The Bennett Aircraft Corporation Model BTC-1 Executive

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The Bennett BTC-1 Executive. The photograph would have been taken on the sales tour of 1938 or 1939 in front of Waco Sales of New York. Site of the photo is not known. Photo: Editor's Collection

Life and Times of the BTC-1

History, and the written record from which history is derived, are written by men. As a result, subsequent research into historical events is often tainted by the intent of the individual who initially recorded it. It is said that history tells us the difference between a patriot and a terrorist is eventually determined by who won. Such is the case of the Bennett Aircraft Corporation Bi-motored Transport Commercial Number One (BTC-1) Executive.

In the ten year span of its known life, the Bennett BTC-1 was identified in print by four different names. In order of reference these were arguably, the Bennett, the Breese Bennett, the Bowlus Bennett and the Globe BTC-1. To paraphrase Sir Winston Churchill, *Never has responsibility for so little been claimed by so many.* How the aircraft was identified at the time of each printing largely depended upon whose axe was being ground.

By the mid-thirties, American light transport aviation was well established in the concept of increasingly higher horsepower multi-engine machinery of all metal construction. By the same token, as sophistication and complexity of the machinery escalated so did the cost.

The airplane that would eventually be called so many names by the publicists was the concept of the aviation entrepreneur F. C. "Bub" Merrill. He foresaw a niche for an airplane with competitive performance with less dependency on extensive tooling and a resulting more appealing price range, ergo smaller engines, and of mainly wooden construction.

To produce that machine, Merrill needed to find a backer for the project. He found him in the person of Frank C. Bennett.

Bennett was, at the time, President of Bennett Oil Corporation, President of Federal Oil of Houston, Texas, and Vice-President of Bennett Oil and Gas of Lake Charles, Louisiana. He was also a major stock holder in several successful foreign oil ventures. In the 1930s, oil companies were frequent investors in the development of airplanes such as the Spartan Executive and often sponsored flights and events highlighting the performance of their products. Considering the possible benefits, and Merrill's obvious salesmanship, in late 1935 the two formed the Bennett Aircraft Corporation of Wilmington, Delaware.

The product was to be a twin-engine (called bi-motored in 1930s parlance), eight-place mid-wing monoplane constructed of plywood impregnated with a phenolic resin compound comprised of carbolic acid and formaldehyde. The resin was patented by the Belgian chemist Dr. Leo Baekland and marketed as "Bakelite." Fine grained plywood, impregnated with the resin, could be formed under pressure and heat by a process invented by Dr. Robert Nebesar and was marketed under the trade name "Duraloid." The result of the combination of the skills of Baekland and Nebesar made possible the development of a "plastic" airplane.

To build the machine, Merrill assembled a design and development team headed up by Art Mankey as Chief

Engineer. Mankey was "borrowed" from the Glenn L. Martin Company. Additional engineering skills were provided by Walter Chaffee, well known for his contributions to the Douglas Aircraft Company. The group was joined by Vance Breese as consultant and designer. Breese was arguably the most highly qualified test pilot of his day. Given the decision that the primary construction was to be of formed wood, there was only one logical choice for the builder of the prototype, William Hawley Bowlus of San Fernando, California.

Bowlus had the reputation and skills as the premier plywood former in the aviation industry. Builder of gliders and sailplanes since 1911, his designs were symphonies of the state of the art of bending and forming wood. The "Big Barn" on the Bowlus Ranch in San Fernando was equipped with the fixtures and equipment it took to develop the structurally strong light weight and graceful shapes of world class high performance sailplanes. Only the size of the BTC-1 offered a challenge to Bowlus and his team.

Bowlus, Breese and Mankey had all worked together before at Ryan at San Diego, California. Bowlus had been the factory manager in the production of the airplane that carried Charles Lindbergh into history, the Ryan NYP *Spirit of Saint Louis.* Mankey was a contributing engineer and Breese flew many of the first flights of the company's products.

When the BTC-1 was completed at the Big Barn it was trucked, partially assembled, to Van Nuys, California, where finally assembly was completed. Flight testing of the airplane was accomplished by Van Breese. On one flight, arguably the first or second, the landing gear would not extend, so Breese bellied it in. Proof of the strength of the Duraloid skin and wooden structure came when it was time to repair the damage. The only replacements required were two bent Hamilton Standard Propellers and the aluminum cowling and landing gear doors.

One of an extremely rare group of photographs depicting the incomplete Executive being built in the Big Barn on the Bowlus Ranch at San Fernando, California. The image was probably exposed in early 1936. Discernable in this view is the 45 degree lay up of the grain of the plywood. Each layer would have been applied directionally opposite to the previous one.

Photo: John Underwood Collection

Proof loading of the wing structure being done with the then state of the art. Sand bags were piled on top of the structure until it failed. Hawley Bowlus is seen on the left. Other people in the photograph are not identified.

Photo: John Underwood Collection

The Bennett further along in the assembly process at the Bowlus Ranch. The engines and landing gear had been installed in the nacelles.

Photo: John Underwood Collection

Airborne…but on a sling. The Bowlus Bennett Executive, as it was then called, being hoisted on the trailer for transportation to Van Nuys airport where assembly was completed. At this point the registration number was NX18960. The photograph was probably exposed late in 1936 or early 1937. The Executive was not granted NC status until November 1, 1937.

Photo: John Underwood Collection

The BTC-1 on the sling, about to be positioned sideways on the truck.

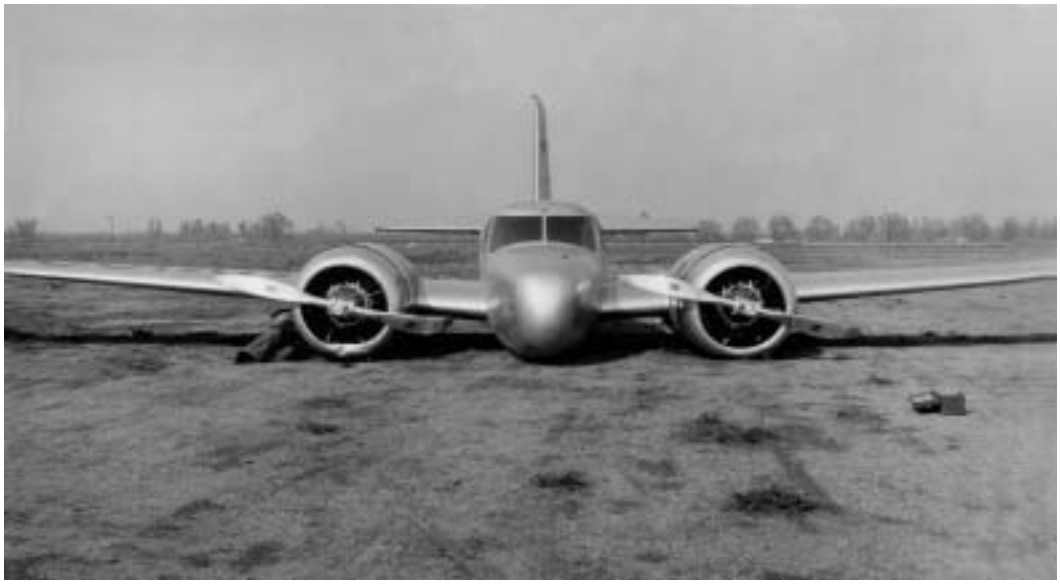
Photo: John Underwood Collection

Tied down and rolling…the Executive is shown on its way to Van Nuys with the rear fuselage and tail hanging out over the road. Art Mankey is shown in the hat on the trailer. From the looks of the traffic behind the trailer the trip appears to have attracted quite a crowd.

Photo: John Underwood Collection

The BTC-1 in primer before the application of the finish colors of cream and red.

Photo: John Underwood Collection



The Executive on its belly on Van Nuys airport after the landing gear failed to extend. The lack of critical damage can be seen in the photograph. The majority of damage is to the aluminum components, not the Duraloid.

Photo: John Underwood Collection

The BTC-1 before application of the finished colors. The view indicates the high degree of finish already achieved when the basic structure was covered and filled as described in the text.
Photo: Gordon S. Williams, Editor's Collection

The Bennett BTC-1 was granted Civil Aeronautics Administration approval number 2-552 on November 1, 1937. The registration number N18690 was assigned.

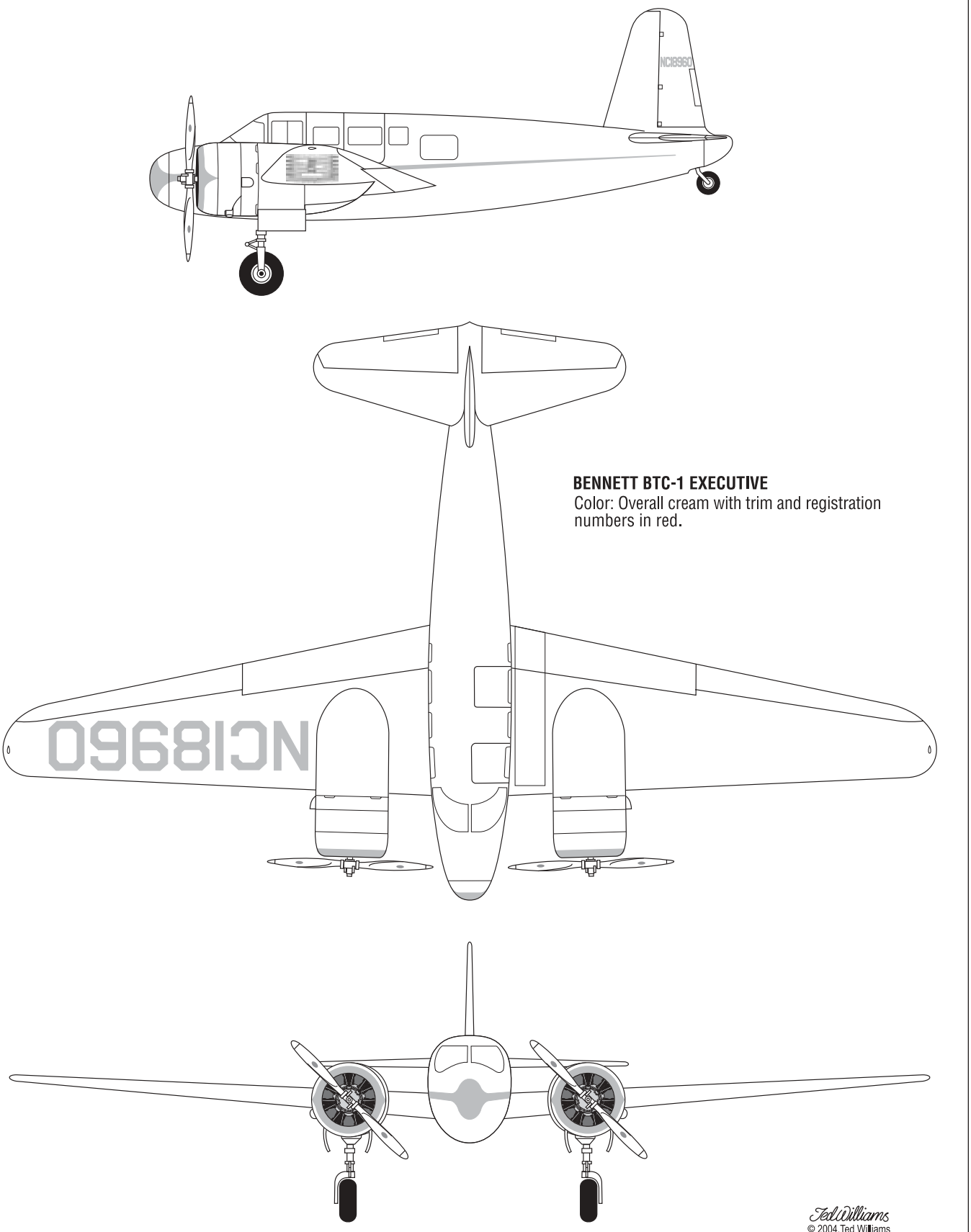
The Bennett Aircraft Company, North Side Station, Fort Worth, Texas, had a certificated airplane but no factory and no sales. The purported cost to that point was $100,000.00 in 1936 and 1937 U.S. dollars. Bennett and Merrill began a sales campaign directed to cities already exhibiting interest in aviation. Among those cities was Fort Worth, Texas.

Fort Worth was the first city in the United States to actually own an airport although the honor of actually coining that phrase falls to another city. Along with that honor came the first city to have an Airport Manager and Aviation Director. An ex-Army enlisted man having served with the aviation branch of the Signal Corps, William "Bill" Fuller was that man. It was a great choice because Fuller spent the rest of his life promoting aviation. Fuller was an attendee at one of the presentations given by Bennett and Merrill.

Enter the immigrant Scotsman John Clay Kennedy. After a lengthy career in cattle sales and the beef industry he settled in Fort Worth. He became partners in a medical pharmaceutical company called Globe Laboratories of Fort Worth. In 1920 Kennedy bought the rights to a serum to immunize cattle from a disease called "Black Leg," an acute anaerobic bacterial disease fatal to most infected animals. Sales of the serum made Kennedy a millionaire. He sold out of the business and retired in 1930.

He spent the next eight years traveling and raising horses. By 1938 he was actively looking for another enterprise to keep him busy. In a chance meeting with Bill Fuller, Kennedy confided his desires. Fuller told Kennedy about the Bennett Corporation and in a short time the Bennett Aircraft Corporation of Wilmington, Delaware, passed into history. On April 9, 1940 the

The extremely smooth finish of the Executive exterior is obvious in the photograph.
Photo: John Underwood Collection



BENNETT BTC-1 EXECUTIVE
Color: Overall cream with trim and registration numbers in red.

Ted Williams
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The BTC-1 Executive.
Photo: Editor's Collection

Bennett Aircraft Corporation of Texas was born. The incorporators of the new firm were Bennett, Kennedy and the owner of a large Fort Worth insurance agency, H. E. Brants.

Kennedy immediately began building an organization of experienced and knowledgeable people from the aircraft industry. The assembled staff represented some of the best minds in the industry leaders such as Curtiss-Wright, Douglas, Lockheed, Martin, and North American.

The "factory" was built on Kennedy-owned property at the junction of Blue Mound and Watauga roads north of Fort Worth. The original structures were the large stables of Kennedy's horse raising days to which was added a large hangar structure. This and subsequent adjacent buildings passed through several hands over the years. At different times it housed Bennett, Globe Aircraft Company, Bell Helicopter Company's Model 47 assembly plant and delivery center and a National Guard storage facility. The building now stands empty and in a decaying state (09-11-04). It is still the largest wooden structure in the State of Texas.

Four years of work had produced a successful design, a factory and a staff and one pre-production airplane but still no sales. Strong efforts had been made to sell the BTC-1 to the U.S. Army Air Corps and the British Purchasing Commission as an advanced trainer but without success. Bennett's death knell was actually sounded by the mechanisms of the federal procurement system. The corporation had everything it took to obtain a government contract but one. It did not have a proven track record of production. As a result, it was not eligible for large scale military contracts. With nothing but expenses on the horizon, the Bennett Corporation declared bankruptcy and went out of the business in 1940.

Late in 1940, John Clay Kennedy, the principal stockholder in the Bennett Aircraft Corporation, emerged from the bankruptcy as the owner of the assets of the firm. Kennedy then formed the Globe Aircraft Company. He also ended up with the BTC-1 which became identified as the Globe BTC-1.

Now enters another legendary aviation personality, R. S. "Pop" Johnson of Fort Worth. The story of Pop Johnson and the piracy of the Culver Cadet is one of the most oft told, if not accurately rendered, legends of the trade. Factually, Johnson joined Kennedy's Globe Aircraft Company organization and succeeded in producing the prototype of the Globe GC-1 Swift. The first GC-1 was produced with wing panels of Duraloid. Then came World War II.

Early in the war, Globe used its Duraloid capabilities to produce various wooden components for major manufacturers such as Beech and Vultee. The practice of the time was to produce non-structural components such as inspection panels and even subassemblies such as seats from formed plywood to reduce the impact on critical supplies of aluminum.

One of the aircraft Globe provided subassemblies for was the all-wood Beech model 56 which became the AT-10 Wichita. In September 1943, Beech transferred the engineering and production of the AT-10 to Globe who eventually built 600 of the aircraft. The Globe production was identified as AT-10GF.

After the war, Globe continued the production of the Swift, now modified to the all metal GC-1A…but then that is another story along with that of Pop Johnson, the Rocket and the Texas Bullet. The BTC-1 was sold off to a private owner.

The BTC-1 has been traced as far as 1947 when it was owned by William Hunt and Company of Washington, D.C. The last known photographs of the machine were exposed by Harry Mutter of Media, Pennsylvania, in 1946. The image depicted the deteriorating BTC-1 at rest at the Limrick (Pottstown), Pennsylvania airport in May of that year.

There then remains the question of importance of the Bennett BTC-1. Probably its most important contribution

to the industry was to serve as a transitional device in the careers of so many people who served in aviation design, development and production over the years. The names of Bowlus, Breese, Johnson, Merrill and Mankey appear time and again as part of the warp and weave of the tapestry of our early 20th century aviation history. It also serves as a proof of the necessary existence of the marriage of the technical side of the industry and the financial as provided by Bennett and Kennedy.

Through the trials and tribulations of the BTC-1, the aviation industry undoubtedly won. So again, whether the BTC-1, by whatever name the reader wishes to identify it, was a success or a failure is a decision of the reader or participant depending upon the grinding of their individual axe.

The BTC-1 also reminds one of a more recent unsuccessful light transport constructed of a new material, the Beech Starship.

The Executive Described

The Bennett Bi-motor Transport Commercial Model 1 (BTC-1) followed the basic design criteria of the 1930s for light transport aircraft. The American design philosophy of the time seemed to evolve around twin-engine, six to eight passenger, monocoque monoplanes. The favored airframe construction of the time was of all-metal duraluminum with flight control surfaces covered with fabric. Favored engines were Jacobs, Wright and Pratt-Whitney. Horsepower ranged from 230 to 450 per side. The one constant throughout the industry was escalating cost.

The Bennett was built "outside the box" in two ways, horsepower versus weight and materials advancement. The principal structural material was Duraloid, a plywood impregnated with resin and processed under a patented process. If the Bennett design criteria proved successful the machine could be driven at competitive speeds with less power at lower manufacturing costs.

Given the dictionary definition of a plastic, the Bennett was the first truly plastic airplane predating the Windecker by at least twenty five years.

Fuselage

The internal fuselage structure of the BTC-1 was one of built-up frames with alignment and load transfer through the medium of routed stringers. The basic frame became the mounting mechanism to which the Duraloid outer skin was bonded.

From existing printed and photographic evidence it is not possible to determine the number and disposition of parting lines of the fuselage skin. However, if William Hawley Bowlus followed his own standard practice, entire sides from upper to lower center lines would have been molded as one piece. The average thickness of the skin would have been one quarter inch with additional laminations providing attaching footprint surfaces for the internal structure. Given the overall use of Duraloid throughout the airframe components it is reasonable to believe the outer skin to structure bonding was accomplished using the same Bakelite based resin.

When the fuselage was fully skinned and mated it was covered with balloon cloth. The current counterpart of balloon cloth would be glider cloth, a lightweight fabric covering material. In 1936 it would have been either cotton or linen doped over the Duraloid skin.

The bonding and filling process would have been accomplished through the use of clear nitrate dope. The filling of the fabric weave would have been accomplished by mixing extra fine sawdust with the clear dope sanded smooth to the desired finish. This same process was followed throughout the aircraft. Some of the earliest comments on the airplane were on the outstanding finish of the product.

With the benefit of over sixty years of hindsight it would appear the interior layout of the fuselage suffered from the same obstruction as some of the earlier

A full left side view of the Bennett Executive. This view shows the location of entry into the cockpit and cabin. Also visible is the outline of the door providing outside entry into the baggage compartment aft of the cabin. The overwing entry to the cabin might have been problematical to female passengers in skirts.

Photo: Editor's Collection

The BTC-1 showing the cabin and cockpit doors in the open position. The centerfold device of the doors is evident.
Photo: Editor's Collection

Lockheeds. The mass of the main spar and its related hump virtually separated the cockpit from the cabin. This necessitated two different entry doors requiring overwing access. Portable stairs would have been required for the assistance of female passengers dressed in skirts.

Wings

The wing structure of the BTC-1 has been described with arguable technical accuracy. Depending on the text available the material selection could vary from all Duraloid to a mixture of that material and untreated aviation grade plywood. Given Bowlus's penchant for consistency and the proof of concept basis for the production of the aircraft, the all-Duraloid construction seems most likely.

There is no photographic or descriptive text indicating the wing to have been other than a fully monocoque cantilever structure. Available information is generally in agreement that the main spar of the wing was fabricated as a full span tapered box. To this box spar was attached a formed leading edge resulting in a full span D-cell. The ribs were bonded to the aft face of the spar and upper and lower wing skins. This method of assembly would have resulted in a strong, light structure.

The flap structure followed the same format as the wing including the covering of the upper and lower surfaces with the impregnated plywood.

Aileron structure varied only in being fabric covered.

Empennage

The vertical fin and horizontal stabilizers were fixed cantilever structures. Their construction followed the same practices as the wing structure. It was noted that additional thickness at the leading edge was added to the stabilizers as protection from rock and foreign object strikes brought about by the tail wheel configuration of the aircraft.

The rudder and elevators were of the same construction but were covered with fabric. Directional and longitudinal trim was accomplished through trim tabs adjustable from the cockpit.

It should be noted that while Vance Breese was primarily referred to as the test pilot he was also acknowledged as a contributing designer of the Executive. The empennage of the BTC-1 was almost certainly a Breese design. When compared with the configurations of the Breese-Dallas, the Vultee model V-1, and the Vultee model 51, which became the BT-13 and 15, the planforms and ratios are virtually the same. Breese engineering skills contributed to all of those designs.

Powerplant

The Executive was equipped with two 285 horsepower Jacobs seven cylinder L-5 radial engines. However, many of the performance figures quoted by the Bennett group were based upon anticipated performance of the aircraft using Jacobs 300 horsepower L-6 engines. Sales information provided also mentions anticipated use of the Wright R-760-E Whirlwind of 350 horsepower. There is no record of installation of either of the larger engine choices.

The propellers were two-bladed Hamilton-Standard controllable pitch with the published option of constant speed units of the same manufacturer.

The engines were mated to the nacelles through standard practice welded steel tube engine mounts. It is notable in the era of the use of mild steel such as the 10 and 20 series for aircraft structure that the Bennett specifications called out the use of 4130 Chrome-Molybdenum tubing and flat stock for the steel structures. It is reasonable to assume that load bearing members of the mount system extended far enough to transfer the torsion and tension loads into the main wing structure.

Landing Gear

The fully retractable main landing gear was constructed of welded steel and flat stock structures providing for single fork mounting of Goodyear low

pressure tires which took up part of the landing shock loads. The majority of the landing loads were absorbed through air-oil struts providing eight inches of travel. Landing loads were carried to the main wing and nacelle structures by welded steel transfer members.

Landing gear retraction was hydraulically provided by an engine driven pump with emergency extension provided for by gravity and a manually operated hand pump in the cockpit.

The aircraft was equipped with a full swiveling tail wheel. There is no mention of the auxiliary wheel being retractable.

Accommodations

As previously mentioned, the cockpit and passenger cabin were separated by the passage of the main wing spar.

The cockpit provided seating and controls for two; however, the right hand controls were noted as being easily removable, allowing for the substitution of a seventh passenger in lieu of the additional pilot.

The passenger cabin provided seating for six in various configurations.

There were provisions for luggage stowage in the aft cabin and in a smaller compartment in the nose of the aircraft.

Doors

Both the cockpit and passenger cabin were entered from the upper surface of the wing center section. Access was accomplished through the use of bi-fold doors latched at the bottom. Both doors were equipped with a center hinge allowing the doors, when opened, to lay folded onto the upper surface of the fuselage.

Finish and Appearance

The aircraft was painted in overall cream with trim lines and number in red. The outstanding feature of appearance was its smooth skin and excellent finish, a virtual trademark of William Hawley Bowlus.

General Description

Wing Span	48 ft 2 in
Length	30 ft 6 in
Height	9 ft 5 in
Wing Area	302 sq ft
Gross Weight	6,908 lbs
Useful Load	2,392 lbs
Certificated Maximum Payload	1,584 lbs
Wing Loading	22.8 lb/sq ft
Power Loading	11.5 lb/hp
Fuel Capacity	200 gal
Oil Capacity	13 gal

Performance*

High speed level flight	206 mph @ s/l
Cruise speed	196 mph @ 8,000 ft
Rate of climb	1,480 ft/min @ s/l
Service ceiling	22,500 ft
Landing speed	54 mph
Single engine ceiling	9,000 ft
Single engine cruise	145 mph
Takeoff distance	750 ft @ s/l
Fuel consumption/cruise	32.4 gal/hr

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*Manufacturer's published figures.

Acknowledgements

To the aviation historians, artists, editors, and publishers who give of their talents and skills to the capture and perpetuation of our heritage, I offer my appreciation. Without their contribution to our collective memory, much of our lesser known history would be lost forever. Sadly, given the nature and age of many of the publications used in the research of this piece, even the names of most of the chroniclers have passed into destiny. To them this is dedicated.

Research sources resulting in this piece are, but not limited to: The personal memories of Mrs. Ruth Bowlus, Raul Blacksten and Edgar Seay, Sr.; the archives and photographic collection of John Underwood; the generosity of Dan Hagedorn of the National Air and Space Museum and David Ostrowski, Editor of *Skyways*; and to the texts of *The Globe/Temco Swift Story* by Stanley G. Thomas; *Aviation Magazine*, September 1938; *Antique Airplane News*, 4/1975; *Aviation Year Book for 1937* and Harry Mutter…wherever you are.

I owe a special debt of gratitude to my son, Michael Maupin. Without his imaging skills this project would not have been possible. ■

The BTC-1 Executive. Photo: Editor's Collection