By Roger Beebe

# The Beginning

*Aeroplane development was well underway before Aircraft Maintenance Engineering was even a thing. So where are the profession's historical roots? AME and author Roger Beebe has traced the timeline in a five-part series that begins this issue in the years leading into the First World War.*

**In 1911, Canadian J.A.D. McCurdy became the first pilot to attempt a massive 160-kilometre ocean crossing in a basic, single-engine wooden aircraft.**

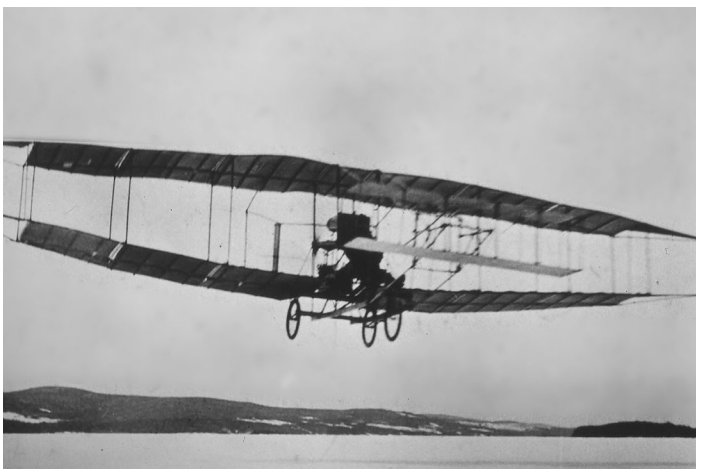
SO **WHERE DO WE GO** to find the start of the profession of Aircraft Maintenance Engineer? A lot of parallel aeroplane development work took place in Europe and North America before the First World War. The earliest designers were a combination of what we today call an engineer or scientist and machinist/mechanic. These individuals designed and build the items needed to make the machine work. They also worked to solve the technical challenges relating to engines, propellers and flight control. Unfortunately we do not have much information on who actually constructed all the bits and pieces.

We know that Charles Taylor, a machinist by trade working in a bicycle factory, built the engine for the Wright Flyer and maintained it. He apparently also completed the first repair so he in fact conducted one of the first aircraft maintenance actions. There were also many examples across Canada of farmers who were particularly mechanically inclined and adventurous mechanics and who elected to build experimental aircraft and engines.


**Above: Avro 504 prototype after modification with conventional ailerons.**

**Right: Much of what was learned during aviation's early years came through trial and error.**

**Below: J.A.D. McCurdy tests the Silver Dart's controls.**



The book, Voyageurs of the Air, by J. R. K. Main is a fantastic source of information on early Canadian aviation history. Much credit must go to the authors of the book which was commissioned by the Federal Ministry of Transport as a 1967 Centennial project to honour Canada's 100th birthday. I quote several paragraphs from this book to demonstrate the state of technical advancement in Canada before World War I. "One of the most striking sagas from this period concerns a man by the name of William Wallace Gibson. He was reared on a prairie farm in southern Saskatchewan. From an early age he had distinguished himself by designing and building kites and model aircraft. As a young man, Gibson moved to Vancouver where he made a small fortune in mining, after which, starting in 1908, he devoted his time and money to designing and building Aeroplanes and aero engines. The first engine was a failure, but his second, a six cylinder, air cooled, two stoke engine, is credited with the capacity to develop 60 hp.

The engine's weight was 210 pounds. The technology applied to these early airplanes was surprisingly modern. Two propellers of opposite rotation drove Gibson's Twin Plane so the torque was neutralized. Rupert Turnbull of New Brunswick is considered the father of aeronautical research in Canada. He did pioneering work on propellers and the matching of all components on an aircraft. He suggested dihedral wings as a way to gain better controllability. The Silver Dart had steerable tricycle undercarriage and a steering wheel rather than a "joy stick", a modern feature."

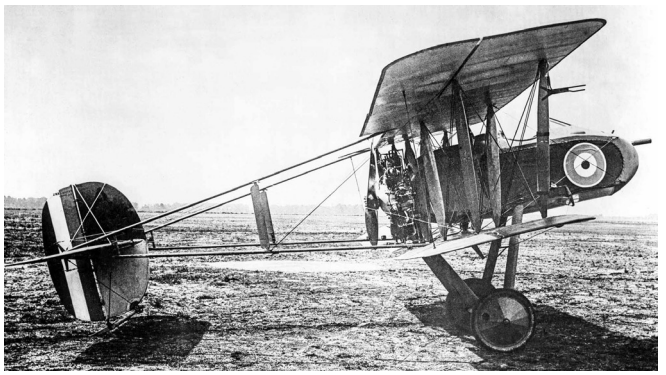
THE BELL FAMILY

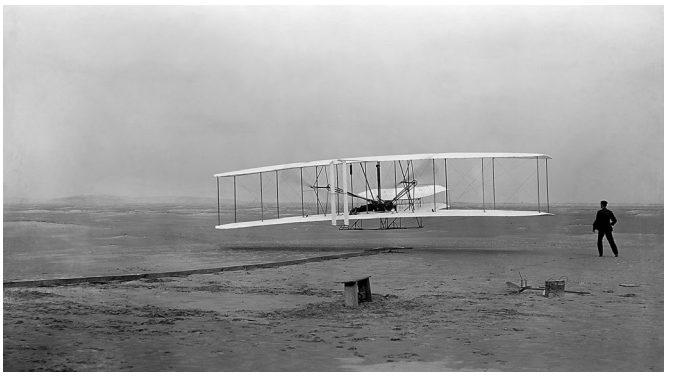
The Canadian military was not easily convinced of the potential of early aircraft.

Again I refer to Voyageurs of the Air to describe the equipment these early aircraft were equipped with: "They had few, if any, instruments for either engine or aircraft. McCurdy is known to have had a thermometer on the Silver Dart to indicate water temperature in the cooling system. They had experienced much difficulty with overheated engines, particularly the air-cooled ones. Indeed, the earliest engines could not be trusted to operate satisfactorily for more than about 10 minutes. For longer periods they overheated to the point where power dropped and there was danger of seizing up. One is startled to learn that a prospective purchaser of an engine specified that it must run full out for 30 minutes before overheating. A temperature gauge was therefore a must. The oil pressure gauge followed quickly thereafter. But instruments to tell the speed and altitude were still in the making. The pilot relied on his natural sense of balance, conveyed through the point of heaviest contact, his posterior, to maintain an even keel, and on the sound of the wind whistling through struts and wires, which were plentiful, to maintain a safe airspeed. he one great indispensable aid to flight was the horizon."

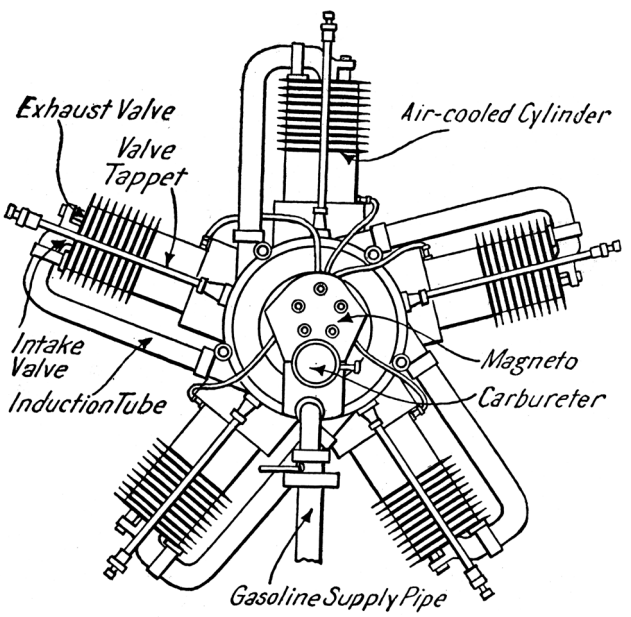
Trades people who were later to become known as Licensed Aircraft Maintenance Engineers were an outcome of the apprentice system of the 19th century. European nations had developed a system of trade apprenticeships, which were a natural growth from the medieval trade guilds. In classical times trades were passed down from family to family member. They had schools to teach reading and writing and other refinements; however it seems trade training was less formal. The medieval guilds instituted a formal training system across Europe. These systems formed the base of training for the industrial revolution, which by then required many skilled trades, and engineers. The title Engineer had not yet been developed to represent a class of university trained and professional association certified pers ons as we know it today.

Our ancestors used the term to mean anyone who made something mechanical work. Consequently, when ships went from wind and sails to steam engines and turbines they applied the term engineer to those who maintained them. The same sort of thing happened in railroads. Since early aviation borrowed so much from the marine world the term engineer was adopted in the British Empire for aircraft





**Above: The first production Vickers FB12C A7352 with Anzani engine and modified nacelle.**
**Below: This illustration shows an Anzani Radial Motor with stationary cylinders.**
**Top right: The Wright Flyer's first flight at Kittyhawk in 1903.**
**Bottom right: United Air Lines mechanic roll-up tool set, from the late 1920s.**


Anzani Radial Motor, with Stationary Cylinders.

maintenance technicians. Logbooks, navigator, captain, first officer, port and starboard all came from the same marine world. The Americans alone among English speaking nations tended to prefer mechanic, a term that is highly respected in the USA. Why they did so is difficult to understand unless they simply wanted to be different from the British Empire, with whom they had a falling out.

One thing that set the American approach apart from that of the British Empire and Commonwealth, and may provide a clue to the different terminology, was that the Americans have focused on the performance of work, while the rest of the English speaking world makes a distinction

A Le Pere biplane with a GE supercharger after making a record altitude flight in 1919.

between actually working on the machines and inspecting them for safety. In the Royal Flying Corps and Royal Air Force for example, the people who worked on engines and airframes were known as Fitters and Riggers, respectively, and initially this carried over into civil aviation. These titles concentrated on hand skills. When it became desirable to add an extra layer of safety it would have been natural to adopt the term engineer for this responsibility, just as in the marine world the ship's engineers oversaw the actions of the stokers and oilers. This difference still exists to a degree. American regulations still focus primarily on who can perform work, while the Commonwealth and European nations tend to put more stress upon who can certify that the work has been done correctly.

In the non English-speaking world the term engineer was not generally used as we know it today. The Anglo-Saxon world came to play major part in aviation and in the far flung British Empire the British model took hold and remains to this today. There has been a long and frustrating debate over these title terms which I will deal with in a later chapter.

Sometimes we forget that our predecessors in this world had the same talents as ourselves. They were skilled craftsmen and women of the past who were able to create all the necessary equipment to be able to fly. The idea of a wing was more easily understood; all you needed to do was to watch the birds. The facilities to make struts and wires and linen coverings were all there. Model gliders had been around for many years and even man-carrying gliders for some time prior to the Wright Brothers. The missing piece was a power source that was light enough to make it all happen. The invention of the internal combustion engine is what really made sustained flight possible.

Although the steam turbine was in use in the marine and locomotive sectors, the weight penalties were too great to have much effect on aviation. There were some people who realized that the principles of turbines could be applied to aviation and some theoretical and practical work was started. The skilled mechanics/engineers of the day were able to refine aluminum and machine engines from it. They also knew how to create radiators or sleeves filled with water to cool the engine if they did not go for air cooling. The industrial revolution had also created the mechanical means to provide feedback and control systems. Today we do most of that by electrical systems and electronics but before World War I it would be fair to say most controls were mechanical. So the technology existed and the skilled people existed. One group had to be created from the start and that was the pilots. Every early flight was by trial and error but gradually a body of flying knowledge was created.

Another change was taking place around this time, which would affect the early AMEs. Society was creating more and more access to higher levels of education for everyone. The effect of that was to create more research capability and a growing pressure to certify engineers in the same manner as doctors and lawyers. By 1914 we find many highly educated

and skilled engineers involved in aviation around the world.

Gradually there came to be a separation between skilled tradespersons educated through apprenticeships and/or on the job work, and those more formally educated. This eventually led to the aviation industry separating into three early classes in most countries: pilots, mechanics and engineers.

The final outcome of this was seen in Canada in 1921 when the government adopted Air Engineer for the title of the new licensed technician/mechanic. Fortunately for those AMEs who dearly love the present title, the profession of engineering was not legally recognized in Canada until later in the 1920s. So the practice of being called engineer continued in Canada and other British dominions. In the United States the term mechanic became an honoured term and has remained so.

So what was life like for the early AMEs? From what I understand they worked in small machine shops and probably blacksmith type forges. I remember how much could be manufactured by a small shop and forge in my hometown in the 1950s. The early AMEs would have worked with lathes and files to form most components. There would have also been facilities to prepare the fabric and cure it. Wires would have been manufactured and adjusted. They would have had to have some knowledge of the handling of fuel and oil products as well. They were probably not well paid. The first American mechanic who built the Wright Flyer was found penniless in his old age. The American aviation industry raised money to keep him in an old folk's home until he died and then he was buried in a hero's cemetery for aviators. I do not recall any Canadian early AMEs becoming rich and famous.

Resourcefulness and a sense of humour were required by the first AMEs. Their work was hard and at times dangerous. Engines were started by hand-swinging the props. One misstep or a backfire could mean maiming or death. Their tools were hand fabricated in many cases and maintenance manuals were rudimentary or non-existent. They learned from experience and from one another. The arrival of World War I and the heavy investment in research changed aviation rapidly. Governments also had to deal with replacing pilots quickly and training masses of mechanics. All of this forced them to adopt structured training and manuals, the effect of this effort were to last until today.

A century before the foundation of the Canadian Institute of Civil Engineers, the Montgolfier Brothers made the first balloon ascents in France. During the nineteenth century Lilienthal in Germany, Pilcher in England and Chanute in the United States experimented with gliders. These activities were the foundation on which our modern aviation was built. Canada took little part in this work. Though there is no doubt occasional balloon ascents were made, the only record of the design and construction of an original flying machine in Canada during the nineteenth century is that of Mr. Charles Pale of Montreal. His backer in the venture was Mr. R. W. Cowan, a retired merchant to the city. His invention was a dirigible, cigar-shaped balloon, from which was suspended a nacelle.

In 1900 the Wright Brothers began their work at Kitty Hawk, North Carolina, which led to the world's first power driven flight on December 17, 1903. McCurdy's "Silver Dart" was completed in November and assembled at the Bell laboratory for trials from the ice there. On the 23rd of February 1909, Dr. Bell was able to cable the London Times in part as follows, "First flight of a flying machine in Canada occurred here today." McCurdy, native of Baddeck, Nova Scotia, flew a distance of about one-half mile at an elevation of about thirty feet above the ice on Baddeck Bay in an aerodrome of his own design, named the "Silver Dart". The following day a flight of four and a half miles at a speed of 40 mph was completed. It made in a circle round Baddeck Bay.

Then on the 8th of March a distance of eight miles was covered in the fast time of eleven minutes. Aviation history was made rapidly in the little town of Baddeck that winter. The "Silver Dart" was without doubt an advance on any aircraft previously flown. It embodied several new and very important features, notably three-wheel undercarriage, tapered wings and the use of aileron control. After several rough landings and a series of early morning successful trial flights, both aircraft crashed on landing, fortunately without injury to its pilot. The military authorities remained unconvinced of the practical value of aircraft in military work and refused further assistance. It is unfortunate that the Militia Department refused to take cognizance of McCurdy's and Baldwin's 200 successful flights made under proper conditions and adopted a conservative attitude based on the reports of the trials made from rough ground at Petawawa. Their lack of vision had an influence detrimental to the whole course of Canadian aviation. Had their foresight been greater, a small aviation corps would have existed in the pre-war years. It would have been expanded to meet the war needs. The splendid record of Canadian pilots would have been made under a Canadian organization and the Royal Canadian Air Force and Civil Aviation would have had a continuity of experience, policy and direction through the war and afterwards in the peace reorganization.

The first aeroplane built and flown in western Canada was a 35-40 horsepower Anzani engine biplane constructed in 1911 out of Sitka spruce and ash. It was made with silk covered wings from the designs of William Templeton, William McMullen and Winston Templeton of Vancouver. This homemade aeroplane, after many weeks of trials, finally made a few successful though short flights from the racetrack on Lulu Island, B. C.

The work of many aircraft technicians, to use a modern day phrase, from that time has gone unrecorded. They did their job as best they could as part of a very new and exciting industry. Aviation was one industry that was to expand rapidly and change mightily during the First World War from 1914 to 1918. ■

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