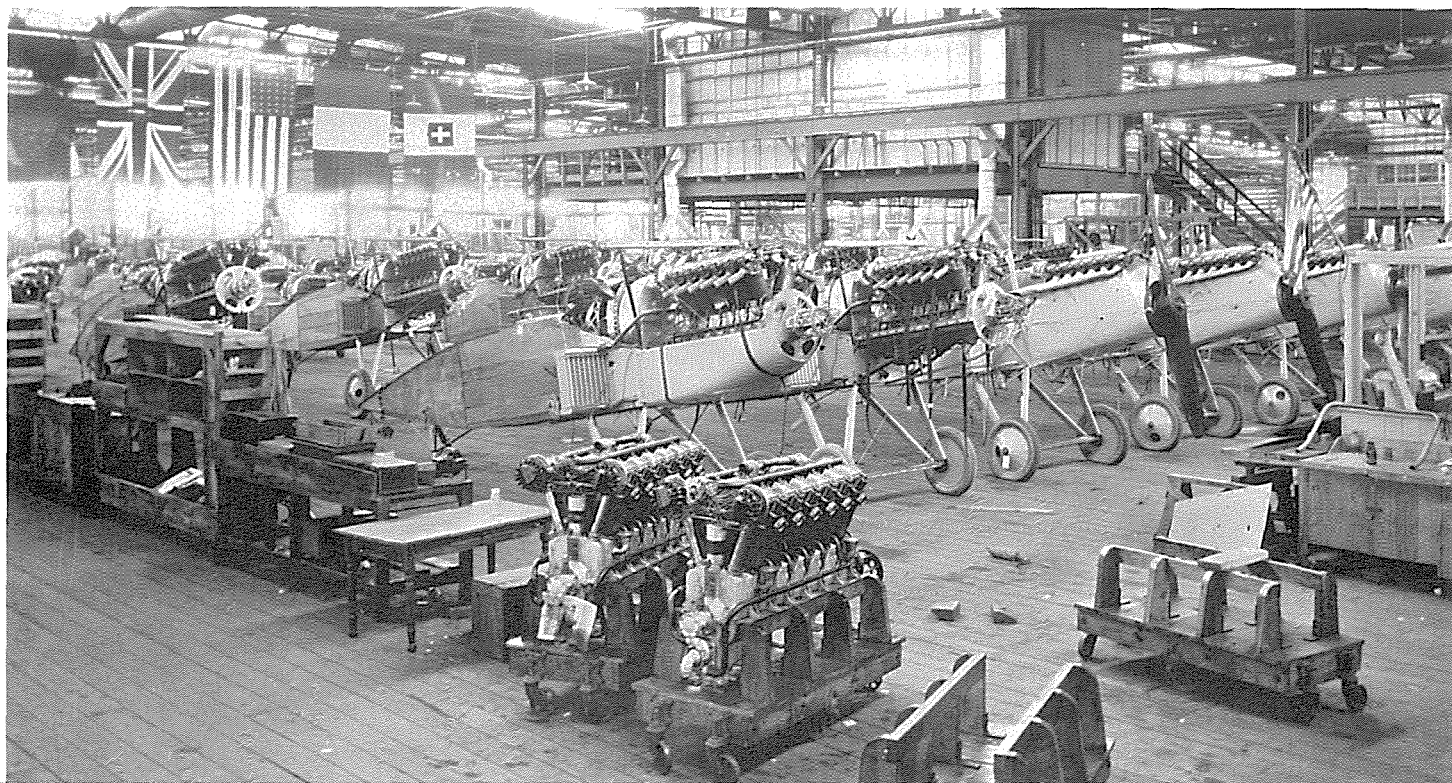




This photo, taken on the day after cancellation of the contract for 2000 Bristol Fighters, shows the Curtiss Buffalo plant final assembly floor. (Courtesy of Paul Matt)

THE AMERICAN BRISTOL FIGHTER PROGRAM, WWI

By BRUCE, GUTTERY, MATT, OPDYCKE, SLOAN, WRIGHT, et al.

Upon the declaration of War by the United States against Germany in April 1917 it was realized that America had fallen far behind the warring powers in the technical development of aircraft. But with a tremendous manufacturing potential, the resources of the country could be mobilized to provide airplanes and engines in large numbers. A mission was sent to Europe to find and recommend for production the best that England, France and Italy had to offer. Shortly afterward the design of the Liberty engine was begun. It was to have more promising results than some of the aircraft production programs.

Among the airplane types proposed for production was the British & Colonial Aeroplane Co. F2B, otherwise known as the Bristol Fighter. The selection and subsequent production of the F2B was to be subject of much confusion, and eventual cancellation in July 1918. The Air Service Engineering Department at McCook Field subsequently undertook a redesign of the F2B and came out with a number of experimental versions leading to, finally, the XB-1A in the post war years, but no large quantity delivery of the U.S.-built type ever came about.

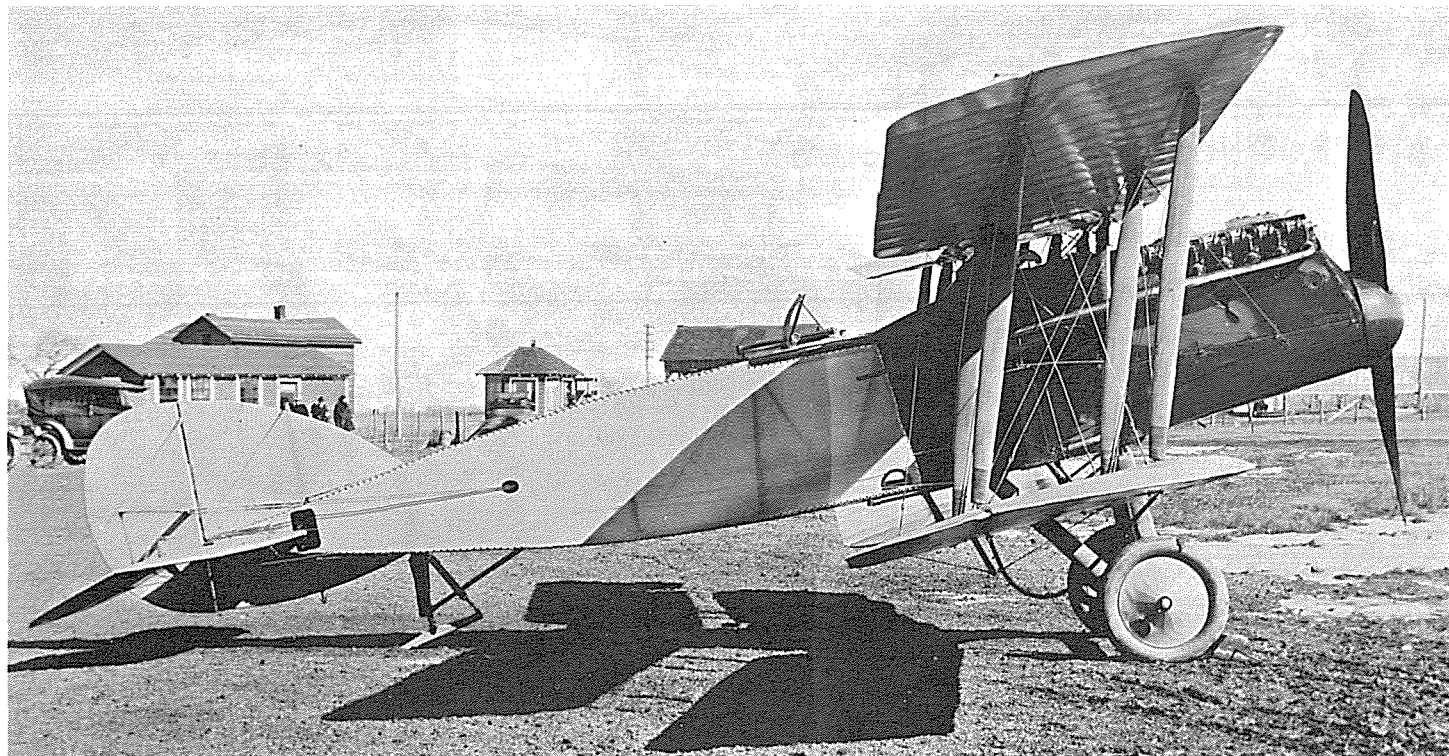
The British & Colonial Aeroplane Co., rather better known as Bristol, started work on the two-seat fighter in March 1916, under the direction of Captain Frank Barnwell.¹ By April 1917 it had gotten into combat as the F2A, and in the same early part of 1917 the later version F2B came into being. Engine production problems were to bring a variety of power plants, even the 200 h.p. R.A.F. 4d, beside the original 190 h.p. R-R Falcon. These engine changes and trials lasted throughout the year, and well into 1918; at least if there were problems in England, there was surely confusion in America. However, British production picked up and by the end of the War delivered 3,101 airplanes. A number of the British aircrews had notable, even heroic, records with the "Biff."

In surveying the record of the U.S. production of the F2B it is

apparent that the confusion began early, some of it because of necessary shifts in the manufacturing scene. The U.S. was trying to achieve a goal of more than 20,000 airplanes in the first year, and as the needs for specific types of manufacture came into focus the production orders were allocated and reallocated to existing and new plants almost continuously during the first six months.² At the crux of the F2B scheme, however, was the desire to use the Liberty engine, which was to come in mass production numbers, in as many places as possible. That there was political pressure brought to bear is not absolutely clear in reading the "History of the Bristol Fighter Airplane, WWI".³

The Bolling Commission was sent to Europe in June 1917 and made its recommendation, through cables from Gen. Pershing that the F2B with 200 h.p. Hispano-Suiza engine be built, on August 1st. A sample machine was sent from London on 14 August, arriving in Washington on 5 September. Col. V.E. Clark was immediately given the task of redesigning the airplane for the Liberty-12 engine. Later Col. Thurman H. Bane, Chief of the Air Service Technical Section at Wright Field, was to report:⁴

"Col. Clark, assisted by a few others, worked for some weeks adding to the drawings of the Bristol and then the ship, with the British drawings plus Col. Clark's drawings, were sent to the Curtiss Company. The production and redesigning of the Bristol to accommodate the Liberty Motor and American equipment was from that time intrusted entirely to the Curtiss Company. Col Clark was never again consulted; there was no centralized control of engineering within the then Equipment Division and responsibility for the matter lay entirely with the manufacturer. It must be remembered that at that time the Liberty Motor was in its very earliest stages; even its weight was not known definitely. The Curtiss people, however, considered that the weight of the Bristol, then designed for the 190 Rolls-Royce, was entirely too light for the Liberty. Their engineers,



therefore, made changes in design and the Bristol as produced by the Curtiss Company was very clumsy and had been patched and repatched and changed so many times by people who did not know their business that it was a very different ship from the original British Bristol which Clark had recommended.”

The first airplane was completed at Curtiss Aeroplane & Motor Co. in January 1918 but a new redesign was begun immediately after Major Hall arrived.

The second one built (in six days) crashed when the fabric came off of the wings. Finally, the third accident, which also killed the pilot and observer, brought an end to the program; the order for 2000 airplanes was cancelled, with 27 of them produced, at a cost of \$6.4 million. Thus in that first long year many things had happened to make the program falter, ending with an investigation by a committee of Air Service officers and civilian experts including Chance Vought, H.M. Crane, Glenn Curtiss and Charles H. Day. Even stockchasers came in the limelight for criticism during the course of manufacture of the first 25 airplanes. It was supposed by some groups at one time that the Bristol Fighter be an observation airplane and at other times as a bomber. And an alternative was suggested that Capt. Barnwell design a two-seat fighter around the Liberty engine.

The most outspoken criticism of the program (many years later) was that which stated that, “Blind to their own blunder in fitting the Liberty to an aeroplane unsuited to the engine, the U.S. Army shifted the blame on to the innocent air craft and condemned the Bristol Fighter as dangerous.”⁵

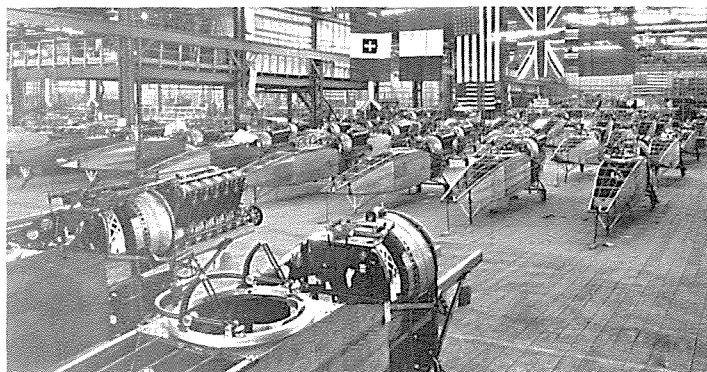
The contemporary source (History of the Bristol Fighter, WWI) however, examined the controversy in detail, with some interesting observations and testimony in 1918 and 1919. The Aircraft Production Board had directed Lt. Col. V.E. Clark to redesign the Bristol Fighter for the Liberty 12 engine. Col. Clark began the redesign in early September 1917, shortly after his return from Europe, and about the same time that the sample Bristol Fighter arrived from London in Washington. It was taken to the corrugated iron building behind the Smithsonian Institution (The Airplane Exhibition Building) and there Clark and a staff of draftsmen went to work. Over a year later, when the matter was being investigated he stated that:⁶

“I was assigned the task of re-designing the Bristol Fighter for the Liberty engine. I was given six weeks’ working time, very poor facilities, and practically no experienced draftsmen with which to do the job. At the end of this time, November, 1917, I turned over some eight hundred and eighty drawings made in my department for the new design to the Curtiss Airplane Company.

“Since that date, I have never been called upon to visit the Curtiss factory, nor have I ever been consulted in any way regarding questions connected with the design or construction. I believe that an official diary kept by Mr. J.G. Perrin, who was designated as the Government Engineering Representative for this job, will show conclusively that the machine as finally flown experimentally, was in no wise similar to the machine that my department designed. The same diary will, I believe, show conclusively the reason for the failure of the Bristol Fighter as flown in this country.

“I designed it to be an Observation machine weighing, fully loaded with all necessary equipment, 2940 lbs. There was built a machine which weighed some 700 or 800 lbs. more, with changes throughout. The machine that was flown was not the machine designed.”

The sample airplane was shipped to the Curtiss plant at Buffalo on the first of November and a few days later Capt. H.H. Blee took the drawings to Curtiss. By the end of January, 1918, the



first Curtiss-built Bristol Fighter was complete. From then on, there was nothing but trouble. Its first test flight was reported as "Bristol flew yesterday, Forced landing due to engine trouble. Landing gear weak. Tailskid weak."⁷ That was on March 5th.

Curtiss had been authorized to proceed with the procurement of metal fittings on October 18th in a memorandum from Col. Deeds, and the manufacture of the parts for the first 25 were released March 23rd by Maj. E.J. Hall. In his release, Hall reported that he had redesigned the Bristol Fighter and enumerated a significant number of changes. Hall had by this time been placed in charge of the program at Curtiss for the Equipment Division of the Signal Corps. He was the co-developer, with Col. Jesse G. Vincent, of the Liberty engine and chief trouble shooter during the initial production stages of the engine, hence his association with the Bristol Fighter project. A number of the changes made on the prototype Fighter were done almost without drawings, on the main assembly floor at the Curtiss plant, and when the time came for release of the twenty-five he described certain of these to be "as now made up on the floor."⁸

These additions were later described as contributing greatly to the all-up weight of the machine, increasing it from approximately the 2700 pounds (in the original F2B) to nearly 4000 pounds.

Hall, now Lt. Colonel, gave a status report on May 20th that cleared up some of this:⁹

"Last of February writer went up to Buffalo to take charge of production and engineering of Bristol plane at Curtiss Plant. This authority also given to me on the DeHaviland plane at Dayton Wright. My time has been divided between Dayton and Buffalo.

"Condition at Buffalo, was that a sample English plane had been delivered to Curtiss Co., Nov. 7, 1917. Various people had redesigned this plane and adapted it for different classes of work. Delays ensued which caused by March 1st, the original English Bristol to become antiquated as far as an up-to-date machine gun fighter was concerned. This English Bristol was originally designed to carry one Vickers gun in front and one in rear. The cables from Europe required 2 guns in front, two

in rear, and a speed of 130 miles per hour, which necessitated the complete re-design of the whole front end of the plane including engine, gun synchronizing devices, ammunition chutes, gas tanks, cowlings, sights, gun mountings, etc. The magazines of the Lewis gun were increased from 47 round each to 97 round which doubled the load to be carried. This increased fighting load, necessitated the strengthening of the plane all the way through, and the principal changes since March 1st have been bringing the safety factor of the plane from zero on some parts to five-plus for the whole plane.

"In re condition at Curtiss there were 25 fuselages on the floor built similar to the first Bristol plane in the job shop from Signal Corps drawings. The Curtiss Co. was at a standstill, because no one had given them authority to go ahead with any part of production and the morale and spirit of both workmen and executives were rapidly being lost.

"It was necessary to get action at once, so an experimental plane — known as Bristol No. 2 — was built up in 6 days from available material on hand to prove out the balance of the plane and advisability of using the Liberty engine. A few flights were made in Buffalo, but account of poor weather conditions and the small field, no accurate official data was obtained.

The first Curtiss-Bristol had flown again at Buffalo on March 24th for 57 minutes, making eight speed trials averaging 115 m.p.h. and it was recommended that the side radiators be eliminated to obtain more speed.

Hall did not wait, though, in getting on with the program. He released the next 375 airplanes, to be made "exactly the same as the sample plane on the floor with exception that the old type tail skid will be used with reinforced check on same."

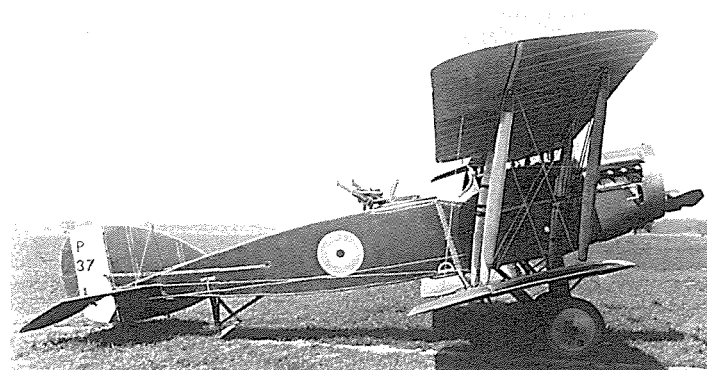
The Liberty engines were still giving trouble to the Bristol Fighter due to the fact that scupper feed motors were installed, and were replaced with forced feed motors in early April. Nonetheless, Hall was confident and related, in his report to Kellogg his feelings about some of the background.¹⁰ Said he,

"... but I do know that the Curtiss Company greatly opposed

The prototype Curtiss-Bristol Fighter (opposite page) on March 3rd, 1918, had fabric covered fuselage from aft of pilot's cockpit to tail, side radiators. It was test flown on March 6 with dubious results. Later the structure was beefed up and this, with mounts for two Marlin guns forward, the Marlins and two rear Lewis guns and ammunition, plus extra fuel, brought the weight to nearly 4,000 pounds but without wing area increase. Structure of modified Fighter may be seen (opposite below) taken after production shutdown. (Matt Collection, Curtiss No. 1272 above, 1114 below)

Below, the sample Bristol F2B brought from England and used for experimental test work at Wright Field as "Plane No. 30" or P-30. (Wright Field photo No. 492, courtesy of L.E. Opdycke). Above right, wing production on July 20, 1918. By this date 25 airplanes of the contract had been delivered, 22 more were completely assembled, and approximately 90 sets of parts were in final stages of assembly.

Below right, P-37, a second sample Bristol F2B in which the 8 cylinder Liberty engine was installed for evaluation, shown here at Wright Field, where it crashed and was written off on September 6, 1918. The performance tests were never completed for this combination of airplane and 290 h.p. Liberty-8. (Photo — Wright Field via R.R. Martin Collection)



building this machine as designed. The Liberty engine was much too large and too powerful for the plane without thoroughly redesigning and strengthening it all the way through. The design furnished was of the crudest type and the plane would scarcely stand up on its own weight on the floor. It was not designed, nor any provision made to carry any type of equipment whatsoever.

"The first 400 machines so strengthened were released to Curtiss for production, and they will be fairly good machines and very serviceable. It was not as good a job as could be made so the writer, in conjunction with the Engineering Department of the Curtiss Company, completely redesigned the machine as a two-seater, pursuit type, equipped with oxygen tanks, forward Marlin guns and two Lewis machine guns in the observers cockpit. With this class of equipment, it is confidently expected that the new machine will make 150 miles per hour, and be superior to anything that is over on the other side. Machine must not carry anything else, and is not suitable for bombing, camera, or radio gun-spotting work.

In fact, Hall offered to quit. He said in concluding this memorandum,

"... If any investigation is to be done, unless the investigator has the ability to design a better machine than the one he is looking at, he should not be allowed to change it ... Rather than give any incompetent man privilege of changing the Bristol as redesigned, the writer would withdraw entirely ..."

The prototype went to Wright Field for further flying tests in April and near the end of the month Hall reported that the first four production airplanes had been completed. Then, on May 7th the second prototype crashed with pilot J.R. Doolittle and observer Lt. W.M. Oler. They were not seriously injured, having crashed through a maze of telephone wires near Dayton.

This airplane had been put together at the Curtiss plant in just six days, possibly more as a morale builder than anything else. Col. Thurman H. Bane, who was just then taking over the Engineering Division at Wright Field from Col. Vincent, reported the crash in a telegram to Hall, surmising that the dope had weakened the fabric on the upper wing causing it to collapse. In turn, Hall gave his analysis of the reasons:¹¹

"In order to comprehend just the reason for this accident it is necessary to go into the construction of this plane and its purpose. *This plane was built in 6 days* from the available material on hand at the Curtiss plant in Buffalo, to prove out the balance of the machine with the Liberty engine in it and the advisability of using the Liberty engine. It should not have been considered as a Bristol Fighter, as it had no machine guns nor any provision for such and was not reinforced as the Bristol Fighter is. Thus, this machine was merely used to prove a few points which were incorporated in the design of the Bristol Fighter, and the failure of this experimental machine in no way reflects upon the design of the fighting machine.

(It) Has since been determined, by watching 2 other Bristols that there were not enough ribs in the upper wing. The addition of two more ribs in the upper wing panel next to the fuselage will strengthen this and not allow the canvas to vibrate and wear through. The cloth on these wings was not properly doped and was too loose, but even if it had been properly doped, result would have been the same on any wing so located."

G.H. Mueller, Chief Engineer of the Curtiss Company, had an examination of the wreckage made and his men reported back to him that the linen was probably loose, due to defective doping procedures, and tore from the upper wing. He caused further tests of the process to be made, but a later report by the Bureau of Standards was contrary and stated that the fabric failed because of poor engineering of the method of attachment of it to the

wing structure and suggested a better method.¹²

Col. Hall continued confident, and reiterated this confidence following the May 7th crash (in his report of May 20th):

"Publicity has been given to an accident on an experimental plane and inference has been made that the fighting plane — which is not at all the same construction — is a failure. This is absolutely unfair to the Liberty engine and to the Bristol Fighter, as Captain Murray just returned from France after a tour of investigation of the latest engines and planes, has said that he had not seen anything overseas which can compare with the performance of the DeHaviland and Bristol planes powered with the Liberty engine.

"My pilots Rader and Doolittle have both seen service over the lines, and they both say the performance of these planes is better than any they have flown."

The program was coming under increasing criticism. Capt. Henry H. Arnold recommended to W.C. Potter, Chief of the Equipment Division in late May that Capt. Barnwell be induced to design an airplane around the Liberty engine. Bane also passed this along to Potter, advising that as many of the Bristol Fighter parts as possible should be used, and that, "No one in this country is as capable of handling the situation as the original designer, Capt. Barnwell."¹³

At the same time, however, a competitive flight between a Spad with 220 h.p. Hispano, flown by noted French flyer, Lt. Flachaire, and the Curtiss-Bristol flown by civilian test pilot Rader, was witnessed by a Senate Committee. Major Edward Moore described it as an astonishing performance, in which Rader matched every stunt that Flachaire was able to do in the Spad. Both airplanes were very lightly loaded. Kellogg advised Hall, though, that the airplane was now being considered as an observation airplane and not a fighter, and that he should get a couple of them in the air for some good flight tests in order to prove what it could do, since performance would affect the decision to continue the program or not. Wing Commander Briggs, who had been chief engineer of the Royal Naval Air Service and was now a part of the British Mission to the U.S., did not help the Bristol situation. In a terse note of June 1st he acknowledged the proposal to have Barnwell design a good airplane, but recommended that the DH-9 be put into production as rapidly as possible, and making the "old" Bristol with the 300 h.p. Hispano-Suiza engine.

The tide was running against the Bristol in the United States. Then:

PHILLIP RADER, ROBERT CONNOR, INSTANTLY KILLED FALL BRISTOL AEROPLANE, CURTISS FIELD, THREE P.M. PLANE CRASHED NOSE DOWN, FALLING FIVE-HUNDRED FEET: GAS TANK EXPLODED. TOTALLY DESTROYED BY FIRE.¹⁴

This telegram of June 10th to the Aircraft Board started other reactions. The twenty-four Bristols which were about to be delivered to training operations on Long Island were put in doubt as to acceptance. It appeared from witnesses to the crash that the same defect, tearing loose of the fabric on the upper wing, was the cause. This was not true, but things were getting nervous and edgy in other areas, too. Sabotage was suspected at the Curtiss plant because of some holes improperly drilled in the rear of the fuselage frame, and some gun-shots were heard on another occasion. Nothing came of the former, and the latter incident proved to be non-connected — some young men in an auto had passed by, firing revolvers.

On June 25th Potter advised Col. Vincent of a decision to put the Bristol, as nearly as possible like the original model received from England, into production with designs for both 300 Hispano and Liberty-8 engines. Vincent acknowledged that work was proceeding on the designs.¹⁵

The weather plagued the work in this crucial period also; exces-

sive heat prevented the proper doping of fabric, thus holding up the work. Hall promised that Bristol production would start in earnest on July 10th but said that it had been impossible within the past few weeks to get airplanes into the air for production testing with wings of improved design and proper doping. W/Cdr. Briggs also put an oar in by recommending to Kellogg that all work should be stopped until the Curtiss-Bristol could be evaluated through flight and sandbag tests.¹⁶

Reacting testily to the recurring proposals that the Bristol be used as a bomber, or an observation or reconnaissance machine, Hall telegraphed Kellogg:¹⁷

"Bristol plane from England was always known as low (sic) place fighting machine and when redesigned for Liberty engine was still a fighter. It was much too fast and powerful and has too much vibration to do camera or observation work . . ."

Vincent had also been making an investigation and in a confidential memo to Potter he reported he had found "very bad situation" at the Curtiss plant.¹⁸

"... The whole Bristol Fighter job has been wrong from the start, and the original fault lies with the Government on account of the decision to put the 12-cylinder engine in this small plane. Now taking steps to remedy this situation by putting in a proper size engine..."

Potter sent A.A. Landon, another member of the Aircraft Board, to Buffalo to look in on the problem and wired him, "(It) is going to take so long to test out the Bristol that we should stop production. Consider what effect this will have on Curtiss. Be ready to make recommendations to Aircraft Board when you return."

That was on July 12th. On Monday, July 15th, the final blow came. In an altitude test, Pilot Sharp and Observer Hale crashed. Hale was killed and Sharp was seriously injured, though the crash was not attributed to structural or covering defect. Still gathering information for the final decision, Landon received a letter from Glenn Curtiss which stated his belief that, while the factor of safety was low it could be brought up, and that speed and flying qualities could be improved by further changes at perhaps another 5 to 15 percent increase in cost.¹⁹ He pointed out that only one accident could be charged to the design and that was the one resulting from the tearing of the cloth on the wings. But his concluding statement was: "*The machine cannot, of course, be brought entirely up to date.*"

Landon gave his report and decision to John D. Ryan, now the Director of Aircraft Production (a new appointment subsequent to the time that the Air Division had been taken away from the Signal Corps in April). He had called to conference, immediately after the crash on Monday, Col. Bane, Maj. B.Q. Jones, Maj. Martin, Glenn Curtiss and Charles H. Day, Chief Engineer of Standard Aircraft Corp. They concluded:

"That the plane as at present constructed was unsafe, overloaded, and had no military value, and was not acceptable to them."

On Thursday, July 18th, Landon conferred again with Bane, Jones, Martin and Potter, and made the decision to stop production. The next day Contracts 2463 and 3443 and all orders placed under these contracts for Bristol Fighters and spare parts were cancelled. The work stoppage affected about 2000 of the Curtiss employees, and a public statement was made by Potter for the Buffalo newspapers particularly which said:

"...Recent flying tests have demonstrated that this machine is overpowered and not of military value, lacking maneuver ability and not having sufficient speed for war purposes."

He went on to say that every effort would be made to put the SE.5 and Caproni into production at Buffalo and hoped to re-employ the workers.

Lt. Col. Hall dropped out of the controversy, of course, having

done a maximum effort to keep the program going. At the request of Gen. Pershing he went to France and became Chief of the Air Service Technical Section, A.E.F., receiving the Distinguished Service Medal for his wartime work.

Col. V.E. Clark had been the expert relied upon to indicate which types of foreign designed airplanes would be put into production. On his return to the U.S. in September 1917 and learning of the engine situation, he recommended:

Day Bomber — The DH-9 with Liberty-12 engine.

Observation — The Bristol Fighter with the same engine.

Night Bomber — The Caproni Triplane with three low-compression Liberty-12 engines.

Two-seat Fighter — The Bristol Fighter with the Liberty-8 engine or "that number of cylinders that should be developed."

Single-seat Pursuit — The Spad with Hispano Suiza.

In retrospect, it seems apparent that, rightly or wrongly, a decision was made to use the Liberty engine in the Bristol Fighter production. The choice of the 12-cylinder engine, instead of the eight, was the wrong part of the decision but under the stress of wartime pressure, enthusiasm to get on with the job, and the rapid evolution of technical demands for faster, better fighter airplanes, it would be difficult to fault the decision even in the light of later comparable experience. As usual, all parties came out looking a little grey, but at least the official history of the program did not single out a scapegoat. Had the choice been to proceed first with the Bristol with the 8-cylinder engine, the results might have been quite different.

NOTES AND REFERENCES:

1. J.M. Bruce. *British Aeroplanes, 1914-1918*. London: Putnam & Co., 1957.
2. The Ribot Recommendation, described by Arnold in his *Global Mission* gave credit for the numbers in the program to Gen. Mitchell.
3. Records of the War Department, Records of the Air Force: *History of the Bristol Fighter, WWI*, National Archives, hereinafter described as RG18.
4. Notes of interview with Col. Thurman H. Bane, Chief, Technical Section, June 17, 1919, by Lt. Col. R.H. Fletcher. RG18.
5. Op. Cit. Bruce, page 137.
6. Letter excerpt, Col. V.E. Clark, A.S.M.A. to Director of Military Aeronautics, Aug. 12, 1918. RG18.
7. Telegram, Heatley Green to M.W. Kellogg, Mar. 6, 1918. RG18. Green was the Government Production Representative at the Curtiss Station.
8. Memorandum, Lt.Col. E.J. Hall to W.M. Kellogg, Mar. 23, 1918. Kellogg was then Director of Production, Equipment Division, Signal Corps.
9. Status Report to Statistical Department, Attn: Lt. E.H. Crumpston, May 20, 1918. RG18.
10. Report on Bristol, Letter Hall to Kellogg, April 19, 1918.
11. Report of Wreck, Bristol No. 2, Hall to Kellogg, May 13, 1918.
12. Report, E.D. Walen, In Charge of Textiles, Bureau of Standards, to Technical Section, A.S., Attn: Col. Bane, May 16, 1918. RG18.
13. Memorandum, Arnold to Potter, May 25, 1918.
14. Telegram, Edmund Leigh, Military Intelligence, to R.B. Horton, Aircraft Board, dated June 11, 1918. RG18.
15. Telegram, Potter to Vincent, June 25, 1918. RG18.
16. Letter, Briggs to Potter, June 28, 1918.
17. Telegram, Hall to Kellogg, June 30, 1918. Probably "low place" meant "two place."
18. Vincent to Potter, 1 July 1918. RG18.
19. Letter, Glenn H. Curtiss to Archer A. Landon, July 17, 1918. RG18.

ACKNOWLEDGEMENTS:

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