

# **HENRI MIGNET and the FLYING FLEAS – AN INCOMPLETE OVERVIEW**

By

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Queensland Air Museum has recently been given portions of an incomplete Mignet Flying Flea so it is interesting to take a look at its French designer, Henri Mignet and his effects on development of home built, ultralight aircraft. The early 1930s HM.14 Flying Flea, or to give it its original name, Pou-du-Ciel (literally “Louse of the Sky”), was possibly the first home built aircraft for which plans were readily available and widely used. First flying in September 1933 it was the end point of a series of attempts by Mignet to produce a simple, easily built and flown small aircraft. Before the Flea his only notable success had been the 1928 HM.8 although some others flew to some extent. Despite later problems surfacing with the original design of the HM.14 it has proved to have had a major impact on the design, development and popularity of ultralight sports aircraft. As well it made a substantial contribution to the abolition of regulations in both France and Britain that prevented amateurs becoming involved in aircraft development and so being able to fly cheaply. So great was Mignet’s impact on mid 1930’s aviation that some European light aircraft designers have continued, until quite recently, to be influenced by his basic principles, especially tandem wing layout.

## **INITIAL DESIGNS**

Born in October 1893 Mignet’s interest in aviation dated from c1910 -12 and at the age of 19 he built his first aircraft, the HM.1, a monoplane glider. It was based on the work of Otto Lilienthal with whose brother, Gustav, he had had earlier correspondence. Mignet served as a radio operator over the war years but by 1920 the HM.2, based on Bleriot’s work and ideas, had appeared. 1922 saw the HM.3 “Dromedary”. No details of either of these has been sighted. 1923/4 brought the HM.4, a parasol with no rudder (Anon 2014a). Ord-Hume (1982a) has a drawing, labelled HM-1, and a detailed description which he identifies as of the HM.1 but this fits the more recent Wikipedia description of the HM.4. Best-Devereux (1982), who claimed to have been a friend of Mignet and student of his activities, also corrects Ord-Hume’s identification and states it was definitely the HM.4.

Ord-Hume says Mignet studied birds in flight and noted they had no rudder. This resulted in a small parasol monoplane with a length of 16.5ft, a span of 21ft and a weight of just 276lb complete with a 10hp Anzani flat-twin car-cycle engine. It was a most unusual aircraft with the wing mounted very far forward on the fuselage. Virtually half each wing was an “aileron”, the rear portion of each being a hinged control surface. These were connected to the control column so that they could be used alternatively as ailerons or moved up or down together like flaps. The tail plane comprised one surface of a more or less equal cord and span but hinged longitudinally so that it could be tilted from side to side about the fuselage centreline. There was neither fin nor rudder. On testing in June 1923 the machine proved directionally unstable on the ground and quickly came to grief against an inconvenient tree.

The HM.5, a sailplane/hang glider followed (see Jones 1986 for photo). A year later Mignet is reputed to have sold it at a satisfactory price. (Anon 2014a). These were followed by the HM.6 with a pusher propeller and the HM.7, a helicopter. Then came the HM.8.

The HM.8 Avionette, with c200 built, could be considered a moderate success, Mignet himself building at least six (Jones 1986). It was a conventional high wing (parasol) monoplane with a constant chord wing over a box-like fuselage with fin, rudder, elevators and ailerons (Jones 1986). It was built in 1928 using some of the parts of the HM.6, including the modified Anzani 10hp engine. Following an initial article in *Les Ailes* magazine in 1928 Mignet published, in 1931, a book *Commen j'ai Construit mon Avionette* (How I built my Avionette) which contained plans to encourage amateur builders (Anon 2014a). This book incidentally was hand written and self-published. He hand wrote the text, drew the required plans, took the photographs and even printed and bound the books himself. (Anon 2014b).

Appleby (1982) describes his construction and flight in an HM.8 he built at Nice, southern France, in 1931. He quotes a wing span of 26ft and a construction time, with the help of a friend, of six months and describes a very hairy first flight due to the sensitive controls and his having only recently learnt to fly. Due to restriction to his flying from Nice aerodrome he mounted the plane on a set of second hand floats from a sailplane. It proved too heavy for these but with the wings removed, he was able to taxi at a very high speed. Appleby was later to build and fly, in July 1935, the first HM.14 in the Britain (Anon 2014c).

All through this period Mignet continued to seek an easy to build and simple to fly aeroplane. When undertaking formal pilot training he had experienced problems in coordinating his hands and feet on the controls and decided there were too many control efforts needed, especially from the feet. He therefore set out to abolish the rudder bar. (Ord-Hume 1973 & Anon 2014b). Harwood (1995) indicates that his quest to abolish the rudder bar because of his co-ordination problem was spurred on, if not initiated, by a fortunately non-lethal crash in the conventionally controlled HM.8.

The continued development of this search took five years of experimentation before the Flying Flea provided a practical answer. According to Best-Devereux (1982) this search included the HM-9 with pivoting wings that operated differentially. It was wrecked on its first flight. This was followed by the HM-10 with a thick section parasol wing and the engine behind the pilot with a shaft driven propeller.

Best- Devereux continues "*The first Pou du Ciel--etc,etc-- was the HM-11 fitted with a trailing Junkers style flap used for pitch control.*" Jones (1982) however states the HM.11 of 1931 was a tri-plane, a development of the HM.8, which Mignet was able to fly for the camera, (Jones 1982 & 1986). This photo shows an aircraft with gradually reducing span from top to lower wing and the lower wing located well back. The photo is not sufficiently clear to be certain although close inspection suggests the central "wings" are indeed large independent Junkers style flaps and does raise doubts that it was a tri-plane as stated in the text and photo captions. Anon (2014c) clarifies this conflict stating that the HM.11 featured large pivoting flaps between the fixed front and rear wings. Best- Devereau (1982) also says the HM.12 continued testing the use of the Junkers style flaps and the HM.13 introduced reflexed trailing edges to the upper wing.

At this stage it is unclear to me where and when the pivoting front/upper wing and fixed rear /lower wing and the drastic staggering of these wings each appeared on the scene. Certainly it was after the HM.8. The tandem wing is evident in the HM.11 photograph but it would appear the top wing was fixed with pitch control by way of the inter wing “Junkers” flaps.

**TABLE 1**  
**MIGNET’S DESIGNS UP TO THE HM-14**

HM No.	Year	Comments
1	1912	Lilienthal type glider.
2	1920	Bleriot in style and type.
3	1922	“Dromedary”, No detail seen.
4	1923	A parasol, wing way forward, lateral swivelling tailplane, no rudder. 7.5kW (10hp) Anzani flat-twin engine.
5		Sailplane/Hang glider.
6		Pusher propeller, modified Anzani 7.5kW (10hp) engine.
7		Helicopter, No further details.
8	1928	“Avionette”, First design to fly well, conventional parasol layout and controls, engine and some other parts from HM.6. c200 built
9		Pivoting wings operating differentially, crashed on first flight.
10		Thick wings, engine behind pilot, long drive shaft to propeller.
11	1931	Listed and photographed in air as a triplane but actually a biplane with large pivoting, inter-plane Junkers style flaps between front and rear wings.
12		Also used the Junkers trailing edge flap on the upper wing.
13		Used a reflex trailing edge to the front/upper wing.
14	1933	Pou-du-Ciel/ Flying Flea, initially highly successful but in original format had potentially lethal top wing positioning. Later corrected.

After:- Various Anon (2014a & b), Best- Devereux (1982), Jones (1982 & 1986), Ord-Hume (1982a)

### **HM 14 - THE FAMOUS FLEA**

Finally Mignet achieved his objective with a simple wooden spruce and plywood box fuselage with the engine bolted to its sloping front panel. A straight through axle in slots in the side panels was attached above the longerons with elastic cord suspension. A tandem wing aircraft it achieved stability by using the low slung fuselage below two equal chord wings with a high level of dihedral, to replace the ailerons. The wings were mounted one behind the other at two different levels. The rear and lower wing replaced the tail plane. The upper/front wing was of greater span and, instead of using elevators for longitudinal change, it was pivoted on its struts so that incidence could be readily changed to climb or descend. This movement was initially controlled by cables from the control stick. In later Fleas these were replaced by control rods. Directional control was via a large rudder and, like the top wing, operated by the single control stick. The stick was moved fore and aft for longitudinal and laterally for directional changes. Power required a 15- 30Kw (20-40hp) engine and most were light weight motor bike types.

This was the HM.14 Pou-du-Ciel. the prototype was powered by a 13kW (17hp) Aubier-Dunne 500cc 2stroke motor cycle engine and a had 5.9m ( 19.5ft) wing span but in his

building instructions for the aircraft, Mignet provided drawings for alternate 6 or 5m wings. The choice depended on the power and weight of the engine chosen (Anon 2014c).

While Pou-du-Ciel literally translates as “Louse of the Sky” it was formally dubbed the “Flying Flea” in Britain. It was widely promoted by the publication of Mignet’s, book, “*Le Sport de l’Air*,” which sold in excess of 6 000 copies across Europe from late 1934. In Britain the Air League saw the aircraft as a means of encouraging interest in flying and had the book translated into English simply titled “*The Flying Flea : How to Build and Fly*”. The first 6 000 copies of the latter sold out in two weeks. (Ord-Hume 1973) The result from this publicity was that a substantial number of amateur built aircraft were started. By August 1935 c500 were under construction in France and over the 1935 -36 period 120 alone were registered, with many more started in Britain. So popular was its building that, besides the rash of individual efforts, actual clubs sprang up to build them and in late 1935 the “Popular Mechanics” magazine published a three instalment article on how to build the Flying Flea.

Despite its initial popularity the “Flea” had a major defect, which caused a number of fatal accidents, and it was banned in Algeria and Switzerland in March 1936, (Anon 2014b). Following separate wind tunnels tests, it was banned in both France and Britain later that year. Both wind tunnel tests agreed the 14’s main problem had been incorrect positioning of the upper wing affecting pitch control. This was achieved by altering the incidence of the forward (upper) wing. In a shallow dive, steeper than 15degrees, there was insufficient rearward stick movement left for recovery from the dive. In fact because of interactions of air flow between the two wings with the stick fully back, and the trailing edge of the upper wing fully depressed, a “slot effect” was caused which pushed the nose further down and a vertical unrecoverable dive resulted. Power plant and fuselage stressing and inadequate ground clearance were other problems. The latter caused many to end up inverted on the ground. As well there was no rigorous inspection system to ensure the parts were of adequate quality and were assembled correctly (Field 1980). Meggs (2009) adds that the variations between individual aircraft could, in part, be due to the fact that the “*only drawings available were the handbook sketches, many of which conflicted with the dimensions listed, and made it practically impossible to build a true replica of the original*”. The later, incidentally, being flown by Mignet for many hours without any aerodynamic problems surfacing.

It cannot be too strongly stated that once the front wing location problem was identified and corrected the basic design of the original HM.14 was quite safe if properly built and flown. This is still not widely realised and the Flea’s bad name continues to be quoted in modern contexts. However Mignet quickly prepared revised drawing and this corrected form continues to be built even using modern materials. More recent aircraft are being built from an updated version of the book “*Le Sport de l’Air*” which appeared c1994. This book contained the revised set of MH.14 drawing which shows a 180mm horizontal gap between the trailing edge of the upper/front wing and leading edge of the lower/rear one (Harwood 1993). What is believed to be an original drawing from the 1935 source has these overlapping c150mm (6in) (Ord-Hume 1973). Harwood goes on to say Mignet’s solution to the problem was to lengthen the fuselage to remove the wing overlap and change the aerofoil section and to make the rear wing pivot in the opposite direction to the front one. (Interestingly, nowhere else has this movement of the rear wing been mentioned and others indicate that Mignet adhered strongly to the fixed rear wing concept). Existing machines could be readily adapted by cutting a vee out of the rear of the lower wing and moving it sufficiently back to eliminate

the overlap while rear wing pivoting could also be introduced (Harwood). The modern versions possibly use the name HM.14B (Maertens 2006).

In the 1930s, as well as private builders, several companies took up the basic design and objectives to produce ultra-cheap commercial versions or adaptations using Mignet's basic principles. In Britain included in this group by several authors are Perman, who actually built 11 HM.14, plus one of their own design, the Parasol, and Broughton-Blayney, who built three Brawney. There may have been some influence of Mignet on the fuselage construction but both were conventional parasol monoplanes with 3 axis controls. Both proved unsuccessful.

However, after some modifications to Appleby's first aircraft (G-ADMH) to get it flying again after a crash landing on its first flight L.E. Baynes, of Abbott-Baynes Sailplanes, set about a more drastic structural and aerodynamic revision of the basic Flea design. Morse (1992) gives details of these changes which while fairly drastic internally did not alter the external appearance that much. The resultant product was to be marketed as the Abbott-Baynes Cantilever Pou. It was powered by a Carden-Ford engine. Orders were received for 60 of them but only three had been completed before the ban on flying the Fleas came into effect.

On the other hand, in France, Emilien Crozes, after first building a "personalised" version of the HM.14 proceeded to develop a range of designs based on the Mignet pivoting tandem wing principles (see later). As well, according to Meggs (2009), from 1935, twenty five Fleas were to be built, under licence, in Japan by Nihon Hikoki, as the NH-1 Hibari (Skylark). Fifteen were registered before the European bans were imposed.

**TABLE 2**  
**SPECIFICATIONS & PERFORMANCE -1935 – 45 MIGNET FLEAS**

	<b>HM-14 Prototype</b>	<b>Mignet/Baynes Flea (Abbott Pou ?)</b>	<b>HM-290</b>
Engine	13kW (17hp) Aubier-Dunne motor cycle	22.4k (30hp) Carden-Ford	54kW (72hp) McCulloch
Wing Span	5.9m 19ft 6in	6.1m 20.0ft	6.1m 20.0ft
Length	3.5m 11ft 6in	3.96m 13ft	4.27m 14.0ft
Height	1.68m 5ft 6in	1.68m 5ft 6in.	
Wing Area	11.05sq m 119sq ft	12.73sq m 137sq ft	
Weight Take off	204kg 420lb	247kg 545lb	317kg 700lb
Weight Empty	99.8kg 220lb	159kg 350lb	186kg 410lb
Maximum Speed	100km/h 62mph	133km/h 82mph	138km/h 85mph
Cruising Speed		106km/h 65mph	130km/h 80mph
Initial Climb	60.96m/min 200ft/min	91.8m/min 300ft/min	183m/min 600ft/min
Range		243km 150mile	
Power/Mass		6.14kg/kW 18.2lb/hp	5.9kg/kW 9,72lb/hp
Source	Meggs (2009)	Anon (2014c)	Anon (2014b)

*Because of the wide range of engines and builders standard HM.14 figures are not available. Those presented are for the prototype and an aircraft (G-ADMH) modified in Britain by L. E. Baynes with the HM.290 figures for comparison. The latter are from "Plane and Pilot 1978 Aircraft Directory" via Wikipedia.*

Flying Flea Archives do sell or at least stock, up dated plans of the original material. Others people made their own adaptations of the basic HM.14 design. One post-war builder used original plans but altered the wings with a revised leading edge and dihedral only on the

outer 406mm (16in). He also lengthened the fuselage by 12ins (305mm) to separate the two wings further (Jones 1997). A number of engines were also commercially modified or specifically developed for use in the HM.14. In Britain the Carden-Ford of 22.4kW (30hp) was one of these.

### TO THE HM.18

The HM.14 was followed in 1936 by the HM.16 Pou-Bebe (Baby Pou) which was a light weight single seat version with a 19kW (25hp) Ava Engine (Anon 2014b). According to Ord-Hume (1982b) the bottom of the fuselage and top almost met at the rear leaving insufficient stern post for both hinges of the rudder. The top hinge was located on a V formed by two tubes projecting back from the top of the rear wing. This arrangement was needed to give the rear wing adequate incidence and keep the nose clear of the ground. Maertens (2006) has a photo labelled HM.160 which, while quite small, shows the beginning of smoothing of the lines that has progressed further as time has passed. It also had improved ground clearance.

However in 1937, even before the HM.14 was banned, Mignet had designed and built the completely different HM.18 which overcame many of the 14's defects. This involved better location of the upper wing, photographs suggesting a much greater separation of the two wings horizontally, and the fitting of small elevators to the trailing edge of the rear wing (Jones 1986). As well a more conventional undercarriage was used increasing ground clearance. The single seat cockpit was also enclosed and the engine fitted, in the prototype, a 26kW (35hp) Mengin, was enclosed in a suitable cowling. It would appear a number were built but the problems with the HM.14 and the soon to come 1939-45 war put an end to any redevelopment of the enthusiasm that the 14 had generated. Post war the MH.290/293 described below took this slot in the ultralight scene in Europe and elsewhere, but apparently not in Britain (Jones 1982).

### MIGNETS SUBSEQUENT DESIGNS

Despite its initial banning and the advent of World War II delaying further development of the basic principles, the HM.14 Flea, and its improved forms, have continued to be built. Plans are still available for a number of these derivatives which are still referred to as Pou-du-Ciel/Flying Fleas.

Of the designs following the HM.18. Anon (2014b) lists the HM.19 as “1937, two seat, enclosed cockpit, 45hp Salmson engine” while Jones (1986) carries a photograph with the caption “*Modern development of the HM.18, Arthur Moerig's MH.19*”. It is of a small aircraft with tricycle undercarriage and cowled engine. A rather large fin and straight backed rudder and the large hump for the enclosed cockpit tend to dominate the print. The wings, arranged in typical Mignet fashion, appear to have dihedral only on the outer sections especially the front wing and fairly wide gaps both longitudinally and vertically. It carries Swiss registration. Jones (1982) shows a different photo of the same aircraft identified as the HM.19c. Jones (1986) also refers to “*A new two seater, the HM.21 which qualified for a French Certificate of Airworthiness after more than 500hours of test flying*”. Anon (2014b) says it is a single seater dating from 1937 and confirms the airworthiness certification.

Prior to this Jones indicated Mignet had set up a small company *Le Societe des Aeronefs Mignet* for quantity production of his designs. However in 1937 he emigrated to America where he established American-Mignet Aircraft Corporation with the prototype of the HM.23 flying in late 1938. Two more were built there, the last only in 1942. In 1939 Mignet returned to France and spent the war years there (Jones 1986).

**TABLE 3**  
**POST HM.14 VARIANTS DURING MIGNET'S LIFETIME**

HM.No	Year	Comments
16+	1936	"Pou-Bebe", (Baby Pou), Single seat, lightweight Pou, 19kW (25hp) Ava engine.
18	1937	Single seat, enclosed cockpit, 26kW (35hp) Mengin engine.
19	1937	Two seat, enclosed cockpit, 33.5kW (45hp) Salmson engine.
210	1937	Single seat, enclosed cockpit, Airworthiness certificated.
280	1944	"Pou-Maquis", single seat, folding wing, parachute command vehicle.
290*	1945	Single seat, enclosed cockpit, popular as plans readily available, optional enclosed cockpit, 19kW (25hp) to 52kW (70hp) engine.
293**	1946	Single seat variant for larger pilots, 37-45kW (50-60hp) Volkswagon air-cooled engine.
294	c1949	"Butterfly", Single seat, built in Argentina, 26kW (35hp) Aeronica twin cylinder engine.
310	1952	"Estafette", Two seat, enclosed cockpit, built in Brazil, 67kW (90hp) Continental C90-12F engine.
311?#	1955?	Also known as Tachikawa R-HM, only one built?
320	1955	Single seat enclosed cockpit, 40.2kW (30hp) Volkswagon engine.
330	1954	"Cerisier en Fleurs", two seat, enclosed cockpit, no other details.
350	1957	Two seat, enclosed cockpit, 67kW (90hp) Continental engine.
351	c1957	Two seat, enclosed cockpit. One with tricycle undercarriage.
360*	1959?	Single seat, enclosed cockpit, improved wing geometry inc. folding.
380*	1957	Two-seat, enclosed cockpit, 499kg (1 100lb) gross weight, 45-75kW (60-100hp) engine.
390	1958?	Two/three seat, enclosed cockpit. 67kW (90hp) Continental engine.
Plans still available from:- + Flying Flee Archives USA, (who also hold HM.14 instructions).		
* Falconar, Edmonton, Canada & ** Grunberg, Roquefort, France		
# Anon (2014b) list this as the 351 but 351 is a modified 350. The R-HM is an updated 310.		

After :- Anon (2014b)- Wikipedia - Mignet Pou-du-Ciel, Jones (1982)

The HM.290 was his first design to take advantage of the post war market. This was a single seat design with an optional enclosed cockpit and an engine range from 19kW (25hp) to 52kW (70hp). It became very popular for amateur construction from plans, which, incidentally, along with the 293, are still available from Falconar Avia (Anon 2014b). However it is interesting to note that the only Mignet design to have flown post war in Britain up until at least 1982 was a solitary HM.293 (Jones 1982). Jones also indicates that the HM.293 was the most popular of the post-war designs possibly because of the Canadian Falconar marketing of the plans. The fact that it was capable of taking converted Volkswagon engines also helped. Anon (2014b) also gives detailed characteristics and performance data

for the 290 such as span 6.1m (20.0ft); length 4.27m (14.0ft); empty weight 186kg (410lb); McCulloch 54kW (72hp) engine. Compare these in Table 2 for the original Hm.14 prototype and the Mignet/Baynes HM.14. This table shows the steadily increasing weight, engine power and performance with essentially the same dimensions.

### **BRAZIL, JAPAN, MOROCCA & LATER FRANCE**

In 1947 Mignet moved briefly to Belgium and then the Argentine where the HM.294 “Butterfly” was built (Jones 1993). He then moved to Brazil where his next post-war design, the HM.310 Estafette, flew in 1951. In 1953, in Sao Paulo, he formed *Avioes Mignet do Brazil* to produce the Estafette commercially. This did not proceed far and by 1955 he was in Japan and had produced, in association with Tachikawa, a refined version of the HM.310, the R-HM powered by a 67kW (90hp) Continental C90. Again there was no success as possibly only one was built. This ended up in the Kotso Transportation Museum (Jones 1982).

After Japan Mignet spent time in Morocco (Jones 1993 & Meggs 2009). The latter states he built the HM.320 and 350 in his factory at Casablanca. The 320 had a 40.2kW (30hp) Volkswagon engine while the 350 had a 67kW (90hp) Continental. Meggs also gives more details of the HM.320 stating it had an upper span of 5.99m (19ft 8in), an empty weight of 208.6kg (460lb) and an all-up weight of 365.2kg (805lb), cruised at 130kph (81mph) and had a top speed of 151kph (94mph). On the other hand Jones (1982) has the two seat MH.350 of 1957 as Mignet’s first design to surface “back home” (France). This was later modified to become the HM.351. They were inspired by the Estafette and externally were R-HM look a-likes. In the 1982 article Jones does not mention Morocco. He does not mention that sojourn until the 1993 article so Meggs’s version can be considered the correct one.

Jones (1982) also has the single seat HM.360 as a further refined version of the 290. It had modified controls and semi-enclosed cockpit as the most noticeable external features. Harwood (1995) has a photo of the 360 prototype and indicates it first flew June 12, 1959. It was followed by the HM.380/381, a scaled up two seat version of the 360, one at least built with tricycle undercarriage. According to Jones again, his last design to emerge was the HM.390, a three seat cabin development of the 381 and the largest of all Mignet designs. It was powered by a 67 kW (90hp) Continental.

A revised version of the 390 was taken up commercially by the Societe Manche Aeronautique as the HM.390 “Auto-Ciel”. This differed from the 390 in having ailerons, its fuselage covered with a reinforced plastic shell and the rear wheel of the undercarriage moved forward to give a reverse tricycle effect. (See Photo Jones 1997) It was not a success.

Jones (1986) says Mignet was working on his fortieth design, the HM.400, when he died in 1961 aged 71. The 400 was to be a four seat cabin aircraft according to Harwood (1995). His son, Pierre, continued to work on this for a time but then put it aside to concentrate on his own design, the HM.1000.

## **FURTHER DEVELOPMENT OF THE TANDEM WING CONCEPT**

Quite early on small variations were being made by individual builders of the HM.14 Flea and, at times, more complete changes by commercial organisations, although these were still relatively minor ones. This occurred widely, in Germany for example, the “Lerche”, with a very smooth outline for the time and powered by a 33.5kW (45hp) Salmson radial, had made its appearance at Orly, Paris by October 1935. (Ord-Hume 1982b). In Britain L.C. Baynes, a sailplane designer, modified a crashed aircraft and then more completely reworked the design, as the Cantilever Pou, without drastically altering its appearance. (See under HM.14)

Another early French designer to use the tandem wing was Pierre Mouboussin whose single seat Type 40 Hemiptere was displayed at the 1936 Paris Air Show. It had two wings. The aft one was well back, where the tail plane would normally have been. It was 60% of the front one in area. The fore-plane had slotted camber changing flaps and associated elevators /ailerons able to be operated differentially. There were twin endplate fins and rudders on the rear wing. The 30kW (40hp) Train 4T engine was reputed to produce a top speed of 160km/h (100mph) (Hooks 2007 & another unrecorded). The Hemiptere’s development did not proceed any further.

Immediately post-war there were a number of people who adopted the tandem wing and pivoting front wing principle for their designs. One of the first, most prolific and most commercial in outlook, was Emilien Crozes. After building a “personalised” Flea he started, in 1957, with his EC-1-02 Geoland with a 47.6kW (65hp) Continental engine. Of wooden construction it had long flaps in the trailing edge of the rear wing to help with a high rate of descent and short landing run (Jones 1982). This was followed by a series of increasingly complex and variable sized designs using the tandem wing. The EC-6 Criquet, a side by side two seater with a 67kW (90hp) Continental engine, flew in July 1965. Jones (1997) says it had an ingenious split-trim-tab system on the rear wing to increase control when landing cross wind, always a problem with the Mignet wing system. The EC-6 was considered, by Jones (1997), as the most successful of Crozes’ designs with more than 30 flying to that date. Crozes also had an ultralight version of the Criquet, the Criquet Leger. They were followed by the three seat B-EC-7 Tous Terram with (100hp) Continental engine and four rough field main wheels (1 built) (Jones 1986). Then came the EC-8 Tourisme and the B-EC-9 Paras Cargo of 1978. The latter was described as “gargantuan” for a Pou with a large roller door giving access to a copious cabin. It had elevators on the rear wing and Jones (1982) doubted if it would sell.

A series of other designer/builders also appeared in France. These included Francois Lederlin who used the HM.380 as the basis of his 380L Ladybug. This had a welded steel tube fuselage and sheet metal skinning ahead of the cockpit. It flew in 1965 with only one built initially but several under construction by 1982 (Jones 1982). Plans annotated in both French and English were available in the early seventies (Taylor 1971).

Jones (1986) also covers Gilbert Landray who to 1986 had produced 4 designs over 10 years. The GL-1 was an update of the EC-6. The GL-3 Pous (Push)-Pou had trigear and twin tails. The GL-4 Visa Pou was an ultralight with a 20kW (27hp) Citroen Visa engine and was of wood and fabric construction. A number of further Landray designs have since appeared.

Other examples of the type included the Bourdin Autoplane from the early 1950s with three examples built. It was a single seater with a 22.4kW (30hp) Bristol Cherub engine (Jones 1982). Built in the late 1980s-early 1990s was Dominique Lascoud's Bifly with a 447 Rotax engine and all metal construction. From a photo it appears very small and the caption names it as a microlight (Harwood 1995).

Also in France there are a number of versions of the APEV Pouchel (Ladder Flea), designed by Daniel Dalby, currently available in kit form or plans. The initial versions, the Pouchel and Pouchel II had an aluminium ladder and rectangular tube design fuselage but the Classic had a newly designed wooden fuselage. It was still in production in 2012 (Anon. 2014d).

In Germany the Frebel F5 flew in 1978 and was built from plastic composite material. (Jones 1982).

In the USA the Flea concept was attracting a growing band of enthusiasts by 1997 with one group even providing a workshop manual and construction drawing for the HM.14 and HM.16. Among other models there were quite a number of HM.293s also flying in the USA by the late 1990s (Jones 1997).

In all of the above designs the Mignet lineage is apparent although sometimes only through the tandem wings with the front one tilting. Many, unlike the HM.14, have dihedral only on the outer wing panels.

Meanwhile Mignet's son Pierre and grandchildren achieved commercial production of later developments of the original concept. They formed *Societe d'Exploitation des Aernefs Henri Mignet (SEAHM)* and in 1982 commenced design work on the HM.1000 Balerit with the prototype flying in April 1984. A batch of ten were under construction by 1986. It is a two seat version featuring a rear mounted 48kW (64hp) Rotax engine driving a pusher propeller. The wings can readily be folded. It has sold widely with in excess of 150 built by 1993, 25 going to the French Army. It has also sold well in Britain (Jones 1997). The 1996 HM.1100 Courdouan was a further commercial development from the same source featuring ailerons on the rear wing, to help landing in cross winds, and folding wings. It has a 62kW (80hp) front mounted Rotax 912 engine.

**TABLE 4**

**SOME NON-MIGNET FLYING FLEA TYPE TANDEM- WING DESIGNS**

	<b>Model</b>	<b>Name</b>	<b>Year</b>	<b>Comments</b>
Abbott		Pou	1936	Britain. Almost certainly that identified in Table 3 as Mignet/Baynes HM.14 converted by Baynes.
Abbott-Baynes		Cantilever Pou	1936	Britain. Developed version of HM.14, Carden-Ford 22kW (30hp) engine, (60 ordered) 3 built
Aero-Eight Club		Super Flea	c1936	Britain. HM.14 with streamlined fuselage, divided u/c, 2 built.
APEV		Pouchel		
APEV		Pouchel II		
APEV	Classic	Pouchel		In production 2012, Available as kit or plan.

APEV	Light	Pouchel		
Bourdin		Autoplane	1934	Single seat, 22kW (30hp) Bristol Cherub engine, 3 built.
Croses	EC-1-02	Geoland	1957	48kW (65hp) Continental A65 engine.
Croses	EC-1-03	Pouplume	1961	1 seat, open cockpit, motor glider, 6kW (8hp) Monet-Goyon motor-bike engine.
Croses	EC-2	Pouplume		2 seat, conventional aero engine.
Croses	EC-3	Pouplume		Definitive version for homebuilt kit, 6kW (8hp) Monet- Goyen motor-bike engine.
Croses	EC-3S	Pouplume Sports		1 seat, widely built in 1970s, 1500cc VW engine.
Croses	EC-6	Criquet	1965	Popular 2 seat, 90hp Continental engine.
Crose	EC-6	Criquet Leger	c1966	Ultralight EC-6 Rotax 614 37-45kW (50-60hp) engine.
Croses	B-EC-7	Tous Terrain		Enlarged EC-6, 3 seat, Tandem 4wheel undercarriage 75kW (100hp) Continental engine.
Croses	EC-8	Tourisme		3 seat, cross country, EC-7 type u/c.
Croses	EC-9	Para Cargo	1978?	Largest of Croses Fleas, six seat/450kg freight, 3 axis control, 134kW (180hp) Lycoming engine, At least 2 built.
Croses	EC-10	Criquet		Fibreglass construction, aero club trainer, heavier /dearer than normal Criquet.
Frebele	F5		1978	Germany. Much plastic in structure, VW engine.
Lascaud		Bifly	1993	Tiny single seat, a microlight, all metal, Rotax 447 engine, Kit available 1995.
Landray	GL-1		1977	Improved EC-6, (LC-6?), 67kW (90hp) Continental engine.
Landray	GL-3	Pouss-Pou	1981	Trigear, twin tail, pusher? Citroen car engine.
Landray	GL-4	Visa Pou	1984	20kW (27hp) Citroen Visa engine.
Landray	GL-5			Open cockpit, Rotax engine.
Landray	GL-6			Open cockpit, VW engine.
Landray	GL	Pou-Plum		Citroen car engine (GL-2?).
Lederlin	380L	Ladybird	1965	Much modified HM.180, 67kW (90hp) Continental engine. Plans were available.
???		“Lerche”	1935	Germany. Most powerful of early flea variants, 33kW (45hp) Salmson radial, 1 built?
Tachikawa	R-HM		1955?	Japan, Refined HM.310, Mignet supervised construction, (HM.311?), 1 built?

Unless otherwise indicated under comments they are of French origin

After:- Various Wikipedia entries, Jones (various), Harwood and others.

## FLEAS IN AUSTRALASIA

That there must have been considerable interest in the HM.14 Flying Flea in Australasia is shown by the fact there are a number in museums. Anon (2014c) lists three in New Zealand, at MOTAT, Auckland; Wanaka Transport Museum; and Ashburton Aviation Museum. However “Waharoa” (2002) also listed three in museums, the first two plus Taranaki Transport, Aviation & Marine Museum. “Waharoa” also cites four other MH.14s:- one burnt 1950; one at Timaro flown Sept 1942; another fate unknown; and one at Waikaway Bay, built 1930s, crashed on first flight, summer 1947. As well it lists ZK-FLE a modified HM.16, at Rangitata Island and photographed in 2008 in pristine condition.

In Australia Anon (2014c) only lists one, at the Queensland Museum, Brisbane. This was built by George Roberts and his brothers in Ipswich in 1935, flown once, and then stored under their house until given to the Museum in 1982 who presently hold it in their storage facility. It had a 17kW (23hp) 4cylinder Henderson motorcycle engine. However Meggs (2009), in his detailed description of aircraft constructions in Australia, indicated that he was able to locate 56 people in Australia who, before 1939, had made enquires, mostly through official channels, about building Pou-du-Ciel. These would almost certainly all have been HM.14s. He goes on to indicate that eleven of these are known to have been completed or reached a very advanced stage of construction. Six are known to have flown to some extent with another three possibly doing so. Meggs, in considerable detail, outlines not only the history but the circumstances surrounding this interest. He also gives background of each project and some on those people involved with each project.

Over this period there was a constant battle by the authorities at first to prevent the construction and flight of the Fleas and later to keep some control over these activities. Their efforts were often ignored. There were no fatalities, partly because quite a few of the aircraft refused to leave the ground (low powered engines?) or if they did, the altitude, distance and speed attained was minimal. Others appear to have flown well, safely and for some years.

Meggs also states that some thought was given to producing the Flea development current in 1957-58 in South Australia. W.A. Lavers, who had spent some time in Mignet’s Moroccan factory, actually applied to do so but did not proceed.

Other Mignet aircraft existent in Australia to-day include a HM.14 built at Bung Bong, Vic., in 1936-37. It refused to leave the ground, passed through several owners before, after a rebuild to display standards, ending up at Moorabbin Air Museum (Meggs 2009). Benalla Aviation Museum also has recently posted a news item, (“Jean-Pierre le Bam” 2014), based on Wikipedia material on the HM.14, titled “The Flying Flea” but it does not indicate if they have one.

Jones (1997) has a photo captioned *“could be mid-1930s rather than 1992 at Luskintyre, New South Wales, Australia, Bob Cornwell’s complete Flea stands next to period pumps.”* The aircraft is a HM.14 and one (unfortunately not recorded) web site accessed shows that Bob Cornwell has built four Fleas, a HM.8, a HM.14, a HM.16 and a HM.293.

As well Meggs says at least two post-war developments were built by Tom Mulcahy and Jim Jenz, each having had earlier association with the mid 1930 Fleas. Meggs does not indicate model numbers but Jones (1997) suggests Lenz’s was his own design and includes Bob Raper’s effort in this category. The latter is, apparently, a 293 modified to 290 or at least is so

labelled at the RAAFA Museum, Bull Creek W.A. It is the HM.290/293?, 10-0718, and is the second Mignet aircraft built by Bob Raper. Meggs indicates this was not completed until 1996 when the builder was 81. No longer on the register it would have first appeared there cJuly 1988. Raper's first Flea was a HM.14 that was tested at Subiaco airfield, Perth, in the 1937-39 period, unsuccessfully. Its fate is not indicated (Meggs 2009).

The RA-Aus Register to 2012 shows 10-7581, a HM.293 registered in August 2010 under a Provisional licence (yet to complete 40hrs flying) and 24-7091, a HM-1000 registered March 2009, while Kay (2013) ran a story on Wide Bay, Qld ABC on the construction by Bill Price of a Flying Flea near Maryborough, Qld. Price estimated he had six months to go to completion with "all the finicky bits" to do after four and a half years work. The model is not indicated and the ½ front view photograph doesn't help. Bill believed there was not another like it in Australia and only two in Canada.

Jones (1997) lists a modified HM.290 with VW 1500 engine (Gordon Laubsch) and a 290 with a Rotax engine (Fred Byron). RAA Register shows it as 10-1438 a Mignet & Byron HM-290 registered August 1994. Add to these the incomplete modern HM.14 Flying Flea that has come to QAM from Ron Aubery of Yandina and we have a fair representation of both ancient and modern Fleas still existent in Australasia. This is likely to be far from the total, especially of modern designs.

## CONCLUSION

Beyond the HM.23, Mignet adapted the French system of model numbering. Jones (1986) quoting the 40<sup>th</sup> design as the HM.400 and Harwood (1995) confirms the changed numbering system retrospectively back to HM.21. The 0 was added after the basic serial number, with the 0 replaced by numbers 1, 2, 3 etc. for minor variations. This makes sense as Anon (2014b) listing the variants of the HM.14 beyond HM.19 uses the 0 suffix. The MH.21 is listed as the HM.210 and the listing proceeds 280, 290, 293 etc. In the case of the 293 of 1946 this is simply a variant of the 290 for larger pilots. This proceeds through to HM.390 with not all numbers taken up. (design not completed/built?). Externally all bear a strong family resemblance to the original 14 but show an increasingly smooth and developed appearance in fuselage contours, engine cowling and undercarriage structure.

There are in fact in excess of 300 different versions derived from the original HM.14, most not designed by Mignet. The most conspicuous changes from the original formula are cowlings the engine, the fitting of a normal undercarriage and enclosed cockpits and some increases in size and robustness. The front wing mounting also changed in many later designs from the flimsy looking tripod pylon to a pair of substantial, well streamlined struts. The basic fuselage construction has also evolved from the wooden box of the HM.14 to a welded steel tube structure but still with wood/fabric wing (Jones 1986). Later ones had even more modern construction styles but all retained the original wing layout and were only marginally larger if at all. However, there was a gradual increase in the power of the engines mounted.

Throughout his life Mignet himself rigidly adhered to his original formula of fixed rear wing and pivoting forward wing and despite his continued output of new or modified designs based on this principal it does not appear as if any but the 290 series and possibly the 360 & 380 were produced in any numbers during his final years. However, according to Jones (1997)

there was a major revival of interest in the basic design features over the early 1990s with 45 so called Fleas present at Marennes, France in August 1993, two-thirds actually flying there. A number of these were the HM.1000 Balerit designed by Mignet's son Pierre (See above). This was for a 60<sup>th</sup> anniversary celebration of the HM.14s first flight.

As well as the HM.290s Falconar in Canada still holds plans of the HM.360 and 380. Anon (2014b) also states that in 2011 plans of a modified HM.293 were still being offered for sale by R. Grunberg of Roquefort, France with quite a number sold and flying. The Flying Flea Archives in the USA also had a set of 72 sheets of drawings of the HM.16 (as the HM.160) available as well as a workshop manual and constructional drawings for the HM.14. (Jones 1993). (See Table 3). All these sources have continued to maintain an interest in the original Mignet designs as well as the developed modern versions such as those of Croses and Landray.

According to Harwood (1995) Mignet was temperamentally unsuited for life as a businessman and never succeeded, despite many attempts both at home and abroad, in setting up a production system for any of his designs. One of his major problems was that he was constantly at loggerheads with the aeronautical establishment.

The series of fatal crashes due to the initial problems with the HM.14 while they were easily corrected, continued to dog Mignet and his formula for the rest of his life. This despite the fact that his basic wing layout has proved to be safe and has been widely used in successful factory as well as homebuilt aircrafts (Anon 2014b).

The 1936 ban calmed the initial rush to build Flying Fleas and many early machines were either broken up or have been found in sheds and barns and passed on to museums. Anon (2014c) lists 31 HM.14s on display around the world, Queensland Museum, Brisbane, where their Flea is now in storage, is shown as one of these sites. Only four of the 31 are indicated as replicas. Outside France and Britain, others are in Finland, New Zealand (3), Spain (2), USA (2), Czechoslovakia (2), Germany, Malta, Sweden, and Switzerland. The continuing use of his wing layout indicates how importantly the Flea and its place in amateur light aircraft development and construction is regarded worldwide, especially in Europe.

## REFERENCES

**(This lists all articles consulted, not all are individually cited above. especially for the HM.14 where statements have, at times, been distilled from a number of sources.)**

Anonymous (2014a), *Henri Mignet* – [http://en.Wikipedia.org/wik/Henri\\_Mignet](http://en.Wikipedia.org/wik/Henri_Mignet)

Anonymous (2014b), *Mignet Pou-du-Ciel* – [http://en.wikipedia.org/wiki/Mignet\\_Pou-du-Ciel](http://en.wikipedia.org/wiki/Mignet_Pou-du-Ciel)

Anonymous (2014c), *Mignet HM.14*- [http://en.wikipedia.org/wiki/Mignet\\_HM.14](http://en.wikipedia.org/wiki/Mignet_HM.14)

Anonymous (2013d), *APEV Poushel Classic*-  
[http://en.wikipedia.org/wik/APEV\\_Pouchel\\_Classic](http://en.wikipedia.org/wik/APEV_Pouchel_Classic)

Appleby, Steven (1982), *On home made wings* – *Aeroplane Monthly* March : 148-152

Best-Devereux, Harold (1982), *Letter to Editor - Flea bites*- *Aeroplane Monthly* : 226

Field, Hugh (1980), *Light Planes and Aerial Sport* - in *Aviation – The Complete Book of Aircraft and Flight* - David Mondey (ed) : 220 - Octopus Books, London.

- Harwood, Ian (1993), *The Flying Flea* - FlyPast : 28-29
- Harwood, Ian (1995), Fleas over Popham – Aeroplane Monthly, December : 46-48
- Hooks, Mike (2007), *Instant Answer* - Aeroplane Monthly, January
- “Jean-Pierre le Bam”, (2014) –*The Flying flea* -  
[Http://www.benallaaviationmuseum.org.au/news-2.html](http://www.benallaaviationmuseum.org.au/news-2.html)
- Jones, Geoffrey P. (1982), *Mignet and Beyond – Post-war development of the “Pou-du-Ciel”*- Air Pictorial, February : 62- 69
- Jones, Geoffrey P. (1986), *Mignet Flying Fleas* – FlyPast, June : 48-51
- Jones, Geoffrey, P. (1993), *Henri Mignet Centenary Celebrations* –FlyPast, October : 50-51
- Jones, Geoffrey P. (1997), *The Flea Fights Back* – Aeroplane Monthly, June : 32-36
- Kay, Ross (2013), *The fabulous flying flea of the Fraser Coast* – ABC Wide Bay 4th December, 2013 (retrieved <http://www.abc.net.au/local/stories/2013/12/04/3905002.htm>)
- Maertens, Andre (2006), *Hibernating-* Pacific Flyer October : 32
- Meggs, K. B. (2009), *Australian Built Aircraft and the Industry- Pou du Ciel – various builders* - 1 (2) : 445- 455. Four Finger Publishing, Seymour, Vic.
- Morse, William (1992), *Baynes: the unknown Innovator* – Aeroplane Monthly June 1992 : 26 - 29
- Ord-Hume, Arthur (1973), *Britains Flea craze* – Aeroplane Monthly, May :11-15 con.: 24-2
- Ord-Hume, Arthur (1982a & b), *Isn't it time we stopped poo-pooing the poor pou* – Aeroplane Monthly, January : 46-49 & February : 109-112
- Shore, Howard (1993a,b & c), *Flea Fever* – Aeroplane Monthly, November : 48-51, December : 56-59 & February 1995 : 56-59
- Taylor, John W. R. (ed) 1970, *Lederlin 380-L* – Janes All the World's Aircraft 1970-71 : 77 Sampson Low, Marston, London.
- “Waharoa” (2002), - Wings over New Zealand Aviation Forum web site,