't see it. Two got back to Melbourne, one made an emergency landing. They were told that Daily Waters is on a railroad, — nearest one is 90 miles. Wonder anyone gets anywhere with the maps and information they furnish here.

17 March 1942

Daily Waters

Twenty P-40s came through today, — started out with 27. One of the pilots, just out of flying school, rolled his P-40 just over the field and into the ground. Just doesn't pay to get hot. We are ordered back to Bachelor. Wish one of these orders would sometime have a meaning.

18 March 1942

Bachelor

Only 16 of those 27 P-40 s left. General MacArthur came through the other day, — didn't stop at Darwin as the papers said. Said he would never fly again in one of those noisy B-17s.

20 March 1942

Townsville

Arrived at Townsville via Cloncurry. My plane is in really bad shape. Every time I take off I don't think I'll make it, — but it's better than staying behind. Only 11 of our planes are still flying. Nice field here, — paved runways, and camouflaged.

The 3rd Bomb Group is here. A good setup. They don't have any ships so they can work on ours. Soon as my plane stopped rolling 10 mechanics started working on it. They were really eager. They hadn't seen a plane for three months and sure wanted to work.

So far I've had 3 planes. All the motors went out in less than 70 hours on each. Something wrong when new motors go out for excessive oil consumption.

Hope we get assigned to the 3rd Group. They have only 9 pilots per group, of which only 5 are experienced. We're a group of experienced bi-motored pilots flying advanced trainers that some crackpot figures can be used in combat. Would sure like to have him here.

28 March 1942

Charters Towers

Am assigned to the 3rd Group, — makes me happy. A bunch of pilots just went south to get some B-25s.

31 March 1942

Charters Towers

Just got checked out in B-25. Good plane but A-20A flies better. Am in the 90th Squadron, — a good

North American B-25

outfit with a bunch of old friends.

A-24s went North today, — hope they do some good.

Our B-25s really belong to the Dutch. They bought them and are as mad as hornets: — but we're better equipped to fly them; — and I guess that's war.

Some of our big shots must be going nuts. A certain staff colonel had an order cut making the 3rd Group an Infantry unit because we had no planes. It was our luck that the order was cancelled, and he was removed. His mind must have got a little foggy.

The staff in various headquarters work from 8:30 to 4:30 and then complain about the heavy work they have to do. In spite of them I hope we win the war. There are some good men in the staff, — they do all the work.

Just got ordered south to Brisbane to get a B-25. We now have the B-25, A-20, and A-24 in the group. Quite an assortment of planes.

3 April 1942

Brisbane

Arrived here today but no B-25. Sat opposite a staff major at luncheon today, — made me a little sick with his talk. He kept complaining about the food and service, which, to me, was really good. Found he had never been farther north than Brisbane. Wish he could have been with us and eaten the slop we had to. I'll never complain about food anymore if I ever get out of the Northern Territory, — and I'll forget that experience just as soon as I can.

Funny thing about food, when it's bad you never hear men talk about women, — just the steak and ice cream they're going to consume when they get to where that type of food is being served. Women seem to rank a poor second to food as man's first love.

11 April 1942

Brisbane

Got orders to get back to Charters Towers, — big mission coming off. The mission is up to Philippines, — hope I get to go.

12 April 1942

Charters Towers

Taking off tonight for Mindanao to run bombing raids from there on Japs in Northern Philippines.

Took off but never did get assembled, — black as pitch. We straggled into Darwin from dawn to about two hours later. Some of the pilots found themselves flying out to sea when dawn broke. No reliable maps to navigate by and no landing aids at Darwin.

We're gassing up to take right off, but I'm not going, — lost one of my tires in landing here. Hope replacement gets here in time for me to take off tomorrow with the others that are being left behind. The next leg will be a 1600 mile trip over water and Jap bases. Too bad if Del Monte, Mindanao, is closed in when planes arrive, — they'll have no alternative field that they can get to.

13 April 1942

Darwin

No tire yet. Schmidt and I are getting disgusted, — spare tires should have been here before we arrived. We just operate without any timely planning, — and that's not good. Got a bunch of good P-40 pilots here, — all just out of school but they're packing up experience. The other day they caught 7 Jap bombers and shot them all down, — good going.

This field is suffering from alert jitters, — anything brings on an alarm.

a war diary

One of our own planes, an Australian Whirraway, easily recognized, flew over the field and brought on a full-scale air alert. Perhaps I'll be jittery too if I stay here much longer. But right now it's really funny to see them run for cover when the alert signal goes off. I run, too, but I'm not jittery yet.

Morale and spirit are low here. Their only concern is about getting out. They don't seem to have any interest in improving their food and living conditions, and they're both bad. While they have to live here they should do a little to make things better. Believe it would give a healthier outlook on life.

14 April 1942

Darwin

Too late now to go on the P.I. mission. The ship bringing our tire is missing. Patched up my own and ran a search for the missing plane, – found it out of gas, in the only open field in that part of the country. They were lucky boys (Petrie and Hall).

The group got back from P.I. this afternoon without losing a ship. They got shot up a bit, but the small bullets the Japs use won't go through the gas tanks, – 25 caliber. They pulled a lot of raids which didn't do much damage, – need more practice.

Each ship came back loaded with pilots. Even though the bombing missions may not have been too successful, bringing out these pilots made the operation worth it. They brought out about 33 officers and men, – not a very big salvage from the 1500 that were in the 27th Bombardment Group.

19 April 1942

Charters Towers

Returned here yesterday. Was alerted at 1:00 A.M. to fly to New Guinea to fly a recon mission. Gassed at Port Moresby and took off at 9:00 A.M. to reconnoiter the N.E. coast of New Guinea.

Saw lots of beautiful islands with native buildings and white beaches, – just like you see in the movies. Couldn't go back to Moresby until after 3:00 P.M. as the Japs raid the field almost daily.

Landed at Moresby, gassed, and took off for Townsville. Lucky to get in at Townsville, – all other fields were closed and it was after dark. Townsville just happened to be open. Tired of riding my luck. Had 17 hours of almost continuous flying, – less time out for gassing.

20 April 1942

Townsville

Headed back for Moresby today. Arrived and spent the night under the wing of my plane.

Took off at dawn to patrol. They briefed me that there were no mountains in New Guinea higher than 14,000 feet. I flew by one with my altimeter reading 16,500. New Guinea is just a mass of mountains, – 90% of the country is wild. Lots of gold and lots of mining camps, – some above 13,000 feet.

Covered the N.W. corner of New Britain, then New Hanover and part of New Ireland. Saw two large Jap transports in the Harbor. Flew around them but got no A.A. fire. Went across the channel to Kavieng. Saw nothing at the airport but some Jap activity in town.

On the way home flew over Solomons and took pictures. Then turned out to sea and flew over Lae, which was heavily infested with Japs. Just as we got over the field I saw five Zeros climbing up to meet us, – never seen airplanes climb so steeply. Some nearby clouds offered me some cover and I got into them as fast as I could. No fun being caught out alone by Zeros.

Pictures turned out O.K. We saw 21 Jap planes on the field.

After gassing at Moresby we returned to Townsville with an overall flying time of 27 hours out of 60. Moresby was considered too dangerous to remain overnight.

22 April 1942

Townsville

Returned to Moresby. Took off the next morning to patrol the Rabaul area. This is the strongest Jap base in this part of the world, – located on the N.E. corner of New Britain. B-26's bombed the docks just before we arrived, – which helped to warm things up for us.

As we approached we saw 3 B-26s pass under us being chased by 4 Zeros. There were plenty of clouds so we were not seen. A few minutes later we saw more Zeros, but gave them the slip in the clouds. We covered the Rabaul-New Ireland area always taking advantage of clouds. We picked up three transports off Rabaul Harbor, took pictures from low altitude of York Island, just off the mouth of the harbor. On our last trip over we got some A.A. fire which put a small hole in our tail and then saw a Zero closing in.

We took to the clouds and headed for home. While passing over the St. George's Channel we picked up a surfaced submarine. We strafed it and it immediately disappeared beneath the surface. Hope we sank it or, at least did some major damage. Had a lot of fun this day.

24 April 1942

Charters Towers

Came in here today, – could do with a little rest. We've lost 3 B-25s to weather. Moresby closed in and they had to land in open water.

29 April 1942

Charters Towers

Headed back to Moresby to recon again. Covered the South Coast of New Guinea on the way. Saw a flare just off Amazon Island, – investigated and saw three men in a small boat. Buzzed them and dropped a note that

I had their location and would report. They could be the crew of one of the ships we had lost to bad weather. Three of them, all inexperienced had been forced down by bad weather while en route to Moresby. It's a wonder that we don't lose more. We're always fighting weather, without much of a weather service to help us.

30 April 1942

Port Moresby

Another patrol. Flew to Buna Bay, to Woodlark Island, to Bougainville, to New Britain — then back to Buna Bay. While over Buna Bay was hopped by 5 Zeros. Didn't have enough gas to dive down to sea level and head for the open sea, as I had to cross over mountains. So started climbing at full throttle; leveled off at 12,000 feet. On the way up we shot down two Zeros, — one each by the upper and lower gunners. The bombardier got a broadside on a Zero with his 30 caliber and it moved out and didn't attack again.

When I reached some clouds I went straight into them. There were supposed to be mountains in them, but I had to get away. The Zeros did not follow us in.

Really funny how one reacts to an attack. I would look out and see a Zero start his pass, his tracers were streaming in front of my face; he continued the attack until you could see his face, — yet it never occurred to me that I could be hit. I did, however, get a delayed reaction after it was over. I think it was a miracle that they didn't shoot us down. No fun being caught alone by a flight of Zeros.

I returned to Charters Towers the next day for repairs. Almost got caught by the Japs at Port Moresby, — took off 5 minutes ahead of a raid.

4 May 1942

Port Moresby

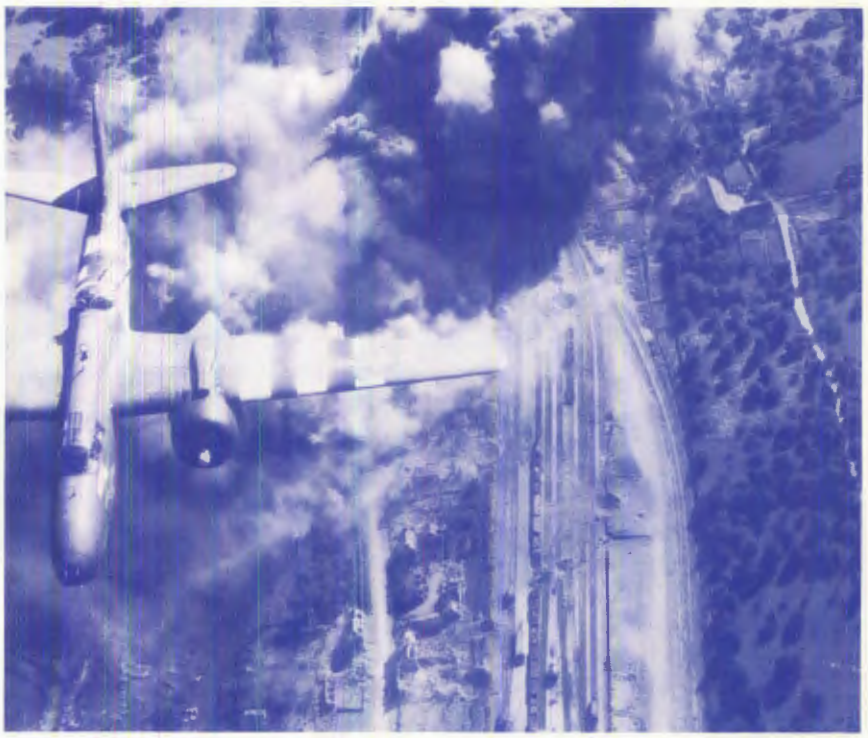
Back at Moresby, — arrived at dark yesterday. Took off at 6:30 A.M., had to stay out until 2:30 P.M., — makes a gruelling flight. Covered Lae, then New Britain, then Bougainville. Didn't see a check point for 3:45 hours. Then I mistook a large Jap carrier and 2 heavy cruisers for islands. Went in to investigate. They spotted me and started to zig and zag. At the same time Zeros began taking off from the carrier, so I headed away at full throttle. A little later I picked up two subs and one sub tender. I couldn't stop to strafe and expose us to the Zeros which couldn't be too far away.

At the New Guinea coast I ran into a front which I couldn't fly over, and which was so rough that I couldn't fly through. By heading northwest toward Lae I finally found a hole which let me fly across the mountains, partially on instruments at 16,500, and then land at Moresby during an alert. It was quite a day.

I, myself, had caused an alert a few days before when the 5 Zeros hopped me. Some town in the mountains had reported that one bomber escorted by five Zeros was headed for Moresby. I was in the bomber but the Zeros were not giving me friendly escort. They shot us full of cannon holes.

The carrier we saw today was later destroyed in the Battle of the Coral Sea.

Have now flown for seven straight days with an average of over seven hours a day.



Douglas A-20

Lt. Roland R. Birnn, a young Army Air Corps Lieutenant, was killed on 4 July 1942, while test flying an A-20.

FROM THE ZENITH TO THE DECK

The first priority job of our fighter groups is escort of the Fortress and Liberator heavy bombers. It is long range, five . . . six . . . seven . . . hour stuff, to Berlin and back, to Poland and back, to Russia, and all of it at high altitude. Yet on August 12th, at the height of the Battle of France, these same groups flew 46 missions comprising 1326 sorties on the greatest GROUND attack on record. Blanketing German supply lines North and Northeast of Paris, our pilots bombed, burned, riddled with fifty calibre API 2616 railroad cars, 359 locomotives, 112 ammunition cars, 464 trucks, 362 oil cars, 9 oil tanks, 9 oil barges, 306 vehicles, 15 bridges, 7 roundhouses, 13 buildings, 4 water towers, 19 aircraft, and many other targets. IT WAS A BIG DAY BUT NOT UNIQUE. On the 13th, it was duplicated, and since the first part of March of this year the 8th Fighter Command has in this striking manner been burning the enemy's deck.

The privilege of ground attack by fighters, if an operation so difficult can be called a privilege, must be won in the air by defeat of the enemy's air forces. This defeat in a long series of culminating battles in which this Command played a decisive part has been described in "The Long Reach" and is already a part of the rapidly unfolding history of our Air Forces. Immediately our fighters pursued the grounded Luftwaffe to its airdromes and there crippled it beyond hope of significant recovery. Not only were our bomber missions freed from more than sporadic attack by this victory but the enemy's entire transportation system was forced to depend for its defense upon flak and m/g fire from the ground. Severe as this has been and despite the losses we have suffered from it, this defense has never been enough to deter our fighters in their determined attack. Enemy locomotives, freight trains, troop trains, truck convoys, barges, oil tanks, ammunition dumps, coastal vessels, power houses, bridges, staff cars, and communications have been victim of a hitherto unimaginable and unparalleled fighter ground assault across the entire face of Western Europe. To the Command's achievement of 4009 enemy aircraft destroyed, 283 probably destroyed, and 1339 damaged can now be added the destruction and serious damaging of rail and road transport by the thousands of locomotives, railroad cars and trucks on such a fantastic scale that to put it into figures fails to paint the picture. The real meaning is that from long before D-Day and through it to the present, German supply and reinforcement has been destroyed or impeded to a point incompatible with the support of modern armies. Since the beginning of this war the profit and loss on the proposition of fighter aircraft attacking ground targets has been the subject of professional debate and pilot discussion. Small profit to shoot up two or three trucks or a couple of machine guns for the loss of a valuable aircraft and pilot. Worse still when two . . . three . . . four go down over one well dispersed enemy A/D or, as on the days of our large scale attacks by the whole Command, 25 or more may be MIA. In addition to the loss of these planes and pilots is the unfortunate fact that our best, our outstanding leaders and fighters who had yet to meet their match in any enemy they could see, have gone down before the hidden gunfire or light flak incident to a ground attack. Duncan, Beeson, Beckham, Gerald Johnson, Gabreski, Juchheim, Andrew, Hofer, Goodson, Schreiber, Millikan, Carpenter . . . the list could go on. For equal numbers engaged four times as many pilots of this Command are lost on ground attack as in aerial combat. Light flak will ring an A/D, or an M/Y. Flak cars will open up in the middle of a train. A truck convoy, with sufficient warning, may be a hornet's nest. Every target of special value to the enemy will be heavily defended and may exact its price.

Where then is the profit? The answer is the successful invasion and the victorious Battle of France. The answer is our flight of many a heavy bomber mission without challenge by enemy fighters, and the presence of our hordes of bombers and fighter-bombers over our troops in Normandy. The roads of France, strewn with enemy wreckage, reply, and an enemy starving for oil, ammunition, supplies, reinforcement could answer with deep feeling. The loss of every single one of our pilots is an individual and personal loss to us but the harsh voice of War says clearly that had the entire 8th Fighter

by Brig Gen Francis H. Griswold
Commander, 8th Fighter
Command, August 1944

Command been wiped out in the course of its tremendous ground attack, the cost would have been well spent towards the purchase of mankind's victory.

In an all out war such as this, a successful air operation must pay the most and must cost the least. With fighter ground attack as with other operations, experience has taught many lessons leading to this desirable end. It is hoped that this bitterly gained experience may not be the only possible teacher and that the recording of it in such publications as this, added to the instruction by those who have been through it, will point the way for replacements and new groups in this and other theatres, for pilots in training, and for those pilots and leaders of experience who have yet to encounter this special type of fighter duty.

The preceding article was Brig. Gen. Griswold's opening comments in the DOWN TO EARTH tactics manual published by the 8th Fighter Command during WW II. The manual was made up from the inputs submitted by the experienced pilots of the command. The next article is just one of the pilot responses and is representative of those included in that publication.

ATTACKING GROUND TARGETS

by Col Avelin P. Tacon, Jr.
359th Fighter Group
(1944)

This letter is the compilation of the ideas and methods of several of the more experienced pilots in the Group on attacking ground targets. Also attached are narratives of several of our noteworthy attacks.

Operations against ground targets can be divided into two main types, strafing and bombing. Each of these can be further sub divided into assigned targets and targets of opportunity. Our best results by far have been against targets of opportunity.

In attacking an assigned target by strafing, approximately 90 percent of the success of the mission depends on planning. The first and most important thing is to know the target. Study all available photos, closely examine maps for roads, railroads, contour lines, and also get all the dope you can on the light flak. The latter is hard to do as there is very little accurate up to the minute information available. Lack of this type of information cost us heavily one day. We were ordered to skip bomb a bridge east of Paris. All the available information we had and that Wing had showed no flak in the area, yet when the first flight of four attacked the bridge two were shot down and one sustained battle

Lockheed P-38

attacking ground targets

damage. Had we known the flak situation then we would have dive bombed.

In briefing for strafing attacks each flight is given an axis of attack, the striking squadron is assigned an initial point, and a group assembly point is designated. In addition, each individual pilot is given a path across the airdrome and the targets, hangars, dispersals, fuel dumps, etc. We usually plan on having flights attack in waves on approximately the same line of attack. Medium and top cover squadrons orbit just out of range of the target at roughly 4000 and 8000 feet. After each flight has made its pass it goes to the rally point and climbs back to altitude under the top cover squadron. This works pretty well as we've never been bounced doing this sort of mission.

Knowing the position of each individual gun would help. It would, as a rule, not make much difference in planning an attack but it is possible that there might be a time when a hill or ravine might blank a known gun position. By taking advantage of this it might save a pilot and an aircraft. As mentioned before, we haven't had much luck against assigned targets, especially airdromes. This is perhaps due to the rapidity with which the enemy moves his aircraft from one field to another.

Targets of opportunity fall into two categories — those you find in assigned areas and those you spot returning from escort missions. On the former we brief on the area in general. The topography is covered, main roads and railroads, marshalling yards, etc. We do not like to comb an area right on the deck. We feel this system has two disadvantages. First, when you do run into a target you're past it before you can identify it and draw a bead. This means that you've got to circle back to attack it and thus you lose the element of surprise as well as speed. Secondly, you're being fired at constantly, particularly in Western France. Our method is to fly as a group with the low squadron, which is the initial striking force, flying about 4000 feet, medium squadron about 5000, and top cover about 8000. From 4000 feet the low squadron can spot their targets, dive and attack with speed, which is like money in the bank. By flying at 4000 feet if you are fired on by light flak it isn't very accurate and if it should become accurate you can dive, pick up speed, and get the hell out of there. When the low squadron attacks the other two orbit and cover it. We rotate the squadron if the expenditure of ammunition warrants it. When attacking targets whose defense is unknown the lead flight goes in first while the others in the squadron hold back. We don't like to commit a whole squadron until we know what we're up against.

In strafing targets of opportunity returning from escort missions the formation leader has to plan his attack as he circles the target. Every advantage must be taken of sun, cloud cover, terrain, and speed. It is usually impossible to achieve surprise on a target of this type so we like speed, around 450 on the clock. It isn't too easy to hit an aircraft going that fast. There is one point we insist on and that is that the flight leader must use good judgment and consider the results he expects to gain commensurate with the expected losses. This is particularly true of airdromes in Western France. Those things are poison. As a rule of thumb on airdromes in that area we estimate a loss of one out of every four pilots attacking. Seems high? Check the casualties on attacking those airdromes. As an example, we had two flights attack an airdrome down there one day, Rhiems-Champagne I believe it was. The eight ships that attacked lost three pilots, all old experienced boys, in fact two were the flight leaders, and another ship just got back to England. On the other side of the ledger, they destroyed the only ship on the

'The incomparable North American P-51 Mustang'

airdrome, an old beat up Me-110. Hardly worth-while. In Germany our favorite targets are those little grass auxiliary airdromes that are scattered about. They're usually either undefended at all or very lightly and have from 10 to 15 single engine fighters on them. However, we attacked one of these one day with FW 190s on it and the dirty Hun had drained all the gasoline from the ships. Although they were pretty well hit they just wouldn't burn. It was an auxiliary field to an air park and evidently the ships were non-operational awaiting ferry pilots. Later we corroborated this practice of Jerry's of draining the gasoline from ships in a British Intelligence Summary. The Hun is pretty tricky.

The Hun doesn't hesitate to hide his trucks in woods, park his convoys in the shadows of trees, and run his trains into tunnels.

On the mechanics of strafing there are as many opinions as there are pilots. Some believe in surprise at the sacrifice of speed. This is accomplished by getting down to daisy top level several miles from the target and following a road or other landmark into the target. These boys like to avoid all villages and pop over the trees, shoot up the target and get the hell away on the deck, reforming and regaining altitude some five or ten miles away. The other school of thought likes to come around the target at about 4000 feet, look it over, and then dive in with around 450 on the clock, shoot up the target, stay low, and get away, reforming away from the target. Both systems have their advantages and disadvantages. Inasmuch as it's his own neck we let the pilots do it the way they prefer. One thing that everyone agrees on is the absolute necessity of aimed fire as opposed to "hosing" the area.

In attacking airdromes we usually do it by four ships abreast, each weaving and firing individually. If a pilot doesn't have a target ahead of him we don't like to see him turn and go for one on the other side of the airdrome as it usually interferes with another pilot. When intense flak is encountered we've found that the closer you are to the ground the better off you are.

We try to open fire at a normal range, 300 to 400 yards, and hold it as long as possible. The exception to this is in attacking trucks and railroad cars that might contain ammunition. The boys like to feel them out from about 1000 to 1500 yards. We've lost pilots who blew up ammunition trains from close range and were hit by the resultant blast.

As for bombing, we much prefer dive bombing. Skip bombing is something we are not at all enthusiastic about. Probably because we can't hit a damn thing that way. The only thing we consider a skip bomb target is a tunnel mouth. All of the bridges we have skip bombed have had low river banks and our bombs have just tumbled cross-country for about a mile before exploding.

Dive bombing is something else. We've gotten pretty accurate with dive bombing since we've had the Mustangs. By starting our dive from about 8000 feet and releasing about 4000 feet we can get pretty good results. Particularly on bridge approaches and marshalling yards. Flak doesn't bother us much dive bombing as we have plenty of speed. We like to dive bomb individually if there isn't any heavy flak bothering us.

Our experience has been that our 500 lb G.P. bomb is a little too light for use against the bridges we have been attacking.

I don't believe that the formation of special ground attack units in our Fighter Command at this time would be justified. If they were formed, I believe that the equipment they needed, maybe A-20s equipped for R.P., would preclude their use as escort groups.

As regards the pilot's point of view on attacking ground targets, I think they all realize the importance of it since the invasion. They have seen the vast amount of equipment that has been prevented from reaching the front in Normandy and also the complete tie up of all road and rail transportation for the Hun. As to the danger — everyone agrees that in strafing you're bound to get it in the end if you do enough of it but that by being smart and taking every advantage you can prolong it somewhat.

DAWNING OF THE JET AGE

To many the beginning of the jet age is etched in the skies over Korea lost somewhere in the contrails of F-80s, F-86s, and MiG-15s. While it's true that the first jet-to-jet encounters occurred during the Korean War, we have to back track a few years to find the real beginning.

The first patent for a jet engine was awarded to an Englishman, Frank Whittle, in 1930. However, England was not the first nation to fly a jet aircraft; that distinction belongs to Germany who flew a jet powered He-178 on August 27, 1939. The information concerning Germany's development of the first jet aircraft did not surface until after the end of World War II. Until that time, Italy was credited with making the first jet flight in the Caproni-Campini aircraft on August 27, 1940.

CAMPRONI-CAMPINI JET AIRCRAFT

With the motivation of world conquest pushing, the Germans made rapid technological advancements. By 1941 the Me-163 aircraft was successful in exceeding 600 miles per hour. Although the Me-163 could have been a highly successful weapon, the German command didn't seem to know what to do with it and constant bickering between manufacturers doomed the airplane while it was still in production.

ME-163, A ROCKET POWERED AIRPLANE

A jet airplane which finally did reach operational status in Germany, the ME-262, was first tested in 1942. Fortunately for the Allies, constant bickering between German aircraft manufacturers coupled with indecision in the German high command delayed the production of this aircraft. At first Air Marshall Goering said the ME-262 should be a fighter, then he changed his mind in favor of a bomber. Hitler said it would be a medium bomber. Finally the airplane was put into mass production and began to appear in the skies over Germany in 1944. Even though the airplane had higher performance than any airplane the Allies possessed, it was too little and too late.

ME-262-INDECISION IN THE GERMAN HIGH COMMAND HELD UP PRODUCTION.

The Germans were much further advanced in jet technology than were the Allies. Late in 1944 two German jet bombers, the Arado Ar-234B, and the Junkers JU-287, appeared. Again the introduction of these aircraft was too late to affect the final outcome of the war. All totaled the Germans built 1,294 Me-262s and 5,000 jet engines to be used on Junkers bombers. Most of the aircraft and engines did not see service before war's end. Even more noteworthy and significant of their rapid technological achievements is the fact that by the end of the war a fighter with jet propulsion and swept back wings had been developed (designated P-101) and had entered the testing phase.

The English, after making the first forays in jet powered aircraft, did not have the stimulus of world domination as a motive power and fell behind the Germans in jet technology. The first English jet aircraft,

powered by a Whittle engine, flew on May 15, 1941. During 1943 they developed what was to be the only Allied operational jet of World War II, the Gloster Meteor. It first flew on March 3, 1943, and was put into combat against the German V1 rocket bomb in 1944, scoring its first kill on August 14, 1944. By the end of the war, the Meteor was in full production.

How about the good old USA? What were we doing during this time period?

As early as 1939 at least one American manufacturer had expressed an interest in jet aircraft. Lockheed Aircraft Corporation (Burbank) submitted a formal design of a radical fighter aircraft powered by a Lockheed jet engine to the U.S. Air Corps. At the time more interest was generated toward the development of the P-38 Lightning, consequently, the Air Corps requested that Lockheed concentrate its efforts on the P-38 instead of the jet aircraft.

The Bell XP-59A, the first American jet airplane, flew its maiden flight on October 1, 1942. This airplane, however, cannot be considered American in the purest sense of the word. The engine was actually an English Whittle engine which had been reproduced by General Electric as the Ge-116.

the successful flight of the Bell XP-59A, Lockheed was informed by the Air Materiel Command that they should enter the jet field. Plans were submitted quickly to the Air Corps and were approved within six days. Under the guiding hand of C. S. Johnson, a team of 23 engineers and designers, and 105 mechanics started working around the clock on the project. Nineteen days later a full scale mockup was finished and on the 143rd day the new airplane was completed and ready to fly. The airplane: the XP-80.

The first XP-80 was powered by a De Havilland engine which was damaged during a ground run at Muroc Dry Lake (Edwards AFB). First flight had to wait until the new engine was installed. The date: January 8, 1944. With the advent of the General Electric I-40 (J-33) engine, which was a greatly improved version of the original Whittle engine, the XP-80 had to be redesigned. The new prototype, the XP-80A flew its first flight for the Air Corps on June 10, 1944 and was put into full production immediately. Two P-80s were in England prior to the end of the war but saw no action; at that time they were not equipped for combat.

It was to be Korea that brought the first jet-to-jet combat; but the jet age began on August 27, 1939 when the Germans flew that first rudimentary jet powered aircraft.

P-80-FIRST AMERICAN JET FLEW IN 1944

The light fingers of the TAC ATTACK staff have struck again! This article was lifted from the June 1945 issue of FLYING SAFETY, a monthly periodical which at that time was published by the Air Transport Command (Army). It's a "gee-whiz" article written by a pilot after his first flight in a P-80. Notice some of the things he says about the possible injurious effects of jet blast, the use of the oxygen system, and the problems he anticipates with fuel consumption. Does it look like background for some of our current day regulations?

Jet TODAY – A P-80

by Lt Col Lane W. Smith

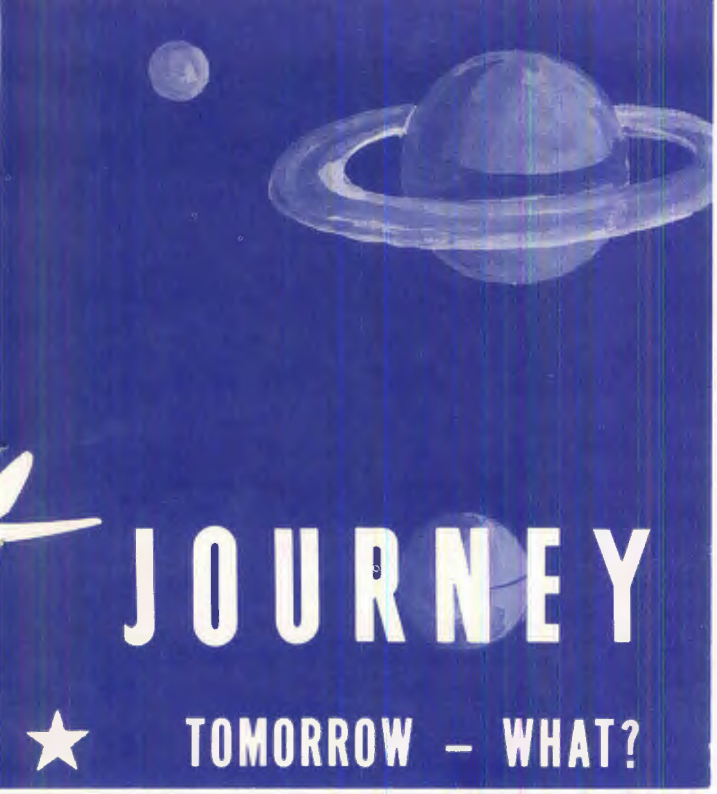
As the time approaches for the jet propelled planes to become members of the Army Air Forces family, more and more of us will have the opportunity to become familiar with this newest approach to man's mastery of the air. Under orders to check out in the P-80 we flew from Long Beach to Muroc in a B-25. When we arrived there we found out very quickly that the P-80 is still a carefully guarded secret. My credentials were weighed and evaluated and only because I had an official letter of introduction to the Shooting Star was I allowed to enter the sacred precincts. My co-pilot was banished to the Officers' Club. However, in the swift moving course of events this condition will soon be a thing of the past so we must begin to get better acquainted with the P-80.

There is an inevitable feeling of anticipation and apprehension present whenever I fly a new airplane. The anticipation always overshadows the apprehension. In this case, the complete departure from the conventional airplane and the tall tales that have circulated about jet planes whetted my desire to fly one. I was glad to be able to talk the plane over with the men who had been testing it, read the TOs and see an 80 that had been disassembled. It was a real opportunity to see the actual physical differences in the engine construction.

After lunch we came back to the Test Area. This area is north of the main bases at Muroc. The parking ramp here runs right out to the dry lake. This lake bed makes an excellent unrestricted space for takeoffs and landings. Always remembering the mirage possibilities apt to be found – the slick water landing but no water.

"It's just another airplane," I kept telling myself but I still felt like Buck Rogers. When I climbed aboard, a special ladder had been wheeled up and I thought they suspected me of being aged and infirm. I discovered this is done to prevent contact with the surface of the plane. So sensitive and exact is the streamlining of the P-80 that it is affected noticeably by skin variances as small as .002 of an inch.

After a cockpit check, I started the engine. Off she went with an explosive ploof. You want to get the Star in the air as soon as possible. It burns a prodigious amount of fuel on the ground. The P-80 certainly cooperates in this get-away – there's no running up of engines, you just point her in the direction you want to go. You feel positively frustrated on takeoff, we're so used to being gadget busy but this is like driving a hydromatic



automobile. You throw in the throttle until thrust is sufficient for taxiing. There's a thought here that's a complete departure from what we've had to worry about before – you have to be mindful of the position of the tail on takeoff for the blast therefrom can be ruinous to persons, planes, and buildings. This brings up the thought of ground crew procedure. Since the first airplane they have been taught to watch out for the props. Approach and work from the rear of the plane. Now all of this is reversed. The temperature from the tail pipe of the jet plane is extremely high. A blast from this pipe is sufficient to burn a man severely or destroy a plane. It isn't feasible to park jets and conventional planes together, neither is it fair to expect ground crewmen to work on both types simultaneously. In the confusion of avoiding props on the conventional plane and the heat and gas from the tail of the P-80, the accident rate of our ground crewmen would increase.

We've digressed far – we were taxiing out – we are at takeoff point, the plane is pointed in the direction we want to go, we use 80 percent flaps, we reach takeoff speed, pull back hard on the control stick and zoom, we are off. The gear comes up. Due to the low wing construction and the use of 80 percent flaps we've been riding down the runway on a cushion of air. As we leave the runway this cushion is dissipated and we must be ready for the slight mush down – hold her steady and up.

There is very little noise or vibration and now that we are underway we are moving faster than we can conceive. That feeling we've had of not having enough to do is replaced now by a superman approach. There is no limit, here we are at around 40,000 feet and the Star is just beginning to feel at home, but comes a reminder that man has his frailities. How does your solar plexis feel? Not so good, mine too. The P-80 has a pressurized cabin but development has not reached the point of making its use advisable. On this flight we've been using regular demand type oxygen equipment; there has been no respiratory discomfort. But, believe me, it's a good deal to know your own limitations and have a good working knowledge of the use of oxygen for a mistake in this direction will be your last.

Now we come to the, so far, least discussed phase of flying the P-80, a phase intimately associated with the Ferrying Division – navigation. I only flew locally but cross-country flight plans kept nibbling at me – suppose I was clearing on a trans-continental. Weather first, and I would go into that pretty thoroughly, especially at destination. It would be a good idea to cut out your pages of the radio facility chart and the regional maps of the territory you are going to whiz over, place them on a clip board on your knees. Have a pencil handy so you can mark off check points as you see them – at P-80 speed and altitude you have to look fast. Speed, that's what you'll have to conjure with or you'll be anticipating Albuquerque and flatten your nose on the Empire State Building. Facetious, yes, but when you begin to realize how fast you are moving nothing seems impossible, hence in all seriousness, the plane is stable, comfortable, and easy to fly, but you have to think ahead of it to land even near your destination.

Now for the business of getting down when you reach there. You want to be able to go right in. The Star comes in for a normal pursuit approach, but your fuel consumption, below 10,000 feet, is terrific. You are at the end of the line and you haven't surplus fuel to be going around. Control Towers will have to realize this and clear you in, but you can't play hide-spie with them, you'll have to announce your arrival in plenty of time. If you try to play around under 10,000 feet you'll find the fire will soon go out.

We haven't discussed weather but it's always there. The Star is a marvelous instrument plane because of its natural stability, however, at its present phase of development you had better stay out of weather if you want to live to see the final outcome of jet propulsion and we hope you do. Flight in even slight turbulence is hazardous to the pilot, the slightest bump when you're flying at P-80 speed can give you a terrific jolt. (Crash helmets are indicated.)

After I landed I felt like going off in a corner by myself and think over my experiences. I felt like I'd been living in another century. We're on the threshold of a really big thing in aviation and what it may mean to the future is either mixed up, or beyond, our wildest dreams. How about having dinner with me on Mars next Tuesday?

HISTORY OF THE AIR FORCE

1947–1972

On Sept. 18, 1947, Chief Justice Fred M. Vinson administered the oath of office to the first Secretary of the Air Force, W. Stuart Symington. Gen. Carl A. Spaatz was sworn in as the first Chief of Staff, United States Air Force, on September 26.

Thus ended an association with the U.S. Army that had endured for 40 years. And thus began a new era in which airpower became firmly established as the Nation's first line of defense and its chief hope for deterring war.

The U.S. Air Force of 1947 was comprised of approximately 300,000 people, was equipped predominantly with World War II propeller-driven aircraft, and possessed a severely limited combat capability in the aftermath of the rapid demobilization that followed V-J Day.

By 1947 the outlines of the cold war had become discernible to American leaders, and they responded to the Communist challenge with a dynamic policy of economic and military aid to other nations. The Truman Doctrine of aid to countries threatened by aggression and the Marshall Plan for economic aid to the war-ravaged countries of Europe were translated into action during 1947 and helped greatly to turn back the tide of Communist expansion. But these measures could be applied successfully against the bitter opposition of the Communist bloc only because of the implicit warning that American military power stood behind them.

The Truman Doctrine initiated a military foreign aid program which eventually included a large number of countries throughout the world and required a great deal of manpower and resources from the U.S. military services. The continuing Russian threat to western Europe, driven home by the year-long blockade of Berlin, impelled the members of the Atlantic Community to form the North Atlantic Treaty Organization (NATO) in April 1949.

As a leading member of NATO, the United States undertook to do its share — a large one — in defending western Europe. This required the dispatch of additional American forces, including strong USAF tactical air units, to Europe, where they were stationed in several of the NATO countries — principally Great Britain, France, and Germany.

After the United States drew the line against Communist aggression in Korea in 1950, there was a great buildup of Air Force strength in the Pacific. And the uneasy armistice after July 1953 required the continued presence of strong USAF forces in Korea and Japan.

The air defense of North America assumed vital importance after the Russians demonstrated their ability to produce atomic and hydrogen bombs and long-range bombers. Because the arctic region appeared to offer the most likely routes for attack against the United States, the Air Force advanced its defense outposts as far to the north as possible.

The Strategic Air Command also reached out to overseas areas for advanced airfields from which its bombers could strike more quickly against any aggressor. Huge new bases in the United Kingdom, North Africa, and Spain greatly added to SAC's bombardment capability.

BERLIN AIRLIFT

One of the first international crises that the young Air Force responded to was the Berlin Airlift. On June 22, 1948, Berlin became an isolated city. The Russians had cut off all surface transportation in the hope of forcing the American, British, and French occupation garrisons to abandon the city to Communist control. They overlooked two vital factors — Allied airpower and determination.

In 15 months, the Anglo-American airlift delivered some 2.3 million tons of food, fuel, and supplies to the beleaguered Berliners. On a single day, in April 1949, 1,398 Allied flights delivered more than 12,940 tons of supplies. Their purpose defeated, the Communists lifted their blockade on May 12, 1949.

KOREA

The next crisis to test the Air Force and the Nation was Korea. For the Air Force, Korea was a turning point.

It found the Air Force, like the other Services, ill-prepared and ill-equipped as a result of five successive limited budgets. Much experience and talent came back via the Air National Guard and Reserves during the Korean buildup. The Air Force budget for fiscal year 1951 rose to $15.9 billion and the next year to $22.3 billion.

Korea confirmed the tactical air warfare lessons of World War II and demonstrated that strategic airpower could confine hostilities to Korea at a time when NATO defenses were too weak to have withstood a Soviet attack.

For the first time in aerial warfare, jet fighters locked in combat. MIG Alley became a household word, and the USAF's 10-to-1 margin of victory over enemy fighters a legend.

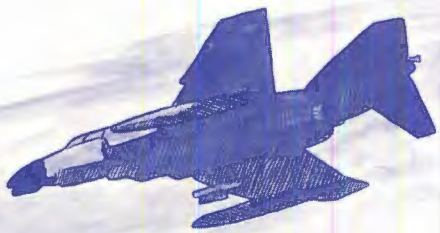
The years after Korea did not see an abatement of crises. There were the Suez and Hungarian affairs in 1956, and Lebanon and Taiwan in 1958. These latter two tested the Air Force's limited-war capabilities and found deficiencies in mobility, airlift, and bare-base operating ability. A reorientation of priorities from strategic forces to general-purpose and airlift forces began in 1961.

IN THE SIXTIES

The Communists ushered in the 1960s by unveiling their new missiles and pressing hard with their new strategic prowess. The full extent and seriousness of the psychological warfare they were pursuing reached its climax in the fall of 1962 during the Cuban crisis.

In the ensuing crisis, the Air Force flew some 85,000 hours in supporting U.S. demands that resulted in a U.S.S.R. declaration that all Soviet offensive missiles had been removed from the island.


Viet



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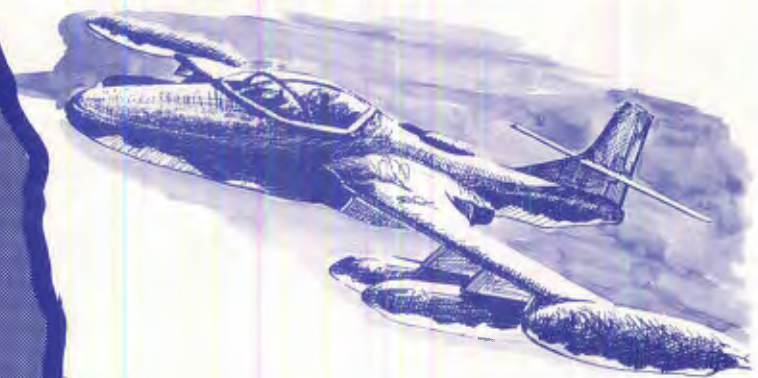


HISTORY OF THE AIR FORCE...

Since 1961 the story of the Air Force revolves principally around Vietnam. As part of the free world military team in Vietnam, our goals are twofold:

- To support the Republic of Vietnam in its fight against Communist aggression, and
- To assist in the development of a country which is dedicated to the concept of freedom and independence.

MEETING THE CHALLENGE

Seldom has the U.S. Air Force or tactical airpower ever been confronted with a greater challenge. Although engaged in a type of war in which it had never previously participated, the Air Force has been able to meet the challenge because of the flexibility of airpower. Through innovation, the Air Force has adapted weapon systems to meet the demands of counterinsurgency, close air support of mobile ground forces, and all other tactical requirements. Airpower has even denied the enemy the shelter of darkness and bad weather.

The story of Vietnam continues, but throughout one fact remains clear to all. The Air Force is a fighting organization.

OUR MISSION IS TO FLY AND FIGHT AND DON'T YOU EVER FORGET IT.

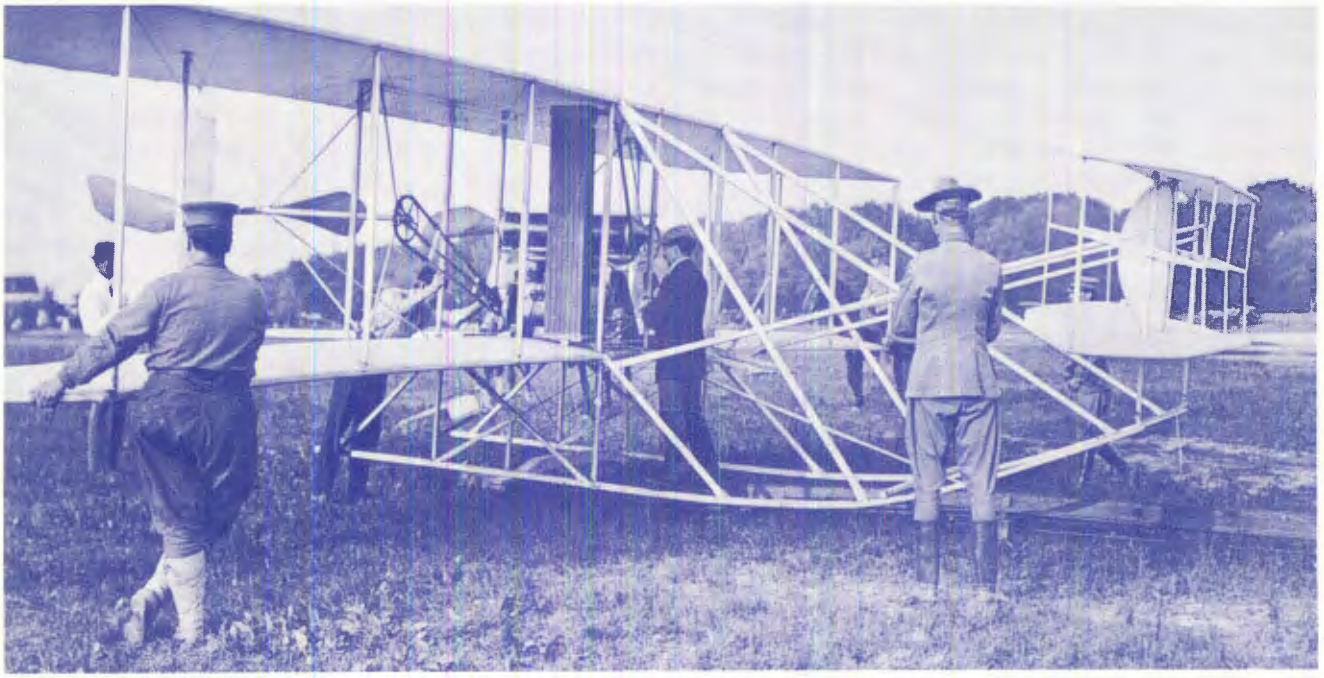
THE EAGLE

The F-15 Eagle

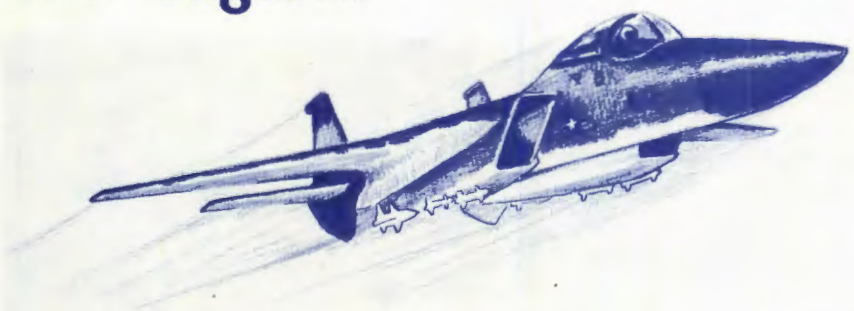
This commemorative issue began with an article about the beginning of aviation and it is appropriate that we end with another beginning, the beginning of the newest air superiority fighter destined to come into the TAC inventory, the F-15 Eagle.

The F-15, manufactured by the McDonnell Douglas Corporation, is the latest in a long line of military aircraft purchases that stretch back to August 2, 1909. On that day, the Wright Military Flyer was obtained by the Signal Corps for $30,000 and became the first military airplane in the world. To simply say that military aviation has come a long way in sixty-three years is a gross understatement. Comparing physical characteristics and performance of the F-15 to those of the Wright Flyer reveals very little kinship, but it does provide a measure of aviation progress.

The military Flyer, made of wire, wood, and cloth, weighed in at 740 pounds. The F-15, constructed of aluminum, titanium, various composites, and other materials, tips


The Wright 1909 Military Flyer

the eagle...



the scales at around 40,000 pounds. The wing of the Wright Flyer stretched just over 36 feet from tip to tip. At slightly over 42 feet, the F-15 has a wing span only six feet longer.

The first military airplane was powered by a 30.6 horsepower, four-cycle Wright engine which pushed the Flyer along at a scalding 42 miles per hour. The F-15 is powered by two Pratt and Whitney F-100 (an engine designation) turbofan afterburning engines which develop about 25,000 pounds of thrust each and give the aircraft a speed in excess of Mach 2. More important than the top speed is the greater than one-to-one thrust-to-weight ratio provided by the engines which gives the aircraft tremendous climb and acceleration capabilities. Add this to the low wing loading, and the result is an aircraft capable of extremely high maneuverability, a capability so necessary in the fighting environment of air-to-air combat.

In 1909 the term air combat (if it was used) most probably meant the art of fighting the airplane into the air, battling with it once there to stay there, and then wrestling it to the ground when you (not it) were ready. It was man against machine. With the F-15 it will be a different story, a man WITH machine story. This machine will be a superb extension of man . . . the pilot.

The story of the F-15 has its beginnings in 1965 with the F-X Superiority Fighter feasibility studies. During a three year study, more than 500 conceptual variation analyses were performed to define the characteristics required to provide the excellence needed for the F-15 in order to meet the requirements of the post-1975 time period.

In January 1970, the Air Force awarded the development contract for the F-15 to McDonnell Douglas. The contract is a combination Cost-Plus-Incentive-Fee/Fixed Price Incentive with successive targets. Under the terms of the contract, the contractor must successfully accomplish development milestones on schedule and within the estimated costs before the contractor is permitted to proceed. To eliminate certain high risk elements in the development of the F-15, competitive prototyping was employed to select the manufacturer for the engine, the attack radar, and the gun.

Pratt and Whitney won the engine competition, Hughes Aircraft Company was awarded the radar contract after a head-to-head fly off with a competing company, and Philco-Ford won the development program contract for the new 25mm gun, the GAU-7A, which fires caseless ammunition.

Late in June the F-15 was presented at a roll out ceremony conducted at the McDonnell Douglas Corporation's St Louis facility. During the ceremonies, General Momyer expressed TAC's views of the airplane and its mission. The TAC Commander said, "With the F-15 making its debut today, the Tactical Air Command is confronted with the challenge of how to exploit the full potential of this new weapon system in the gaining and maintaining of air superiority in battle. Air superiority is essential to the survival of air, ground, and sea forces in a theatre of war . . . who controls the air will ultimately determine the outcome of the battle. We must never be second best in our fighters, for to be second best is to be not at all.

"The F-15 is our reply to the future that we shall not be second best. The United States Air Force has a long and great tradition of fighter aircraft and this has not come about by chance. It's been the product of imagination, research and development, technical know-how, skill, and above all else, its fighter pilots have the will to go after the enemy, no matter where he is."

Later during his presentation, General Momyer said, "The F-15 really has more potential than the pilot can physically take and we must now find the physiological measures that will give him the stamina to get the most out of his machine."

The F-15 Eagle promises to be every inch a fighter's fighter and will undoubtedly leave behind a history that is as noble as the achievements of all fighters which have come before. Unlike the Wright Military Flyer of 1909, which controlled the air because it was the only heavier-than-air flying machine around, the F-15 will control the air because it is the best.

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TAC TALLY

MAJOR ACCIDENT RATE COMPARISON

	TAC		ANG		AFRes	
	1972	1971	1972	1971	1972	1971
JAN	0	1.6	0	16.7	0	0
FEB	0.8	1.6	0	11.6	0	0
MAR	1.6	3.1	6.3	7.0	0	0
APR	2.8	2.7	8.1	4.9	0	0
MAY	4.0	2.5	6.3	5.7	0	0
JUN	4.9	2.6	5.1	6.9	0	0
JUL	4.2	2.9	6.2	7.1	0	0
AUG		2.7		7.8		2.7
SEP		3.2		7.4		2.4
OCT		3.2		6.9		2.1
NOV		3.3		6.9		2.0
DEC		3.2		6.4		1.8

AIRCRAFT ACCIDENTS

UNITS

*Estimated

	THRU JULY 1972 ACDTS	THRU JULY 1972 RATE	THRU JULY 1971 ACDTS	THRU JULY 1971 RATE		THRU JULY 1972 ACDTS	THRU JULY 1972 RATE	THRU JULY 1971 ACDTS	THRU JULY 1971 RATE
9AF	4	2.7	4	2.6	12AF	10	4.3	4	1.8
1 TFW	1	4.5	0	0	23 TFW	1	9.8	0	0
4 TFW	0	0	0	0	27 TFW	1	8.1	0	0
31 TFW	1	6.8	1	7.5	35 TFW	1	5.5	0	0
33 TFW	0	0	0	0	49 TFW	2	7.6	0	0
68 TASG	0	0	0	0	58 TFTW	2	5.8	3	10.0
316 TAW	1	4.6	0	0	67 TRW	0	0	0	0
317 TAW	0	0	0	0	71 TASG	0	0	0	0
354 TFW	1	7.0	1	7.1	313 TAW	0	0	0	0
363 TRW	0	0	0	0	314 TAW	0	0	0	0
4403 TFW	0	0	2	20.7	355 TFW	0	0	0	0
					347 TFW	1	12.5	0	0
					463 TAW	0	0	0	0
					474 TFW	2	10.4	0	0
TAC SPECIAL UNITS									
1 SOW	1	3.2	3	7.9	4410 SOTG	2	11.2	1	7.2
2 ADG	0	0	0	0	4485 TS	0	0	0	0
57 FWW	1	9.3	0	0	4500 ABW	0	0	0	0

SUMMARY

TAC JUL 72	TAC Thru July 1972	TAC Thru July 1971		ANG JUL 72	ANG Thru July 1972	ANG Thru July 1971
2	32	19	TOTAL ACCIDENTS	3	13	13
0	21	13	MAJOR	3	10	11
0	28	6	AIRCREW FATALITIES	1	2	4
0	20	9	AIRCRAFT DESTROYED	2	8	11
0	21	8	TOTAL EJECTIONS	0	5	9
	13	8	SUCCESSFUL EJECTIONS		5	7
	62 %	100%	PERCENT SUCCESSFUL		100%	77.8%