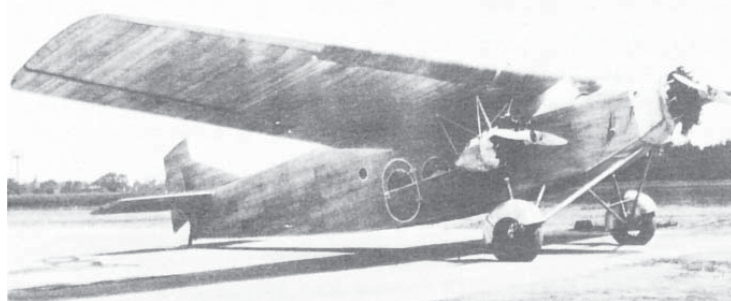
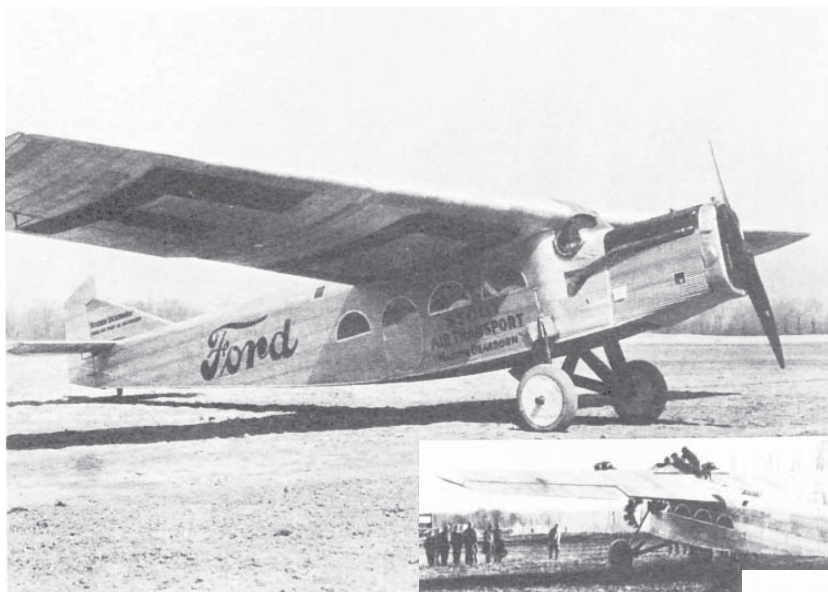


WHO DESIGNED THE FORD TRIMOTOR?



"For years we have heard and read statements saying William B. Stout designed the Ford Trimotor. In June 1953 there was a seven-page article in *Popular Mechanics* called "Those Fabulous Flying Fords," as usual naming him the designer. It was then that I felt this myth had gone too far for me to keep silent any longer. I immediately wrote a letter to the editor of *Popular Mechanics* describing how I designed the Ford Trimotor, affectionately called the "Tin Goose." The managing editor wrote to Mr. Stout explaining the confusion resulting from my letter, and requested a reply from him. I understand this started quite a furor behind the scenes. As far as I know, he left the matter as ambiguous as ever. But he never said he did design it!"

The above is the introductory paragraph of a talk presented with slides, and tape recorded, at the Third Northeast Aero Historians meeting, of which the American Aviation Historical Society was one of the sponsors, held at the Van Curler Hotel, Schenectady, New York, on October 27-29, 1967. The address was given by Mr. Tom Towle, entitled "Designing the Ford Trimotor."

The career of Tom Towle literally spans the age of powered flight, since his inspiration and interest in aircraft began almost with the dawn of the age, from seeing the Wright Brothers fly their airplane in the fields near Dayton in 1904. He was born close to the shop of the Wright Bicycle Co. and used to take his bicycle there to have it fixed by Wilbur or Orville or Charles Taylor.

Mr. Towle graduated from Yale University in 1920 with an M.E. degree and, by early 1921, was working at the Dayton-Wright Airplane Co., then headed by Orville Wright, E.A. Deeds, Charles Kettering and H.E. Talbot, beginning in stress analysts under Kenneth Lane.

Over the next several years he put in brief stints at McCook Field, and at Glenn L. Martin Co. and Aeromarine Plane & Motor Co. as the contracts for airplanes favored one company and then another. In 1924 he joined the Stout Metal Airplane Co. In the following pages he describes, in his own words, his connection with the famous Ford Trimotor and how the design evolved, as he saw it.

A contemporary account, from another participant on the Ford scene at the same time, Mr. John G. Lee, is presented as the second half of this review of "Who Designed the Ford

Trimotor?" It is interesting to note that the areas of close agreement provide a highly colorful description of Mr. Henry Ford and his operations in this era just preceding the great boom in air travel that was to be opened by the Ford Trimotor and other great transport airplanes.

As Mr. John G. Lee has pointed out in the accompanying article (see page 187), a successful enterprise is a desirable connection, and a third party who claimed considerable responsibility for the success of the Ford Trimotor design was Mr. Harold Hicks. We do not have direct testimony from Mr. Hicks, but his claims were set forth in an article in the *Dearborn Historical Quarterly*.¹

That the Ford Trimotor had great impact on the growth of air transport is indisputable. In the period from 1926 to 1934 the Trimotor became the mainstay of a number of American airlines whose descendants are in existence today. After that, the "Tin Goose" became the most ubiquitous of all - it established a legend only surmounted by its replacement, the "Gooneybird." Ford Trimotor is still synonymous through the world with nostalgia.²

It is apparent that no one person could have been entirely responsible for the development of the Ford Trimotor. But this inside story, from two great men who were there and can write about it objectively from passage of time, is an account of intrigue, foibles, great and small personalities, and the agony of birth of a great enterprise.

We take up Mr. Towle's story where he was describing his first connection with the central figures in the Stout Metal Airplane Co., later to be absorbed by the Ford Motor Company.

Note: This article originally appeared in *AAHS Journal* Vol. 15, No. 3, Fall 1970.

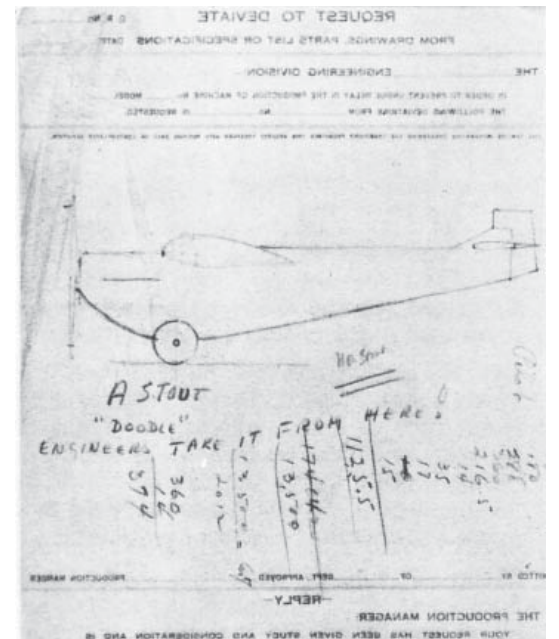
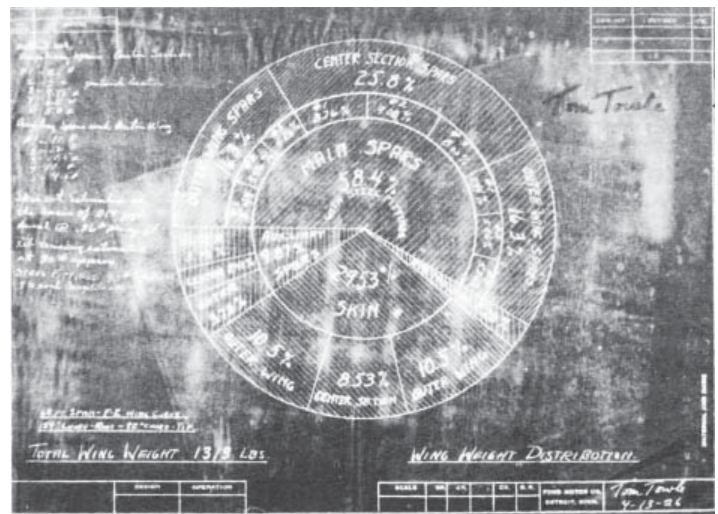


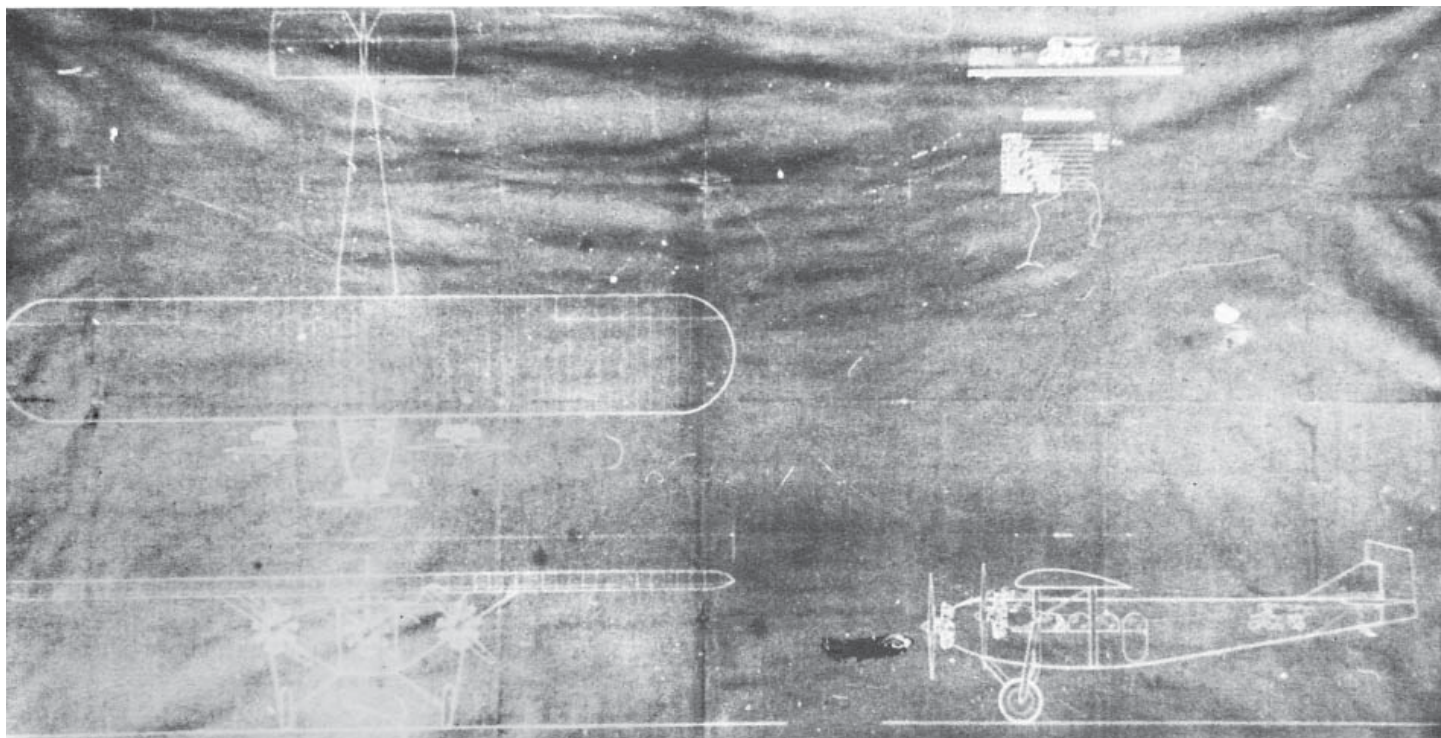
Above: The prototype 4-AT-1 with Wright J-4 engines of 200 hp and Curtiss-Reed propellers at Ford Airport, sometime between its original wing planform and the modification which moved the ailerons aft. Revision of landing gear to final configuration had not yet taken place.

Photo credits previous page - Upper left: The Stout Air Pullman, one of several MAIDEN DEARBORN'S, from Ford Motor Co. courtesy of Alex Reinhard. Center: The ill-designed 3-AT-1 of 1925, from Ford Co., courtesy of Stephen J. Hudek. Right: The prototype 4-AT-1 from Ford Co., Negative No. 3435 dated June 5, 1926, courtesy of Hudek.

Right: The Wing Weight Distribution diagram prepared by Tom Towle, dated 4-13-26.

Below left: the Aeromarine AM-1 Mailplane and its design staff, in a photograph dated 8-21-23. Tom Towle is at extreme right. The photograph at right, below, shows a Stout "doodle" saved for posterity by Tom Towle, the equivalent of the storied "design on the back of an envelope." Actually the back of a change request form, Towle added the notation, "A Stout 'doodle'; engineers take it from here," as being typical of Stout.





Photograph of a drawing of one of the versions of Trimotor designs drawn by Towle showing straightwing, above-fuselage concept, circa late 1925.

DESIGNING THE FORD TRIMOTOR

By Tom Towle

Starting from 1924, when I arrived, until near 1927 when I left to start my own company, the “cast of characters” involved in design and engineering at the Ford Airport included, beside myself: Mr. Ford, William Benson Mayo, William Bushnell Stout, George Prudden, Harold Hicks and Maj. R.W. Schroeder.

Mr. Stout was a very likable man, a college freshman dropout because of eyes. He was not an engineer, but a good inventor, writer, speaker, story teller, sketch artist, cartoonist, promoter, and salesman. He started in the early twenties to initiate the designing and building of a series of “Bat-Wing” Prototypes. Unfortunately, all were doomed because the tail surfaces adjacent to and behind the huge wing chord were blanked in landing, and in maneuvers in general.

George Prudden, with a good civil engineering background, was making a preliminary design, single-handed, for the Stout Air Pullman late in 1923. In 1924 I was brought in to help him with stress analysis, weight computation, drafting and design. George Prudden was chief engineer (of the Stout Metal Airplane Co.) and I was glad to take orders from him. *He* was the designer of the Stout Air Pullman. Most of the time there were only the two of us in the engineering crow’s nest under the high roof. Besides stress analysis, much time was spent on substituting formal drawings for many free hand pencil sketches used in the shop. Almost no parts were interchangeable and production was (to be) increasing in the summer of 1925.

In May 1925, Mr. Prudden told me we were to do the design and stress analysis necessary to fit an Air Pullman with three Wright J-4 engines, in place of the single Liberty. Using Mr. Stout’s freehand sketches for the general configuration, we concentrated on these changes. No change at all was allowed in the wing span or shape; contrary to his (Stout’s) autobiography. Temporary draftsmen were hired from time to time to help out.

Three or four Air Pullmans were being used on the Ford Motor Company’s private freight airline between Dearborn and Hammond, headed by Maj. R.W. Schroeder, formerly chief test pilot for the Army’s McCook field at Dayton. He hired fighter pilots from Selfridge Field for the airline. When *he* spoke, Mr. Ford and Mr. Mayo listened.

When I first began to work at Stout Metal Airplane Co., I was amazed to find that the Air Pullman had a low-lift wing shaped like a streamlined strut, maybe an NACA 81, and engine mounts made of riveted sheet aluminum. A disassembled corrugated German Junkers was stored up in the roof trusses. The Ford Airline people eventually reported fatigue cracks in the Air Pullman engine mounts, and I told Schroeder and Stout. Stout was unconcerned and ordered no change. Schroeder was worried. I had taken some aeronautical engineering courses at the Army’s McCook Field in Dayton at the same time Major Schroeder was chief test pilot. We agreed that I should substitute chrome moly steel tubing. So, without Mr. Stout’s approval, I designed, had made and installed a steel engine mount on

Schroeder's Dearborn-Hammond airplane. There was no love lost between Schroeder and Stout. Stout was infuriated when he found out.

Early one September morning, I was called down to Mr. Stout's office. In the presence of Stout and his business manager, Mr. Knauss, George Prudden said, "Towle, you're fired!" I made no answer, and went up under the roof to pack up. The news travelled fast. Within a few minutes Major Schroeder had come over from Mr. Ford's laboratory and stood, out of breath, and asked "What happened?" "I got fired." All he said was "Well, I'll be . . .," and went back to Ford lab about 600 yards away. In my room that evening, Major Schroeder, with his accordion, tried to cheer me up.

Incidentally, Schroeder and I were justified in making the engine mount change, because a couple of months later the engine nearly fell off an Air Pullman during a landing.

The day after getting fired, I got word to come over to Mr. Ford's farm laboratory, and found that I was the first to be hired in what was to become the Airplane Division of the Ford Motor Company. I was provided a drafting board and desk in the empty south half of Mr. Ford's lab, far away from anyone. Parked on a small area of beautiful, polished maple floor were about 15 to 25 current foreign and domestic automobiles that Mr. Ford pondered over, alone, from time to time. Also in one corner was a space curtained off to the 30 foot ceiling, about 100 by 130 feet, which served as Mr. Ford's square-dance floor. Fiddlers many times would practice all day. They punched time cards like the sweepers. It appeared to me that the number of personnel in the lab was at maximum around 50 at times, of

which 20 were sweepers.

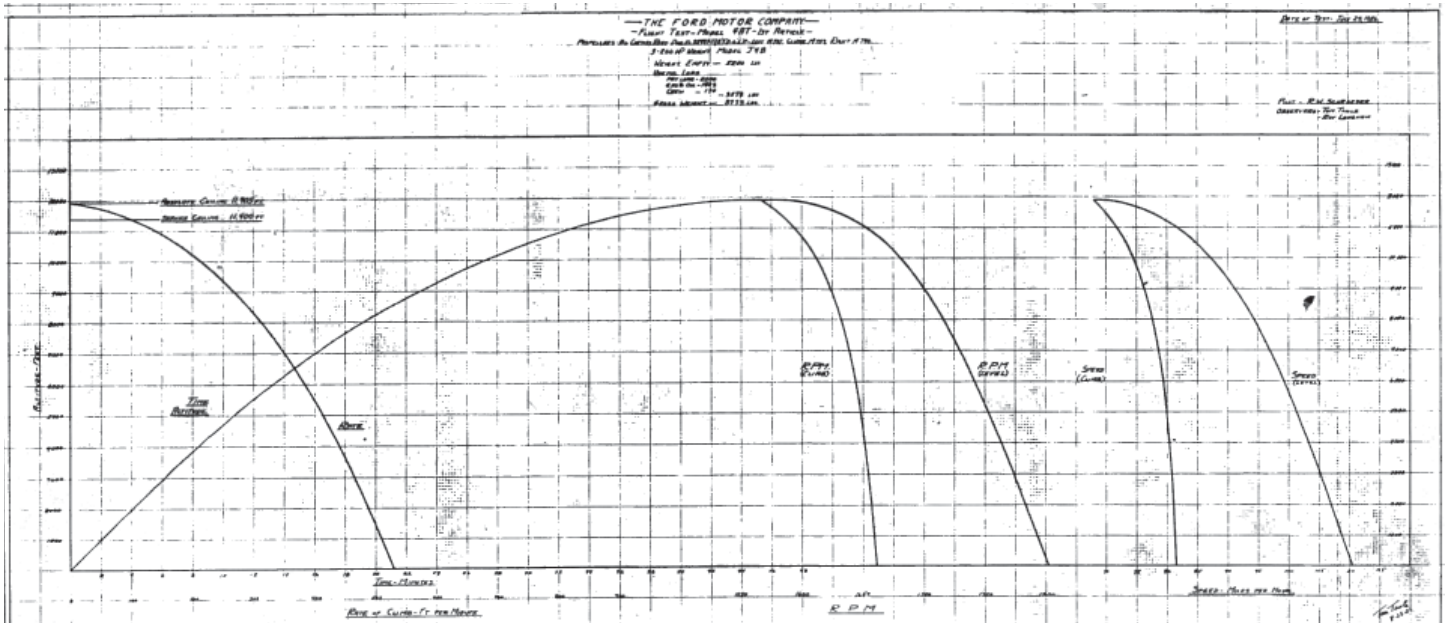
I found Mr. Ford's laboratory out in the country quite different. Mr. Ford disliked and avoided college graduates. We kept it quiet. He would not permit titles of any kind. Mr. Mayo had the only title, and the title of chief engineer of the Ford Motor Co. was given him by the newspapers, not by Mr. Ford.

With no titles, it was impossible to know who your boss was from one week to the next. Although I tried to cooperate with everyone, I took orders only from Mr. Mayo. But I consulted with Major Schroeder.

Because Mr. Ford's laboratory was on Mr. Ford's farm, it was controlled by Mr. Ford's "Back Door" gang, a group made up of his farm manager and others without much talent, but who Mr. Ford had trusted over the years. They "snooped" for Mr. Ford, and protected him. The sweepers were told they were not sweepers but instead were "detectives" and must report everything. I asked one of the "Back Door Gang" why Mr. Ford always shook hands with everyone. I was told, "So they can't shoot him!"

I worked alone for several months, and kept myself busy investigating design changes to improve on the Air Pullman design, especially that of the low lift wing. The pilots had no love for this airplane's sluggish takeoff. I calculated its performance with different wing sections from wind tunnel reports.

One of the wing shapes I designed was a combination of airfoils similar to a Gottingen 387 root with a USA 27 tip. The airfoils had to be altered to get them to "blend" together structurally but, for this and other reasons, I could not use their



This flight test report, signed by Tom Towle and dated July 23, 1926, includes the following information:

Flight test - Model 4-AT - 1st Article
 Propellers - All Curtiss Reed Dwg. Ea. 32997-77; 8'9"D.-6'5"P.
 Left M737, Center, M739, Right M740.
 3 - 200-HP Wright Model J4B
 Weight empty 5200 lbs.
 Gross Weight 8773 lbs.
 Pilot - R.W. Schroeder
 Observers — Tom Towle
 - Roy Langham

Absolute Ceiling 11,900 feet. Service Ceiling 11,400 feet.
 Time to Service Ceiling — 36 minutes, time to Absolute — 44 minutes.
 Climb speed dropped from 82 mph at sea level to 68 at Absolute Ceiling.
 Level speed dropped from 110 mph at sea level to 70 mph at Absolute Ceiling.
 RPM dropped from 1800 at sea level to 1575 at Absolute Ceiling.

Editor's Note: Chart image reverse (negative) of original for clarity.

wind tunnel test (results) for performance calculations. The combination just looked right to me, and I used it later when designing the Ford Trimotor prototype.

Incidentally, this wing shape was not wind tunnel tested until 1928, after it had already proven itself. As I said I had some tutoring under Col. V.E. Clark at Dayton-Wright Co. on designing airfoil sections and didn't worry about modifying some wing sections within certain limits.

I can best describe the wing by saying it was of the Gottingen 387 type for the root section. It was not exactly the "387," but it had flat bottom contour, no camber. The tip airfoil was not the "USA 27" but was of that type; it did have camber, (and) a three-degree "wash-in" at the tips.

Mr. Mayo had many associations in aviation's financial world, and was convinced that the multi-engined airplane had to come. During those three or four months I made several three-view drawings of three-engine transport planes for study: straight wing, taper wing, metal wing, fabric wing, and many combinations. I designated these different versions the 1-AT, 2-AT, and 3-AT, and still have blueprints of one, the straight wing.

The grapevine told me the three-engine Air Pullman was going to get its first flight. Major Schroeder was to fly it in late November 1925. Mr. Ford and Ford "brass" were there. I stayed away from the Stout crowd, but could see the whole show. Overcast day. Cold. The takeoff. Smiles. Then almost immediately, coming back to land, and in landing, it dropped like a polished brick, from about 30 feet, and bounced about 30 feet in the air again. Schroeder apparently anticipated it for he gave full throttle to all three engines at the start of the drop. What a landing gear! He flew around again and landed, "engines on."

I was told Schroeder was so mad at Stout, he could only sputter. Mr. Ford quietly suggested he come over to his house after supper. What Schroeder put into Mr. Ford's ears, must have been plenty. Mr. Ford, always suspicious, had another pilot fly it. The report wasn't good.

Unexpectedly, one Friday in January 1926, Jimmy Smith, one of the "Back Door Gang," told me to go over to the Ford-owned Stout Airplane Division factory Saturday afternoon after work when no one was there and get all the drawings and take them over to Mr. Ford's farm lab. A pick-up truck would be at the factory to help me out. This I did.

The next Monday morning on the *Detroit Free Press* front page was a large picture of the Stout Division factory completely gutted. The only traces of the three or four airplanes, including the three-engine Air Pullman, were the steel parts on the floor in all of their correct relative positions. My own opinion was that much gasoline was used in the fire, and the heat was so intense there was left not a trace of solid aluminum. The floor was covered with gray ashes. Everyone at the factory was laid off, indefinitely. There was little talk about the fire because there was little doubt who had the factory burned, or why!

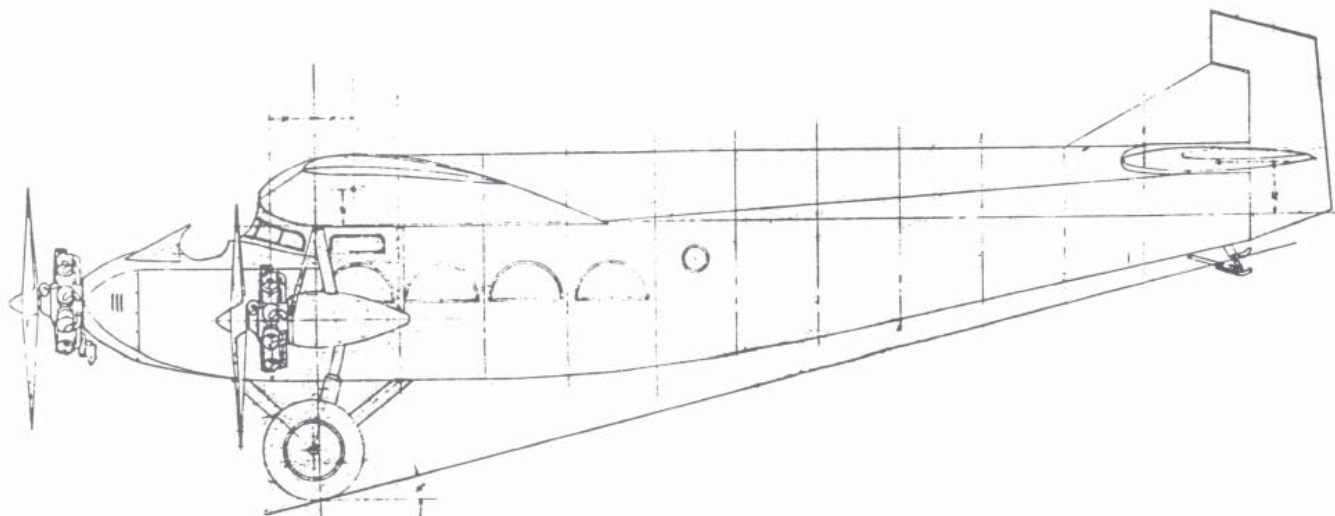
Monday, January 17, 1926. The factory, gone. The airplanes, gone - even the three-engine Air Pullman. Nothing was left of Mr. Ford's attempt in the airplane business, but bad experience and expense. Mr. Mayo had escorted Mr. Ford into this airplane business. Would Mr. Ford blame Mayo? Would it be the end of Mayo? Mayo must have been desperate.

The next day Mr. Stout came to the empty south half of Mr. Ford's laboratory with a roll of craft paper, a hammer, glue, some sticks, etc., and started to make a wood and paper mock-up on the floor near my lonesome drafting board. He worked only an hour or so and took off.

I DESIGNED THE FORD TRI-MOTOR THREE VIEW DRAWING WITH CLOSED COCKPIT, BUT THE TEST PILOT AND I KNOWING WE WOULD RUN FIRST FLIGHT TESTS DECIDED ON A CELLULOID WINDSHIELD AND AN OPEN COCKPIT, AS WELL AS SEAT TYPE PARACHUTES. THIS SIDEVIEW SHOWS MY CLOSED COCKPIT GRASSED AND THE CELLULOID SUBSTITUTE (SEE FLIGHT TEST CHARTS FOR 1500, 2000 & 2500 LB. PAYLOADS)

Tom Towle

Towle's concept of the Trimotor design, shown in this sideview layout, was prepared in late 1925 and dated Jan. 6, 1926.



Mr. Mayo appeared, alone, shortly thereafter and told me to start immediately to design a three-engine transport. Special! Rush! Pull out all stops! I protested because Mr. Stout too, had in July 1925 become a Ford employee and I assumed he would be my boss again. I had visions of having to duplicate the three-engine Air Pullman. The wood and paper mock-up indicated it. Also, I had seen Stout's seven page proposal, after the fire, to immediately build another similar trimotor Air Pullman, apparently directed to Mr. Ford. The brown printed cover (of my copy) reads, "Henry Ford & Son, Inc. Street Car Department." On page three is a side view of the proposed airplane. It is signed and dated on page seven: "Wm. B. Stout - Jan. 22, 1926." Six days after the fire.

Mr. Mayo promised me a "free hand" and "no interference from Mr. Stout." I don't recall seeing Mr. Stout in Mr. Ford's laboratory after that. Stout's proposal to Mr. Ford and Mayo had forced their decision to keep him out of airplane designing. He went on a speaking tour and when he returned, was put on the job of starting a commercial airline from Dearborn to Grand Rapids, the Stout Airlines.

I was alone, as usual, for another week or so, recrystallizing and reviewing my three-view drawing, recalculating wing area, tail location, tail areas, arrangements so there would be no interference, rough performance calculations, etc. This was the chance to use my airfoils. Several times Mr. Ford came by and leaned on my drafting board, asked some questions, and drew some detail. I still have these freehand sketches.

After getting approval from Major Schroeder, I called for center-engine instruments to be on the dash and the outboard engine instruments installed on their respective engine supports facing the pilot to simplify and eliminate equipment that could go wrong. All tail surface controls were on the outside to facilitate daily inspection and eliminate pulley jamming. The dual wheel control column cross-tube extended outside the fuselage to the elevator cable control horns welded thereto. The stirrup type rudder pedal cross tubes also extended outside to the rudder cable control horns.

The landing gear included long travel rubber bungee stock absorbers, attached to and below the engine mounts which in turn fastened to the wing at the center section attachments. The 200-hp Wright J-4 engines had just appeared on the scene. Lindberg had not yet proven their reliability. These seemed the best available at the time. I planned a collector ring only on the center engine. Stacks on the outboard engines. A simple steel shoe, rubber shock absorber type swivel tailskid to bring up the rear.

I had finished the three-view drawing and I soon needed some help, and got two auto-body draftsmen. Sometime later I asked for someone to help me with detail drawings and to check my calculations. In airplane design, checking one's own figures is hazardous! Three fairly recent MIT graduates appeared.

Here I must hash back to near the time Mr. Prudden fired me for Mr. Stout. The Ford "Back Door Gang" was full of tricks, including how to get rid of the Johnny-come-lately's. Prudden was still working on the three-engine Air Pullman. Mr. Ford was concerned with dirigibles, too, and had a mooring tower built at one end of the Ford Airport. The Shenandoah had

crashed south of Columbus, Ohio, in the autumn of 1925 and Prudden was sent to get first-hand information. Mr. Ford didn't like his employees talking; except to himself or his employees, and especially not to newsmen. In Ohio, Prudden did talk to reporters, and got his name in the papers. And besides, the "Back Door Gang" knew how Major Schroeder felt about Prudden's firing me only a short time before. He was immediately fired. This illustrated how the "Back Door Gang" operated.

That left Mr. Stout with no aeronautical engineers to design for him, and he lost no time recruiting three. I had been preoccupied with trying to settle on a suitable three-engine transport (design), and was not aware they were working for Stout, at least not until I asked for help to rush ahead on the Trimotor prototype after the fire.

They arrived singly and I put them to work: Otto Koppen on the tail skid; John Lee on the wing structure; and James McDonnell on - I don't remember. Anyway, I do remember I had to fire McDonnell because he had a habit of falling asleep on his drafting board too many afternoons at about 1:30, when Mr. Ford usually came along after lunch, with Edsel. They would sit together in the front seat or on the running board of a car in sight of our drafting boards. Mr. Ford did most of the talking, and Edsel listened; it was the daily tutoring session and Ford worked hard on Edsel.

Koppen stayed only a few weeks and disappeared from my group. Harold Hicks and the "Back Door Gang" hid him away to design a single-place single-engine fliver airplane now in the Ford Museum. Hicks was kept busy designing an air-cooled engine for it. Koppen is now a professor at MIT. I understand that Hicks headed up Mr. Ford's last aviation effort by designing a three-engined monster that fortunately they didn't try to fly.

I called this airplane the "Model 4-AT" because, as mentioned above, I had already drawn up three different trimotor transport configurations for Mr. Mayo after I arrived in Mr. Ford's lab, and this new one was the fourth in the series. Some years later, Mr. Stout began calling his Air Pullman the "2-AT," and his 3-engine Air Pullman the "3-AT." This fostered the impression that the "4-AT" design was one of a series of his airplanes, when actually it was an evolution of my previous design series.

Refinements, as on nearly all new designs, were continuous: rounded wing tips, cabin changes, etc. I remember I had a hard time convincing the sheet metal workers that my design for the curving transition line between the round nose-engine cowling and the rectangular fuselage could be built. Then in 1927, I left Ford's Airplane Division to start my own company. John Lee stayed on; improving the design. He did a fine job.

I started the Towle Marine Aircraft Engineering Co. in Detroit. After a year or so, Mr. Mayo helped me raise \$250,000 to incorporate the Towle Aircraft Co., a lot of money in those days, and he became chairman of the board. George Holley of Holley Carburetors was president. ➔

REFERENCES

- 1 Bombard, Owen. "The Tin Goose," *Dearborn Historical Quarterly*, Vol. 8, Nos. 1-2 (May 1958), published by Dearborn Historical Society, Dearborn, Mich. It states, "Harold Hicks . . . was now placed in control of all aviation engineering . . . Hicks was instructed to begin a completely new design in the Dearborn Engineering Laboratory. . . . Hicks directed Towle to bring all blueprints from the airplane factory to the Dearborn Engineering Laboratory where a new design was already under way." And later (after the fire of January 17, 1926), "Harold Hicks now in full charge of aviation engineering, had as his principal assistant Tom Towle . . . Hicks later declared 'I relied on Tom Towle principally in the design of that ship.' John Lee, a capable graduate from MIT, was placed in charge of the wing while other engineers and draftsmen assisted in the details."
- 2 Larkins, William T. *The Ford Story*. Wichita: The Robert R. Longo Co., Inc., 1957.
- 3 At this period of Mr. Towle's discussion, the Ford Motor Co. had purchased the Stout Metal Airplane Co., effective at the end of July 1925, and it became the Stout Airplane Division of the Ford Motor Co., as related in Larkins.
- 4 See description of Mr. Ford's animosity to the name Stout Airplane Division of Ford Motor Co., by John G. Lee, page 190. The Airplane Division of the Ford Motor Co. was a separate entity from the Stout Airplane Division.
- 5 Telephone conversation, Mr. Towle and J.J. Sloan, Editor, July 5, 1970.
- 6 James S. McDonnell, in 1970, Chairman of the Board and Chief Executive Officer, McDonnell-Douglas Corporation.



About the Author

Mr. Towle went on to design and build several amphibians; joined the Lambert Aircraft Corp. for design of the Monocoupe, became chief engineer of the Hudson Motor Car Co., and ultimately vice president of Church & Dwight Co., makers of Arm & Hammer products, and only recently retired. In the picture at left he is shown, while at Lambert Corp., with Charles Lindbergh.

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Please include brief author's biography written in third person, together with author's photo.

When the transcript of the talk by Mr. Towle became available, it was shown to Mr. John G. Lee, who had had a part in the engineering of the Ford Trimotor in the same period. He had stayed on at the Ford Motor Co. until the end of 1926, and was engaged in redesign work on the wing, and in cleaning up some of the design of the Trimotor as it went into production.

Of Mr. Towle's account he said, "It is a fascinating story, (but) there is a fair amount of which is not known to Mr. Towle. With your permission I would like to take a little time for this, as I think it is important to get the record straight. The old Trimotor was a turning point in American aviation. The skill, the luck, and the mistakes of its designers, and above all the extraordinary methods of the Ford Motor Co. at that time represent a fascinating relationship. I'll . . . try to give you an unbiased account.

As a result the following article by Mr. Lee arrived, entitled:

WHO DESIGNED THE FORD TRIMOTOR?

EARLY DAYS OF THE FORD TRIMOTOR

Recollections of a Participant.

By John G. Lee

Whenever a project or device is notably successful, everyone connected with it likes to take credit for being its originator. The Ford Trimotor was no exception. Usually credited to William B. Stout, who was certainly the initial driving force, it was generally assumed that others were also involved, for neither Mr. Stout nor the Ford organization ever produced another really successful airplane.

I have before me the brief paper by Tom Towle entitled "Designing the Ford Trimotor," which was originally given as a talk, and tape recorded. In this paper Mr. Towle takes much of the credit for designing the Ford Trimotor. Since I was employed by Mr. Stout and the Ford Motor Co. and assigned to the Trimotor, I was much interested in Mr. Towle's account.

However, I was also greatly distressed; for while many of the things Mr. Towle mentioned fitted with my memory very well, there were others that seemed not to fit at all. Finally I came to realize that many of the discrepancies between Mr. Towle's account and my recollections might be explained by the peculiar organization of the Ford Motor Company. This organization in the 1924-27 period was still a monolithic dictatorship, with Henry Ford at the top. Only two other men were ever mentioned; one was Henry's son Edsel, who was vice president, and the other was William B. Mayo, chief engineer. Nobody else in the company had a title.

As in any other dictatorship there were cliques and factions. Whichever clique had the confidence of the boss was in control. So there was constant jockeying for power, no end of secrecy, spying and power politics, all the way from the top to the humblest draftsman. One's future might depend upon which clique had access to Mr. Ford at any given time. However, if one's work was outstanding, and the project itself of importance, one might be courted by several different cliques or their sub-groups, and this was also a tricky business. It happened that Tom Towle and I, through circumstances beyond

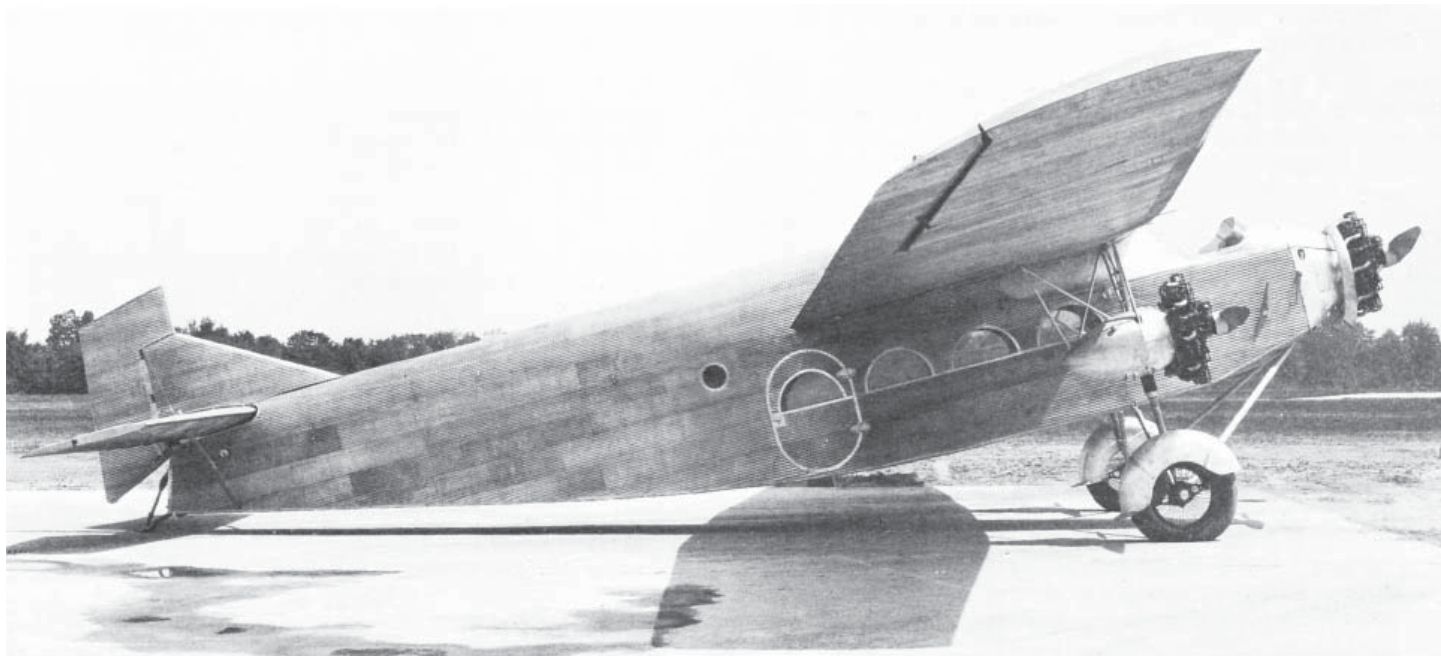
our control, were usually in different cliques. So we often saw the same events very differently.

One thing I think we can agree on is who the principal individuals that played key roles in the actual design of the Ford Trimotor. Aside from Mr. Ford, I believe there were five. They were William B. Stout, George Prudden, Tom Towle, Maj. R.W. Schroeder, and myself. There were others, such as Mayo, Koppen, McDonnell, Hicks, and Karcher, to name a few, who certainly contributed, but they were not key figures for any appreciable time during the critical months when the airplane was designed and put into production.

Perhaps, before we try to assign credit amongst these key men, it may be enlightening to try to catch the flavor of those early days, the habits of mind and custom that then controlled the Ford Motor Co. and all connected with it. So I have written the events as I remember them, helped in many places by Mr. Towle's paper. Professor Koppen was also kind enough to look over a draft of this paper and add his comments.

To go back a bit, I graduated from MIT in the spring of 1921 in Mechanical Engineering, and followed this with a Masters degree in aeronautics in 1922 under Prof. Edward P. Warner. The next year I was an instructor in drafting and other odds and ends, also under Prof. Warner. James S. McDonnell was one of my students; Otto C. Koppen was another. The following year Koppen took over my job as instructor.

When I left MIT in the spring of 1923 I took a job with the Curtiss Aeroplane and Motor Co. in Garden City, Long Island. This was the outstanding company at the time. They had a well-organized engineering department and an excellent shop - one of the three or four wind tunnels in the country, and a competent staff of structural analysts and designers. They were in the midst of designing a series of racing airplanes for the Army and Navy which dominated the high speed records for several years. I learned a great deal.



The prototype 4-AT-1 a few days before its first flight on June 11, 1926. The aileron has continuous trailing edge with the wing. The forward landing gear strut is shown moved inward to attach to the center line according to John Lee's "quick fix". (Photo - Ford. Co. # 3433-6-5-26)

In the winter of 1925 I left Curtiss to develop a "bright idea" I had for a new type of airplane. This proved to be a quite useless concept, and I had to go job hunting. In those days, if a company had a contract with the government, there might be a job. There was no way of telling whether a company was expecting a new contract or not, except to go and see. So I made the rounds. This brought me in time to Detroit, where I had heard about the Stout Metal Airplane Company. I couldn't get to see anybody, but did learn how to apply by mail, and promptly sent in my resume — which, in addition to an MS from MIT also included a summer's work with the Gallaudet Aircraft Company.

Nothing came of any of my applications, and I ultimately took the summer off, and got an unpaid job with Dr. Grenfell's medical organization in Labrador. One night I got word from the telegraph operator that my mother had wired that Ford had offered me a job. I wired back to accept, and caught the weekly boat — which fortunately came by at that time - for Quebec. And before I realized what had happened I had exchanged the hazards of Labrador for the hazards of the Ford Motor Company. Arrived at Dearborn, I was delighted to discover Otto Koppen, who had arrived the week previous, and had been hired as unexpectedly as I. We shared adjoining rooms in a local boarding-house.

The Stout Metal Airplane Co., for which we both worked, had a neat little red brick factory on the flying field in Dearborn, not far from the Ford Motor Company's experimental laboratory. I met Mr. Prudden, briefly, but do not remember Tom Towle at this time. Koppen was assigned the job of installing a new Packard 500-hp engine in one of the single-motor Fords (the Stout "Air Pullman," to be exact). I was assigned the job of re-designing the wings.

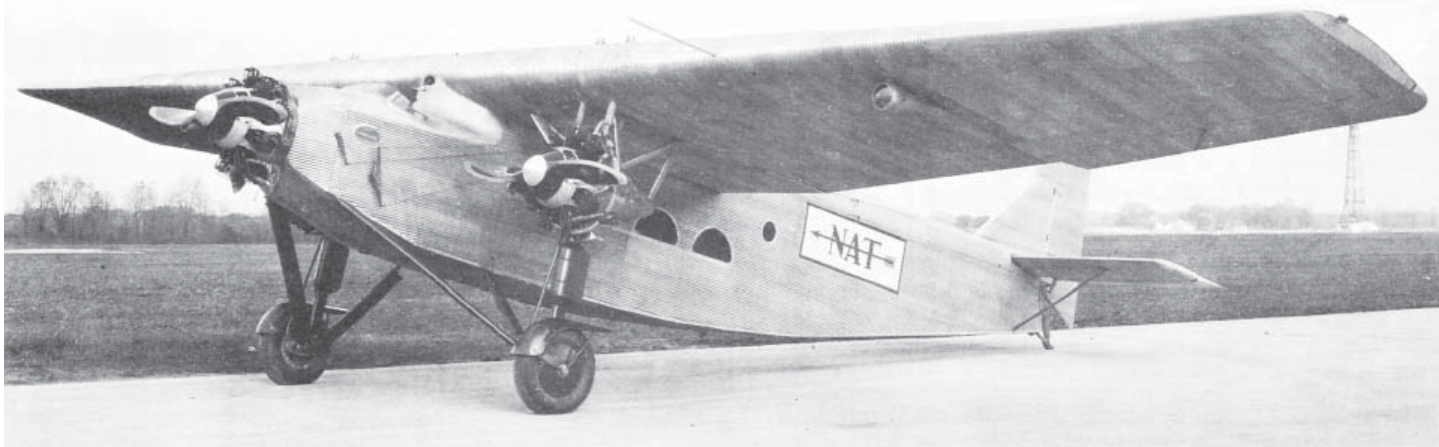
The little shop was a crowded and busy place. The "Air Pullman" was impressive, at first sight. But, when I got into the

details, I was appalled. The structural design was, I thought, perfectly awful, and positively dangerous. Everything I had been taught not to do, both at MIT and at Curtiss, was done repeatedly. Things I knew to be dangerously weak were staring me in the face. And the airplanes were flying. For example, structural members that were supposed to meet at a point, might be several inches apart. It all depended upon whether it was convenient to attach them near together.

This was quite a shock. I couldn't understand why the machines didn't collapse in the air, why there hadn't been several fatal crashes. I was very unhappy for a week or two. Then the secret began to dawn on me: the machines were redundant. This means that there was always more than one way for the loads to go - and generally speaking, you couldn't tell which way they went.

The truth was, nobody knew where the loads went, or what they were, or how strong the structure was. Things had been built as they had been in the days of the Model T Ford car. If something was weak, it broke, and you made it stronger the next time you had a production change going through. This was all right for a car. The worst thing that could happen was for the brakes to fail, or the steering gear to become disconnected, and maybe the driver would skid into the ditch at 30 or 40 mph. But in the air, things were different. If your plane dived into the ground at 200 mph, you would not be in any position to explain what broke, or complain about it either.

I determined to speak to Prudden about it. He was an engineer and must have understood the risks. Perhaps he had a better understanding than I of the added stiffness that redundancy and the corrugated metal wing covering provided. Only he never seemed to be around. And I soon learned that you couldn't make criticisms of this sort in the Ford organization. If it worked, it was all right. Unless it was cheaper, or quicker, or handier, they were not interested in changes or suggestions. So



The 4-AT-2, second trimotor, incorporating John Lee's revised landing gear strut using rubber compression blocks, Hamilton wooden propellers, and the repositioned aileron. The fuselage emblem below the cockpit reads "Stout Metal Airplane Co. Division of Ford Motor Company." (Photo- Ford #3886-11-2-26)

I determined that in my re-design of the wings I would make the design sound, and simple, and hope none of the planes would be overloaded and crash before I got the new wings on them.

The next thing I ran into was that there were no accurate drawings. In fact, there were only seven drawings for the whole single-engine Ford. They were the "three-views," the wings, the tail, the fuselage, the engine installation, the landing gear, and the control system. No detail drawings at all. None of the drawings was correct in the little detail they did show. Changes had been made in the shop, and nobody took the time or trouble to correct the drawings. "Why should they?" asked Mr. Stout. "Once you have the shop jigs built, every part will be the same," and who cares if the aileron hinge has been moved outboard a couple of inches. The word was that one reason why Bill Stout stood in so well with Mr. Ford was just because of this attitude. In fact, the whole Ford development of the Model T, and later the Model A cars, was founded on this premise. You built something practical, and drawings were used only as a last resort. At Ford, the shop was king. Whereas at Curtiss where I had worked, and in all modern aircraft companies, engineering was king, and the shop built what it was told.

One could not quarrel effectively with the Ford approach. After all it had produced the Model T Ford car, certainly the cheapest and most effective automobile built up to that time. But applied to airplanes, it involved some frightful risks. The engine mount on the Air Pullman was made of riveted sheet aluminum alloy members, with fittings stuck on the ends and bent to fit. A more hazardous construction could hardly be imagined. It simply invited fatigue cracks, and several had been discovered. Tom Towle was quite aware of this situation, and in collaboration with Schroeder, designed and had built a properly constructed welded steel tube engine mount.

This did not conform with Stout's concept of an

all-aluminum airplane, and Towle was summarily fired, as he has related. This episode was absolutely typical, and illustrates the behavior of the contesting cliques in the Ford dictatorship. It also explains why I saw so little of Tom Towle in my first few months with the company.

Before Towle's transfer to the Ford laboratory he had determined on the new wing profile. The new wing was to be same size and planform as the old one, but with a different profile. It had, according to Towle, a root section that was a modified Gottingen 387, and for the tip a USA-27 with a three degree "wash-in." This should have been a good high lift wing, and so it proved. Although there had been a limited amount of test data on the original Air Pullman wing, which was, I believe, an NACA-81, there was absolutely none on the new wing.

Faced with this situation of knowing nothing as to the air loads on the wing, and of being unable to evolve a rational distribution of load between the three spars, I made two arbitrary decisions. First, I decided to put the spars in precisely the same positions as they were on the Stout Air Pullman. Consequently, the new wing could be fitted to the old airplanes with a minimum of change. Second, I arbitrarily said that 70 percent of the load would be carried by the front spar, 70 percent would be carried by the middle spar, and 80 percent by the rear spar. Never mind that this added up to 220 percent. I was not going to have a wing fail, and so far as I know, none ever did, despite the steadily increasing loads they were called upon to carry.

On the shop floor stood the "original" three-motor Ford. This was a perfectly dreadful airplane. It was basically one of the Air Pullmans, with all their built-in faults and hazards, plus some new ones of simply magnificent character. The single 400-hp Liberty water-cooled engine in the nose had been replaced by a 200-hp Wright air-cooled J-4 radial. Two other engines had been added, one to each wing. The whole front of

each wing was cut away as far back as the front spar, for the full diameter of the engines. The engines that were uncowed, were simply bolted to the wing spar. You could see that the one or two cylinders that stuck up above the wing might be cooled, and perhaps two or three others which stuck down below, but how the remainder that were directly in front of the spar could possibly be cooled was a mystery. Far worse than that was the effect of the disturbance to the wing contour. It appeared to my aeronautical eyes that the entire center section would be stalled all of the time, with an enormous loss of lift, and increase in drag, and an unpredictable effect upon the tail controls.

Koppen and I discussed this airplane many times. As I remember it, I was for writing a letter to Mr. Ford or somebody to warn them, but Otto was more practical. He thought that a letter would only serve to get us fired, and would in no way change the airplane. However, he maintained the airplane would never fly. If the engines did not burn up in taxiing, any reasonably cautious pilot would discover the stalled center section and inadequate control before he was two feet off the ground, and settle back down.

I was not present when the three-engine monstrosity was rolled out to fly. Somehow these things were scheduled so that only those wanted by the clique in control would know about it.

Mr. Towle has described its first flight. The pilot who tested it later was Larry Fritz, a husky man, who regularly flew the Air Pullmans from Dearborn to Chicago and Cleveland. Koppen was

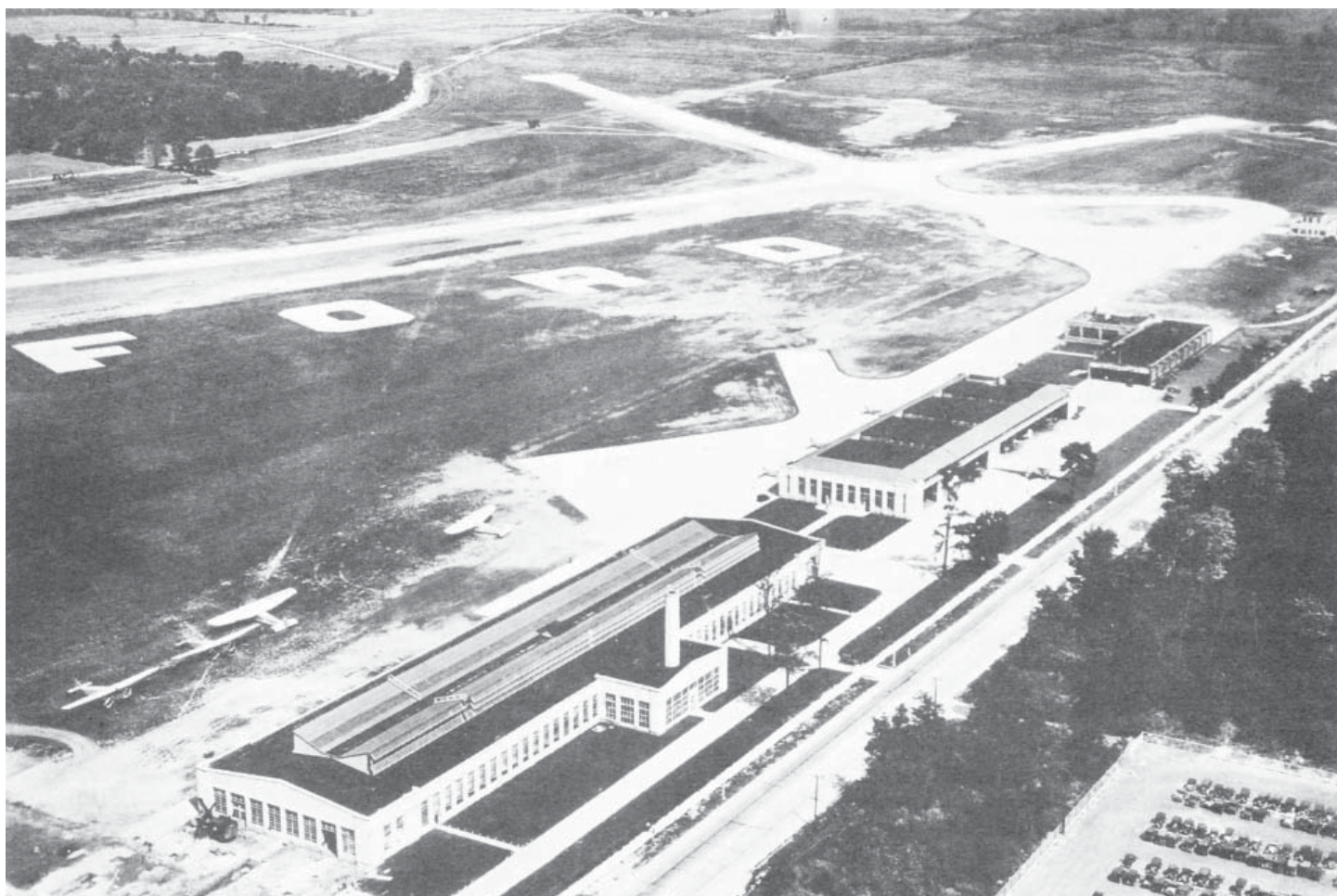
the observer on that flight. He told me that he could see Fritz pushing with all his might on the control column, the sweat literally streaming off his face, and the column with a bend of unbelievable extent. There was no question but that the airplane was almost unmanageable. The pilot swore he would never fly it again.

Apparently Otto and I were wrong about the engine cooling. The slipstream was so turbulent that they did cool adequately (in November), but we were not wrong about the wing stall and control. As soon as the engine was throttled back, the center section stalled. I do not feel that any one person should be tagged with the responsibility for this airplane. Rather it was almost the inevitable result of warring cliques, of the objectives and orders by one and counter decisions and new orders by others.

One weekend in January 1926 I managed to get Saturday morning off and went to Chicago to see my mother. To my utter amazement I read in the paper when I got off the train Monday morning that the Stout factory had burned down.

I got out there as soon as I could. There was really nothing left, only a corner of the office was still standing, and it was a shambles. I was able to rescue only three of four drawings. What a completely unexpected event! We would have to start all over again, from scratch!

Tom Towle, I discovered, when I read his paper a few months ago, took a wholly different view of the affair, and had some further knowledge of it. His account included the statement,



The Ford Aircraft Division factory, circa 1930. Pan American Grace Airways' NC-403H is in left foreground. Ford dirigible mast is just barely visible at upper center edge of the photo.

“There was little talk about the fire, because there was little doubt who had the factory burned, or why!”

At this point let me quote a letter from Prof. Koppen, dated Feb. 6, 1969, after he had read over a draft of this paper. He wrote:

“About the factory fire, I never had any doubt but that Jimmy Smith set it. I am sure also that Ray Dahlinger helped him. You may remember that I saw a great deal of Jimmy while I was locked up in “the room.” I gathered that the fire came about in this way. After Bill Stout had started his company in Detroit he sold Edsel the idea of having the Ford Co. take it over. Mr. Ford was opposed to the idea, but reluctantly gave in to please Edsel.

“You will remember the old airplane factory had a sign on it —

STOUT METAL AIRPLANE CO. Division of Ford Motor Co.

This may seem trivial to you, but Mr. Ford simply could not stand that sign, so he burned the factory down to get rid of it. You will remember the new factory was called:

AIRPLANE DIVISION Ford Motor Co. Stout’s name was gone for good.”

At the time I didn’t suspect arson. I was inexperienced, I admit, and I marveled at the complete destruction of the aluminum airplanes and most of their engines. There were various rumors at the time, but I put them down as simply rumors put out by one clique or another. But Tom’s instructions from Jimmy Smith (more on him later) put a very different aspect on it. Also, Otto Koppen not only saw a great deal of Jimmy Smith, but of Mr. Ford as well. His report that Mr. Ford vigorously objected to the sign is undoubtedly true. That “he burned the factory down to get rid of it” seems a bit far-fetched. He could so easily have had the sign taken down.

More likely, Mr. Ford couldn’t tolerate the loose control he had over the Stout organization, presided over, as it was, by the spectacular and competing personality of Bill Stout. Whether it was intended to burn the whole plant down, including jigs and fixtures, I do not know. My guess is that the object was to destroy the three-engine Air Pullman, and whoever was assigned to it was a bit too thorough. At any event, from then on the airplane activities were handled directly by the Ford organization, based at their research laboratories.

Tom Towle went on to describe the events following the fire. My own recollections do not tally with Tom’s exactly. I do know that the day after the fire or perhaps a short time before it, I, too, was assigned to the Ford laboratory, at the empty end. I had a drafting board but no desk. There were one or two others there. My recollection says they were Tom, a draftsman (probably Schultz), and one Harold Hicks. He had been in the Dept. of Naval Architecture at the University of Michigan. Prof. Koppen thinks he was “brought into the company when Edsel was interested in racing boats. I don’t think he knew too

much about engines.” Be that as it may, he knew nothing about airplanes, but he was thoroughly familiar with the routine of the laboratory. He was, I assumed, there to keep us in order. The day I arrived in the lab, Hicks asked “Are you a college man?” “Yes,” I said. “Well, don’t ever tell anybody!” And this was good advice. Hicks took no part, initially, in the airplane work. I do not remember seeing Mr. Ford or Mr. Mayo at this time or seeing Mr. Stout’s “wood and paper mockup.” The events Tom Towle describes must have occurred earlier. I did, however, have several later contacts with Mr. Stout, both in the lab and the new factory. Otto Koppen, with whom I had worked so closely, disappeared at this time, without a trace. Later he told me, on the quiet, that Mr. Ford had him locked in a room in the old part of the lab, designing a single motor personal plane, on an extremely hush-hush basis.

I had salvaged enough of my wing work to get going almost immediately. A three-view drawing of a revised Trimotor seemed to be at hand. Probably this was the three-view Tom Towle said he drew. It showed a fuselage of approximately the same cross-section as the Air Pullman, a tail of the same shape, the same corrugated construction, of course, and wings also of the same plan, but with an extended center section. All I can say about this three-view is that, like all other drawings at that time, it served as a point of departure. The truth is, the drawing was not always available. Possibly Tom kept it locked up in his desk. Its absence did, however, result in some peculiar circumstances later on.

For my part, the one thing I insisted on was that the engines be located below the wing, and not directly in front of it, so there would be no danger of stalling the wing, and also where they would be accessible. I do not remember whether the new three-view showed them in that position or not. All I know is that when I came to design the engine installation I placed them a reasonable distance below the wings and sufficiently outboard of the fuselage to provide adequate propeller clearance, even if a slightly larger propeller should later be installed. This was probably another case of where two or more people may have independently made the same decision, and each felt that they had been personally responsible for the beneficial result. It is not surprising that we made this decision. It was a natural one, in view of the demonstrated behavior of the three-engine Air Pullman. Besides, it had the precedent of the Fokker wood-wing trimotor that had just made its appearance in Europe, and was known to handle well.

When I arrived at the lab, my drafting table was added to the others, at the unoccupied end, and on the main aisle. This was my first contact with Jimmy Smith. My next came a few days later. I was just finishing the stress analysis of the Trimotor wings — a job that would have taken a month at Curtiss. I had done it in three days. “What are you doing?” he asked. “Analyzing the wing structure.” “Well stop wasting time and get going.” I thought at the time that Jimmy Smith was a “Service Man.” This meant, at Ford’s, that he was one of Harry Bennets’ group of private detectives and strong-arm experts. I soon learned, however, that he was a very freelance, with close association and immediate access to Mr. Ford. He told Koppen that he was the first machinist hired by Mr. Ford, and had

previously worked in a machine shop that made parts for Ford's first car. He was a little Cockney Englishman, hard bitten and tough. Also he could get things done. If I wanted something made, he would snatch my sketch almost before it was finished and disappear. Next morning the finished part would be sitting on my desk.

The climax of my relationship to Jimmy Smith occurred a few months later when the first Trimotor was pretty well assembled. The fuselage was nearly complete, the center section installed on top of it, the two wing motors installed on their steel mounts under the wing, and the landing gear in place. Jimmy appeared at my drafting table. "Come out to the ship," he said. We walked down the main aisle and out the cross-corridor to the plane.

"See anything different?" he said.

"Yes, the propellers are on."

"See anything peculiar about them?"

"No"

"Well, they won't go 'round!"

Nor would they. They hit the landing gear. I had made an improvement over the original single-engine design, and the brace strut, which carries the fore-and-aft loads in landing, I had carried forward, instead of back. It did simplify the construction quite a bit.

"What are you going to do about it?"

I knew my goose was cooked, and I would be fired in a minute or so, so with the boldness of desperation I answered him right back.

"I can't move the propeller, so I'll move the strut."

"Where will you put it?"

"Here," I said, pointing to the middle of the fuselage instead of the edge where the strut was fastened.

"When will you have the fittings?"

"In about 10 minutes."

"Well, hurry up!"

I did. In 10 minutes he had his sketches. Next morning the finished fittings were on my table. Two days later the necessary fuselage reinforcements were in, the new brace struts installed, and the propellers went properly around.

I learned a lot from this episode. First, that to make a mistake of this magnitude was not unusual in the Ford organization. Second, that it was how you got out of it that counted. In later years I have seen many times that the man who could correct a mistake got much more credit than the man, who by forethought, avoided making one.

Jimmy Smith and I got on beautifully after this propeller episode. I found that more and more he asked my opinion on the engineering aspects of things, and somehow things turned out the way I had suggested. He was a bear for getting things done, and his loyalty to Mr. Ford was such that he was quite capable of doing things he believed to be for Ford's good without telling him about them. Once, in a burst of confidence, he told me about the transcontinental automobile endurance race of many years before. It was from New York to the west coast, with "sealed engines." That meant that almost no adjustments could be made to the engines, and certainly no overhauls. He said that somewhere out in Colorado the Ford engine went bad,

and that he had personally replaced the engine with a new one and reinstalled the seals. Ford won the race. I doubt if Mr. Ford ever knew what had taken place - certainly not until sometime afterward.

I do not personally remember seeing Mr. Ford, or Edsel, or Mayo, the chief engineer, near our group of tables. Jimmy Smith came by nearly every day, Bill Stout and Major Schroeder occasionally. Particularly in the first weeks after the fire, Mr. Stout came around, and on more than one occasion he had a drawing he had made of how the new trimotor should look. This was not a "three-view" that showed the proportions of the machine, but rather a cutaway side view in perspective and in color, which showed the interior of the cabin, with even the expressions on the passengers faces. It was quite a piece of work.

One feature it did disclose was a new arrangement of the landing gear. Instead of the shock absorber strut joining the axle just inboard of the wheel, which was common practice at the time and for many years thereafter, he had drawn the strut coming down outboard of the wheel. I explained to him that with this arrangement, if you had to change a tire (which was not infrequent), you would have to jack up the whole airplane independent of the landing gear that was no easy task on a high-wing monoplane, disconnect the shock absorber, and then take off the wheel and tire, whereas with the usual arrangement an ordinary jack under the axle would suffice. Mr. Stout explained to me, with great enthusiasm, that his arrangement allowed the axle (if projected in the front view past the usual bend) would meet the shock absorber similarly projected, at the point of contact of the tire and the ground, and would thus reduce the bending in the axle, which would save weight. And so it would. But Mr. Stout, who was usually a practical person, was "hipped" on this idea. Like many another man of great originality and enthusiasm, he lacked the power to differentiate his good ideas from the others. Any novelty he thought of carried the full steam of his enthusiasm. Since Mr. Stout came around less as the airplane progressed, I conveniently "forgot" the idea, and designed the landing gear in the usual pattern.

One may be inclined to laugh at Bill Stout on the basis of these anecdotes. One should not. He was highly original. Many of his ideas were excellent; most were ahead of their time. He just couldn't differentiate the good from the bad. If they were novel, that was enough. In addition, he was a genial man, amusing, and kindly. Without him there would have been no Ford airplanes.

While you could discuss any matter with Major Schroeder, and reason with him in a mutually constructive way, there was one thing on which he was adamant. The new Trimotor would have an open cockpit. Of course the Stout Air Pullmans had closed cockpits, and the new Fokker had a closed cockpit, and the Fairchild and they had all been successful. It was obviously the coming thing. No. The new Trimotor would have an open cockpit. Nothing was ever said about the advantages of the open cockpit — you could "feel the wind in your face" and you could get out with a parachute. I figured that after the three engine Air Pullman flight if the Major wanted an open cockpit, he was entitled to one. I did take the precaution, however, of so arranging the structural members that a single or dual control



4-AT-2 back for reconfiguration, late 1926. Grand Rapids Air Pullman at right. (Photo-Fokker Corp. #469, courtesy North American Aviation)

could be employed either open cockpit or closed. So the first Ford Trimotor had an open cockpit. Even before it flew I was drawing up the controls for the closed dual-control cockpit that was ultimately used.

While all this was going on, I became engaged to be married. The wedding day was set for June 1, 1926, which gave plenty of time for the first test flight before then. Unfortunately, airplanes have a lamentable tendency toward delay, and this was no exception. As May drew to a close it became apparent that the Trimotor was substantially complete, but the last minute odds and ends were yet to be finished. There was no way to speed up the airplane, or postpone the wedding, so I took off, and when I returned with my bride two weeks later, the airplane had flown. It was successful, and was followed by a long series of improvements, some major, including the enclosed dual cockpit, a revision of my impromptu landing gear, more cabin seats, etc.

During the late summer of 1926 an event occurred that even now seems astonishing. Tom Towle and a young draftsman got into a fist fight. The draftsman, whose name I forget (could it have been Chapman?) had the table in front of mine. He could not have been more than 18. What the reason was I never knew. All I knew was that suddenly there was a violent fist fight going on within three feet of me! Several of us jumped up and intervened, but within an hour both men were fired and had gone. For there was an ironclad rule in the Ford organization. In case of a fight, no questions were asked, but both the participants were fired.

I have thought about this many times since. Towle was certainly frustrated — as were we all, with the clique power struggle — and he may have been sorely provoked, but he was an intelligent man, and he knew the rules. Why did he let himself in on this? Of late years I have wondered if someone had not put the draftsman up to it. Not as a conspirator, of course, but suppose someone from one of the cliques who wanted Tom out had said to the young draftsman, “Well, if the boss criticizes your work like that again, be a man, give him a poke in the jaw, and show him where he gets off.” It is a possible explanation. And it is borne out to some extent, because Tom started an airplane company of his own in Detroit, with quite substantial backing

from Mr. Mayo, and perhaps others at Ford. He built at least two all-metal amphibious flying boats, which were successful, but he too, like so many others, fell victim to the depression in the 1930s and ceased his aeronautical activity.

One of the planes in the 1926 Ford Tour was the three-engine Fokker. This was about the same size and arrangement as the Trimotor Ford, used the same engines, and was a direct competitor for the future commercial market. Only the Fokker wing was made of wood, its fuselage of steel tubing and cloth covering. Fokker was an experienced designer, with several highly successful (German) war plane designs to his credit. He was also a pilot and had the reputation of designing “sweet flying” airplanes. Needless to say, the Ford crowd looked it over thoroughly.

By that time I had enough reputation for knowing what I was about so that when I said we should not start changing wings before we knew what we were doing, I was listened to. I said that I wanted some wind tunnel tests before we did anything. To my considerable surprise I got the go-ahead. We made up a wind tunnel model with three wings, the one on the airplane, the one Jimmy Smith had “acquired,” and one I designed myself, for which I had great hopes.

My wife and I took off for Boston. I ran the tests myself, with the help of John Markham, in the old four-foot MIT tunnel with its N.P.L. balance that Dr. Hunsaker had installed years before, and my wife typed up the reports. We discovered, as others have before us, that with properly arranged expense accounts, two really can live as cheaply as one. But what was more important, we discovered that the original trimotor wing that was now in production was appreciably better than the other two!

Neither my wife nor I liked Detroit. While work at Ford was certainly stimulating, I wasn't too sure how much more “practical” development I could take. Perhaps the time Jimmy Smith tested an aileron for me by propping one end up on a bench and walking up the length of it had something to do with it. “See, it's plenty strong enough,” he said. Afterwards I found he had cracked the spar in three places. Anyhow we decided we had had enough. So around Christmas time in 1926 I said goodbye to Ford and went east to work for Fairchild.

Shortly after that, with the threat of competition from Fokker, someone, (I think it was Harry Karcher) replaced the 200-hp Wright engines with 400-hp Pratt & Whitney, and this made an airplane out of it.

To Mr. Stout certainly must go the credit of “selling” the idea of building a commercial airplane to Mr. Ford. Also, he doubtless was responsible for selling the idea of an all-metal airplane, whose outer covering was corrugated aluminum alloy. The Junkers Company of Germany had built several airplanes of this material, and I seem to remember seeing a Junkers JU-6 low-wing cantilever monoplane constructed of corrugated aluminum in the fall of 1924 on Long Island. Wherever the suggestion came from, the successful exploitation resulted from Mr. Stout's efforts. These days I think we would call him an “idea man” or an entrepreneur.

To George Prudden must go the credit for designing the Fort-Stout “Air Pullman,” or “Single-Engine Ford” that was

the immediate predecessor to the Trimotor. Such men as Stout can only succeed when they are aided by a sound engineer who can winnow out the good from the bad and develop the good in a practical manner. This function George Prudden certainly performed for Stout.

Tom Towle took over from Prudden, and I took over from him. Actually we were all three there for weeks at the same time. It will probably always be impossible to determine just who did what. Since we were often separated and reported through different cliques, it might easily happen that we both advocated the same thing, and if that thing was done, we both felt responsible and mentally took credit. There is no doubt, however, that Tom settled on many of the important features - the choice of the wing-section for one, and the shape (but not the size) of the control surfaces, and probably several other key items.

I, myself, designed the structure of the wings, the landing gear (as previously noted), the control system, and the powerplant installation, and had a hand in many other things.

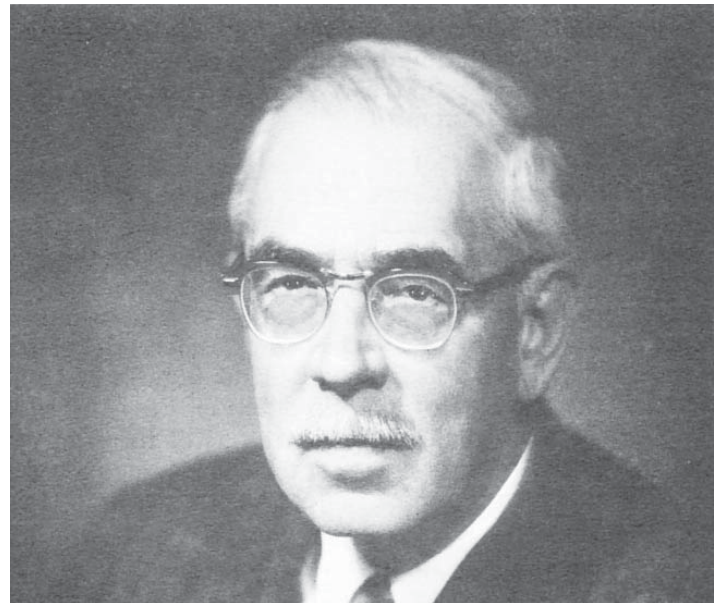
Maj. "Shorty" Shroeder was an experienced test pilot, and held the world's altitude record. He was a most impressive figure, about six foot two. His job was to manage the Ford private freight airline. This he did very well, and he was unique in that he had the respect not only of his pilots, but of everyone in the Ford organization, irrespective of which clique they belonged to. He was responsible for keeping the machines "safe" and airworthy, and was responsible too, I feel, for many of the minor features which made the Ford "Tin Goose" stand up so long.

And we should not forget Jimmy Smith. His name does not appear in any of the record books. If you told all he had done, he might have to deny much of it. But he did get things done. He did keep Mr. Ford informed of what we did, and so maintained the level of confidence that meant that Mr. Ford continued to supply the money and not interfere in the details. He was, one might say, a free-lance catalyst. His methods were devious, but he was invaluable.

Who, then, designed the Ford Trimotor? Who was responsible for its success? No one man can take the credit. Certainly the accomplishment was in the hands of the little group of men just mentioned. They, working sometimes together, sometimes at cross-purposes, and often in complete ignorance of what the other was doing, are responsible in one way or another for the Trimotor. The element of luck was a powerful factor. With such a confused background it seems extraordinary that anything useful came out at all. But it did. And from it came commercial aviation in the United States. →

REFERENCES:

- 1 Telephone conversation, Mr. Tom Towle to Editor, J.J. Sloan, July 10, 1970. In reviewing the manuscript of this portion of "Who Designed the Ford Trimotor?" Mr. Towle denied any recollection of the fist-fight.
- 2 Professor Jerome C. Hunsaker, Professor Emeritus, Massachusetts Institute of Technology, Member AAHS.



About the Author:

After leaving the Ford Motor Co., Mr. Lee went to the Fairchild Airplane & Engineering Corp. at Farmingdale and became project engineer on the "Pilgrim." In 1932 he joined Chance Vought Division of United Aircraft Corp. and was project engineer on shipboard fighters and dive-bombers, notably the SBU- and SB2U-series. In 1939 he became Assistant Director of Research at United's Research Laboratories, and ultimately Director in 1955, where he remained until his retirement in 1964.

Mr. Lee served as Vice President for Aircraft of the Society of Automotive Engineers in 1943 and as both member and chairman of various NACA subcommittees on turbines, propulsion and high-speed research airplanes, and was a Fellow of the Institute of the Aeronautical Sciences. He became Chairman of the Board of Regents of the University of Hartford in 1957, and has continued as vice chairman since 1966. He is currently a member of the Connecticut Research Commission and is a consultant to United Aircraft Corporation.

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