

The Moth And The Tiger Moth

For longevity of design—some of its structural features are traceable back to 1915—the British-originated Moth is in a class all its own. Royal Navy still has some of the de Havilland planes on hand by PETER M. BOWERS / AOPA 54408



1.



2.



3.



4.

1. A Canadian-built de Havilland Moth with folded wings. A removable spreader bar between the front-spar fittings kept the wings in rig when folded. The hinges were also the rear-spar attach fittings.

Photo by Gordon S. Williams

2. A de Havilland DH-60X Moth seaplane. Canadian registration symbol until 1929 was the letter "G" followed by a dash and "CA" (for Canada), then two letters to identify the individual airplane. Canada now uses "CF-" followed by three letters.

Photo by Gus Moore

3. American-built DH-60GMW Moth with Goodyear airwheels. Note left-hand propeller on American-built engine. Most European lightplane engines were left-hand (counterclockwise when viewed from cockpit), while American engines were right-hand.

Photo by Peter M. Bowers

4. A Canadian-built DH-82C Tiger Moth restored in authentic World War II markings by an American owner and flown to 1968 EAA convention at Rockford, Ill. Note the canopied cockpit and the U.S. registration applied in the position of the former RCAF serial number.

Photo by Peter M. Bowers

■ ■ The British-designed de Havilland *Moth* has two very solid claims to aviation immortality. First is the fact that it was the first practical lightplane to achieve significant production. As such, it became the backbone of flying clubs and even military training programs in many parts of the world. It was considerably more than just the *Cub* of its day—it had the field almost to itself. At the end of 1929, for example, 85% of the private aircraft in England were *Moths*.

The second claim results from the remarkable longevity of a design that can trace some of its structural features to 1915. While it never really caught on in the United States, the *Moth* and its direct descendant, the *Tiger Moth*, are still on the international scene in significant numbers. The Royal Air Force retired the last of its *Tiger Moths* around 1956, but the Royal Navy still has some on hand.

Under the factory designation of DH-60 (for de Havilland Model 60), the *Moth* was developed as a follow-on to an ultralight monoplane, the DH-53, which de Havilland had built for a lightplane sponsored by the British Government in 1923. While several interesting designs appeared, all suffered from the too-low power requirement. Virtually powered gliders, they did not have the utility needed for practical club, school, and private owner use. De Havilland had also produced a larger and more powerful biplane model on its own, the DH-51, but this went to the other extreme and was too much airplane for the market.

These two extremes showed de Havilland engineers the right path to the ideal airplane for the purpose. Taking the conservative approach, they in effect scaled down the DH-51, which at first glance was hard to distinguish from the famous DH-4 bomber-observation two-

seater of 1916. Many of the proven DH structural features were transferred intact from the DH-4 to the DH-51, and from it to the *Moth*. However, instead of being merely a latter-day antique, the *Moth* had enough refined detail to make it quite a modern airplane by contemporary standards.

One unique feature was a simple method of folding the wings without the need to de-rig the flying wires. Such a gimmick was almost a necessity for the preservation of a wooden club airplane since hangar space was scarce in England at the time. With folded wings, two *Moths* could occupy the space of one, or members and owners could tow their planes home and keep them in their own garages.

The designers of the *Moth* immediately found themselves with a serious problem on their hands—they had designed the optimum airplane for a particular market, but there was no engine

available at the time that was suited to the new airplane. This was solved by designing a new engine simultaneously with the building of the prototype *Moth*.

Frank Halford, a free-lance engine designer, worked with de Havilland technicians to develop an upright, four-cylinder, air-cooled engine of 60 h.p. Instead of being entirely new, however, this new engine, named the *Cirrus*, was designed to use many parts of the World War I surplus Renault engines that had been widely used in British military trainers. An organization known as the Aircraft Disposal Company (AIRDISCO), formed after the war to take over and dispose of the aircraft surplus, had hundreds of these at near-scrap prices. After the *Cirrus* was tested and proved satisfactory in the first *Moth*, AIRDISCO placed it in production.

First flight of the *Moth* was on Feb. 22, 1925. With a market waiting for it, the *Moth* was an immediate commercial success and can be credited with saving the company, which was one of the wartime giants that was hard put to keep going in the first few postwar years. Minor refinements were introduced on the 1927 model, including an optional steel-tube fuselage (DH-60M) and a 105 h.p. version of the *Cirrus* (DH-60X). By mid-1927, the end of the surplus parts supply for the *Cirrus* was in sight, and it became necessary for de Havilland to develop a replacement engine if *Moth* production was to continue. Again with Halford's help, de Havilland built the *Gypsy*, which was also an air-cooled, upright four, but delivered 85 h.p. For 1928, the *Moth* picked up further refinements along with the *Gypsy* engine, including split-axle landing gear and the patented Handley-Page automatic leading-edge slats for the upper wing, and became known as the *Gypsy Moth* (DH-60GM).

The fame of the *Moth* was now worldwide. Manufacturing licenses were granted to several countries, and de Havilland established factories in Aus-

tralia and Canada to assemble and later manufacture complete aircraft. Floats had been fitted to the *Moth* in England, but the Canadians made wide use of skis and modified some *Moths* by enclosing the cockpits in a winter canopy.

Few *Moths* reached the United States by way of Canada. A new company was established at Lowell, Mass., under the name of Moth Aircraft Corporation. This company, wholly owned by Americans, built *Moths* under license from the British firm. Early versions (DH-60GM) used imported *Gypsy* engines, but later ones (DH-60GMW) used the Curtiss-Wright *Gypsy*, which was an American-built version of the same engine. American Approved Type Certificate (ATC) 197 was issued to the *Moth* in August 1929. Sales were handled through the nationwide Curtiss-Wright Flying Service.

Early in 1930, Curtiss-Wright took over Moth Aircraft and transferred production to the Curtiss-Robertson plant near St. Louis, Mo., after some 168 *Moths* had been built at Lowell. St. Louis production was limited, however, for the plant closed in 1932 because of the depression. British production of the DH-60 in its later variants continued until 1934.

Just as U.S. *Moth* production was ending, the British plant came out with an improved model intended primarily as a military trainer. One of the problems with the old design had been that of getting into the front cockpit, which was located between the center-section struts. A more serious problem was that of getting out in flight while wearing a parachute. De Havilland solved this by moving the upper wing forward to put the struts and wires ahead of the cockpit. However, since this made the plane tail heavy, it became necessary to sweep both wing panels back considerably to bring the center of lift back in line with the center of gravity. Sweepback, an inverted de Havilland *Gypsy III* of 120 h.p., and more dihedral on the lower wing than the upper, were the principal identification features of the new DH-60T, now named *Tiger Moth*.

It was not long, however, before all of the new features were considered enough to justify a new designation, so the *Tiger Moth* became the DH-82. The 1934 version, with 130 h.p. *Gypsy Major I* engine, became the DH-82A. With the exception of the American Stearman-Boeing *Kaydet* series [PILOT, Nov. 1967], and possibly the Russian Polikarpov PO-2, the *Tiger Moth* became the world's most widely produced biplane. An estimated 8,811 were built from 1931 to the end of WW-II by de Havilland plants in four Commonwealth nations and in licensed plants in England and other countries, plus a further 420 which were wooden fuselage versions built as radio-controlled target drones under the name of *Queen Bee*.

Canadian conditions dictated a few minor changes and the revised designation of DH-82C (for Canada). A steerable tailwheel replaced the skid, the

main landing gear was moved aft slightly to unload the tailwheel for easier steering, brakes were added, and steel-tube interplane struts replaced the wooden ones with their 1915-style fittings. The most notable feature of the Canadian version, however, was the inclusion of a large winter canopy as standard equipment. Because of early wartime shortages of imported British engines, 136 of the Canadian *Tiger Moths* were built with 125 h.p. American Menasco engines. These were readily identifiable by their right-hand propellers and required special rigging and piloting instructions to accommodate the opposite propeller reactions.

By the time *Tiger Moth* production got under way in Canada there was no longer a U.S. civil market for such a design. The age of the *Cub* had dawned, and the civilian biplane trainer was largely a thing of the past. Time plays funny tricks, however, and the now venerable *Tiger Moth* has become very attractive to U.S. pilots as a result of the current antique airplane boom that started in the 1950's.

Here was a genuine antique that looked even older than it actually was—a "two-hole two-winger" that was capable of routine aerobatics, and one that was still available in relative quantity in Canada at reasonable prices. However, there was one serious hitch—the *Tiger Moth* couldn't be licensed in the United States! Several eager American buyers found this out the hard way after they had bought their *Tigers* abroad, brought them home, and then tried to license them.

The trouble lay in fine points of timing and changes in the regulations. It seems the *Tiger Moth* was so old-fashioned that it incorporated a lot of structural features and a few aerodynamic quirks that had been declared illegal for new design in the United States in the late 1930's. Infuriated antiquers pointed out that the earlier DH-60GM *Moth* with many of the same features was still licensable, as was the even more "illegal" Aeronca C-3 [PILOT, Feb. 1960]. The joker here was that these designs had all received their ATC's at a time when such features were legal for new design and therefore operated under a "grandfather clause" in the regulations. Unfortunately, no one had gotten a *Tiger Moth* into the country in time to qualify it as a "grandfather."

By the time the antiquers tried it in the early 1960's, the *Tiger* was so far behind the times engineering-wise that simple recognition of other countries' approved designs under reciprocal airworthiness agreements was of little direct help in bridging the technology gap. Of course, American *Tiger* owners could fly on experimental licenses, but these were onerous. The antiquers wanted the unlimited licenses they felt their classics deserved and battered their heads against the walls of adamant bureaucracy trying to get them.

There was a proper way to go about this, of course, but the antiquers didn't seem to be aware of it. They imported their airframes first and then tried to

SPECIFICATIONS AND PERFORMANCE

	DH-60GM/GMW Moth	DH-82A Tiger Moth
Span (both)	30 ft. 0 in.	29 ft. 4 in.
Length	23 ft. 11 in.	23 ft. 11 in.
Height	8 ft. 9 in.	8 ft. 9½ in.
Area	243 sq. ft.	239 sq. ft.
Powerplant	De Havilland Gypsy, 85-90 h.p. @ 1900 r.p.m., or Wright Gypsy, 90 h.p. @ 1950 r.p.m.	De Havilland Gypsy Major I, 130 h.p. @ 2350 r.p.m.
Fuel	24 U.S. gals.	19 Imperial gals.
Empty Weight	1,027 lbs.	1,115 lbs.
Gross Weight	1,650 lbs.	1,825 lbs.
High Speed	102 m.p.h.	110 m.p.h.
Cruise Speed	85 m.p.h.	90 m.p.h.
Landing Speed	40 m.p.h.	45 m.p.h.
Climb	700 f.p.m.	673 f.p.m.
Service Ceiling	16,000 ft.	13,600 ft.
Range	360 mi.	285 mi.
Price	\$4,500	

fight the battle of the paperwork. A model with certain features unacceptable under U.S. airworthiness requirements, but still legal in the country of the plane's origin, could be licensed in the United States with a certain degree of international cooperation. First, the manufacturer had to provide certified copies of certain engineering and flight test data. Next, the Department of Transport or its equivalent in the originating country had to issue a Certificate of Airworthiness for Export. Finally, the registration of the plane had to be cancelled in its own country. In other words, the plane had to be licensed and in good condition before coming into the States, and not be brought in on a truck as a basket case, or even as a recent run-out needing only an annual inspection to become fully airworthy again.

De Havilland officials in England were cooperative, but the basket-case owners and some Canadian officials were not. The owners naturally didn't want to go to the expense of transporting their rebuilt back to Canada, re-registering them there in the name of a Canadian owner, then cancelling the new registration and going through the export-import procedures with attendant duty on a now more valuable item. Some of the officials concerned felt that the world's image of Canadian aviation would not be enhanced by official approval of such obsolete material. The logical argument to this attitude, "If you don't like *Tigers* up here, help us get them out of the country for you!" didn't seem to work.

Some owners and would-be owners even tried the gambit that the *Tiger* was actually a war-surplus U.S. Army primary trainer, since 200 of them carried the U.S. designation of PT-24. This didn't mean, however, that they were U.S. trainers in fact. Since this particular batch had been built in Canada during the war with U.S. lend-lease funds channeled through the Army Air Forces, they had to have standard U.S. Army designations suitable to their type in the procurement records.

The "do-it-the-hard-way" boys finally won their battle, and DH-82A *Tiger Moths* (but only the British A version) are now eligible for standard American licenses. Credit for this coup belongs to movie star Cliff Robertson (AOPA 275071). The improved Canadian C version, for some reason, is still an outlaw subject to the restrictions of an experimental license. With the legal blocks out of the way for one version of the *Tiger Moth*, word of their popularity has spread abroad, and both private owners and used-airplane dealers in several foreign countries are now advertising DH-82A's in American magazines. As with domestic antiques that have appreciated greatly in recent years, you can expect to pay at least equal to and up to double the cost of a *Tiger Moth* when it was new, 25 to 35 years ago, plus crating, shipping, and duty. The price of \$6,000 dockside in the other guy's country seems to be the top at the moment. □