

I have chosen to start the story about Avionics and the Aircraft Electronics Association (AEA) EA with a quick review of the development of avionics from the beginning of World War Two. Prior to the war there were electrically driven components and some simple, by today's standards, electronics devices that were found in aircraft. Mainly radio and simple navigation equipment. But not to the scale found during and after the Second World War. The following story has been developed from my life experience in aviation and avionics since I joined the Royal Canadian Air Force (RCAF) in 1963.

A large part of the avionics story concerns the Aircraft Electronics Association (AEA) in Canada as well as the United States, although later the AEA expanded to other parts of the world. So, to start I have copied the AEA Mission statement to give the readers some sort of overview of why they exist. You will see as I progress the AEA fulfilled those objective over the years I worked with them. The AEA mission statement:

The AEA membership includes government-certified international repair stations, manufacturers of avionics equipment, instrument repair facilities, instrument manufacturers, airframe manufacturers, test equipment manufacturers, major distributors, engineers and educational institutions.

Mission Statement

The mission of the Aircraft Electronics Association is to be a worldwide, self-sustaining organization committed to enhancing the profitability of its members by...

- *providing effective leadership to its members,*
- *facilitating the communications between members,*
- *encouraging members to establish quality processes,*
- *furthering the education of its members and their various constituent groups,*
- *influencing the applicable legislative and regulatory processes.*

Rapid Advances since 1940

A quote from a 1940's speech by The Hon. C.D. Howe, Minister of Transport and Minister of Munitions and Supply,

“A cataclysm of the magnitude of the present war affects all civil activities. Aviation has no exception. Every phase of flying has been gravely affected by the change-over from peace to war. While meeting the Air Force requirement in all respects, the aim of the Department of Transport, Civil Aviation, has been to ensure that when the time comes to return to normal peace conditions, as much as possible of the war effort and expenditure may be adapted to increasing the facilities for civil air transport in the Dominion. The aerodrome situation at any rate will be vastly improved.

The size of all the main aerodromes on the trans-Canada airway and its principal feeder lines has been increased. New hard surfaces have been added and many fuel hangars and other buildings have been built on the aerodromes. Some of these no doubt will still be required by the R.C.A.F. when the war is over, but much may be surplus to their requirements and can be made available for the expansion of our civil transport services. In addition, aerodromes have been built to serve many new districts. Speaking to a Montreal audience one naturally takes the local situation as an illustration of what is happening in all parts of the country. St. Hubert, the old civil airport, will next summer be turned over to the R.C.A.F. and a new airport designed on modern lines and complete with all facilities will be ready for use by the civil air transport services. The new airport will, at the same time, accommodate an Air Observers and a Wireless school for the duration of the war”.

The successful execution of this massive expansion of aviation and its supporting aerodromes and electronics equipment was due to in the first place to the vision and initiative of the Honourable C.D. Howe. In both capacities he was head of services intimately connected with the war effort. As Minister of Transport he was responsible for the organization of the Trans-Canada aerodrome and navigation system, which has been the basis of this aviation expansion program. Without which the rapid wartime aviation industry progress made would not have been possible. The quote above was found in some old papers really gives one the scale of the new aviation industry and its electronic support system in Canada. This expansion created a requirement for specialist technicians and AMEs. This soon

led to even more specialization in a new field, which was to become known as Avionics.

The foundation of the cross Canada aviation technical trade education system was built during these years as well. Toronto Central tech had been around for most of the century, followed by places like the Southern Institute of Technology in Calgary. Gradually the system expanded across Canada and tech colleges can now be found in all parts of the country. The schools or Colleges as they are known today did not have avionics courses as the term was not used. Like the military they used terms like, electrics, instruments, RADAR and communications describe the technical teaching subject areas.

The technology in both aircraft manufacturing and maintenance was changing in step with the complexity of the aircraft systems. This all set the stage for the introduction of turbine power into the post war civilian world. That fact, together with the electronic revolution caused by the war, brought major changes to all later AMEs, including the licensing and oversight system itself. Eventually this led to the Avionics category in the current AME system.

Times are Changing in aircraft electronics

The 1950s was a time of great change for many AMEs and technicians. The training and experience many of the senior AMEs was no longer so effective in maintaining the new jet aircraft. Nothing changed in a hurry, because many piston engine aircraft soldiered on for many years. In fact, there are still large piston engine aircraft in service today, in 2020. The new design, manufacturing and operations emphasis was on the complex turbine powered aircraft, namely pure jets and turboprops. These types of aircraft required new and means of control which led to a major use of electronics, a fact which continues today. One of the issues airline management had to face was that an electronics education requires a good foundation in science and mathematics, which some of the older AMEs did not have. I lived this experience in both RCAF and later in civilian airlines. The requirement for more formal education in science, mathematics and electronics led to the creation of a new trade; avionics.

The creation of the avionics trade led to many interesting and fractious debates in the 1970s and 1980s, until Justice Dubin addressed the matter of licensing Avionics Technicians in his famous report on aviation safety. This issue will be

dealt with in the section on AME's and Transport Canada. The advent of avionics did not end the role of the classically trained (aeroengines and airframes) AMEs. They were the senior people and remained so for years. Their experience in managing and leading technicians served them and the industry well for many more years, however the workload dramatically shifted, so we went from crews heavy on engine fitters and riggers, to crews that included many more avionics technicians. The radio and navigation component shops continued to be staffed by people who had narrower but more in depth training in such fields as instruments, electrical equipment, etc. This continues today.

So, as the composition of the crews changed, so did the work. On the flight line, more systems troubleshooting was being accomplished by the avionics technicians. The work and training line between job functions blurred. One major negative on legacy AMEs, aeroengines and airframes, was that the major airlines management did not train them or offer training on the new electronically controlled systems. That moved the system troubleshooting, installation and repair over to the new avionics specialty. This caused aircraft work certification problems in that there was no avionics AME Licence. This had to be addressed in later years; a task in which I played a major role.

The nineteen sixties really brought to the fore the issue of how aviation maintenance work in the airlines would be organized and conducted. The steady advances in the use of electronics to solve mechanical engineering problems continued at a fast pace. Developments in transistor technology and miniaturization of circuitry added to the speed of integrating electronics into aircraft systems. Since many of the older AMEs did not have the necessary mathematical or basic electronics training, something had to happen, as companies really weren't that interested in re-educating their older workers. What happened was the advancement of the classical instrument, electrical, and control systems trades into the new trade called Avionics.

Regulatory bodies had used specialist licences for radio, instruments and such back in the 1920's but that approach had faded away in Canada by the 1950's. To cope, the Department of Transport, later Transport Canada, had delegated certification authority to three major airlines who set up company-based certification authority. This meant avionics technician could sign off their work, but you would still need another AME to release the aircraft. This produced lot of overlap and duplication which was frustrating to the technicians and costly to the

companies. Obviously, this system also has major problems from safety and regulatory perspective. Outside of the three major airlines the AME licence was the basis for all certification. This led to avionics work being certified by non avionics trained individuals. It only worked because of good airmanship by all involved.

This meant that work associated with the overall authority of the basic “A “or “R” licence was being infringed on for very good reasons. This was most apparent in larger airlines who could afford to become more specialized in their trade structure.

The military, which had always had sub-trades, was not as quickly affected since they could staff large crews. When I joined the RCAF we had 14 aircraft trades on the flight line. In addition, military requirements had to account for wartime losses among maintenance crews and rapid deployments to operational areas. The growth of the on-aircraft avionics specialization was not that apparent in business or general aviation. They were supported by many small independent avionic maintenance facilities employing avionics technicians. More on the transition later in this article.

My First Work with the AEA

I joined Transport Canada after some time with t the RCAF and two airlines. In the RCAF we had radio and radar, instrument and electrical shops and of course maintenance hangers. I never thought much of the third level repair work in those days. Once I left and joined Wardair, I soon found that our avionics shop was very limited in scope, and nearly all the electrical, instrument and electronic work went out to outside shops. Some of these were in Canada, most were in the United States. Some equipment went to Ducey Avionics in Edmonton, where a friend from Medicine Hat was working. We did not know each other back then.

Earl Morris of Medicine Hat, Alberta, had a fascinating career in electronics in aviation and other fields. The word Avionics, according to Earl came into vogue in the early nineteen seventies.

I was working for Wardair in Edmonton, Alberta, at that time. Earl was working in Edmonton at Ducey Radio (Now Ducey Avionics and still in business!). In 1967 Earl had set up some of the electronics courses at the then new Northern Alberta

Institute of Technology. He taught RADAR, microwave and radio transmitters and receivers. He was then hired by R.J. (Bob) Ducey at Ducey radio located next to Eldorado Mines hangar at the municipal airport. Wardair sent a lot of radios and equipment to Ducey for repair. Earl worked on DC4's, Cansos, Beavers, Twin Otters, and other typical aircraft of that time. They maintained Narco, King, Bendix and many other brands familiar to the nineteen fifties and sixties. They did not work on any accessories. He recalls a lot of work installing and tuning HF systems. His background as a licensed radio amateur gave him an advantage in tuning up such radios. HF radio communications was very important for aviation in the North, especially in the Arctic. He fondly remembers walking through water in the belly of a Canso (Canadian version of the Catalina), to work while airborne, on a trailing HF antenna. Earl later saw the future was bright in telecommunications and moved on to the Alberta government telephones systems now known as Telus, a private corporation. Earl saw the beginning of the avionics world as we now know it.

The major airlines had extensive in-house shops and were able to do in house repairs on most of their own equipment, although much was still sent out to outside shops. Around this time, the early nineteen seventies, the term Avionics was expanding to include anything using electricity on the aircraft. So, I was soon troubleshooting and repairing pretty much all the ATA code chapters systems. The so-called black boxes were all being sent out to independent shops and or the original equipment manufacturers. Unfortunately, the AME Licensed aircraft categories electronics training did not advance as fast as avionics systems did. This led to the AME Category E licence in Canada. The Royal Commission by Justice Dubin recommended that we, Transport Canada, add avionics as a category to the AME Licence. The implementation of this fell to me as the Chief, Manufacturing and Maintenance for Transport Canada. I was based in the Transport Headquarters in Ottawa. It took over two years of intense consultations of which the AEA was major player. I had worked with many great classical AMEs and held strongly to the opinion the real solution was to increase the avionics education of on- aircraft technicians and AMEs. I was not convinced that we needed to take away any privileges from the on- aircraft AMEs but create a new category, avionics. There was one licence we had to change; it was known then as the AME B Licence. It was a structures licence but had taken over certifying avionics mods because many mods required airframe work. I also foresaw a major increase in avionics training for technicians and AMEs. That would have meant the Category "E" for avionics would one day disappear as an on-aircraft

licence. That has never happened, and I don't foresee that anymore. The addition of a new category was a major undertaking as it involved sorting out the relationships with existing categories, building curriculums and getting colleges approved to the new standards. Eventually it was implemented and still exists today. A lot of hard work was accomplished by the AEA members of that time. The two biggest decisions I recall were not removing privileges for the existing AME license and requiring all aircraft certification to be based on an AME license. These are still in effect today, basically worldwide.

Flashing back to 1975, the first job I was assigned to in Transport Canada was to be a member of the avionics shop inspection section in our Ontario Region Toronto office. This meant I would be approving, inspecting and auditing all the avionics shops in the Ontario region. There were many in those days, some were imbedded in airline maintenance facilities and many were standalone shops. These ranged from one person shops in small towns to shops with a staff of over one hundred people. That is how I first met up with Jack Grose, Navsari, Toronto who was also the leader of the AEA in Canada. It was soon apparent to me that across Canada and in the United States the AEA was the voice of airborne electronics, Avionics in North America. My first technical change in my new career was to work with the FAA on the ELT battery reliability issues. Lithium batteries were overheating and causing problems; sound familiar? I also became involved in avionics ELT engineering issues, as a manufacturing inspector, monitoring the manufacturer who was developing deployable ELTs. The idea was they would fly off the aircraft in a crash and so survive to transmit location of the crash.

The AEA was involved in many joint consultation projects with both TC and the FAA. They had already been holding large international conferences to which I was soon deployed. They were extraordinary chances to see the latest avionics and meet all the industry key personnel. This was to become invaluable for me when I was tasked with implementing an avionics licence.

The heavier avionic equipment used by the airlines usually went back to their manufacturers for repair and overhaul. The smaller air carriers sent their avionics to some of the larger shops in AEA. Most general aviation avionics went to local shops. I am speaking of VHF radio, ADF systems, VOR/ILS receivers and so on. This changed over the last 40 years when so much avionics has become plug and play systems which do not lend themselves to small shop repairs. I have watched over

the years as many of the smaller shops have disappeared and one-man shop are rare. However, the AEA does continue. One reason is that the FAA and TC needs to have such an organization to discuss current avionics issues with. The AEA was instrumental in creating some of the early avionics shop guidance material with Transport Canada which I was highly involved with during the nineteen seventies and eighties.

The conferences that were organized by the AEA were a major point on the annual work calendars of people who had a role in installing and maintaining avionics systems or the regulation thereof. Not only were they held in interesting places but were filled with technical briefings. As the Transport Canada senior person responsible for both the avionics licence and certification and regulation of avionics repair stations, I attend most of them. There was always a large FAA team there as well. Many of them I knew of course, as we participated in technical workshop panel discussions and presented technical papers to the attendees. I recall some of them attracted as many as 1500 avionics associated attendees.

In closing, I commend the AEA for all its work over the last many years and DOM magazine for featuring them.