AEEC Standards
Past, Present, Future?
December 13, 2004

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Some industry people have been recently questioning the continued viability of the Airlines Electronic Engineering Committee (AEEC) General Session. Since this meeting is really mostly about the ARINC standards produced by AEEC, the question also must apply to the continued viability of those standards.

A question that might shed some light on the future of AEEC and its standards is, “If AEEC did not currently exist, would it or a similar organization be formed today?” To study this question, we have reviewed AEEC documentation going back to its beginnings in 1949 and followed the standards development ups and downs until the present.

Industry Situation in 1949

Air transport was fast recovering from the war years in 1949. Many technical advances had been made in support of the war and many of these were finding their way into the electronics of the commercial airplanes then flying. Transatlantic flight, although still not non-stop was becoming a viable part of the world infrastructure. Radio had advanced during the war years with VHF introduced as well as single-side-band HF. Radio navigation was becoming a requirement for flight in the US. Airborne Radar was looming on the horizon for weather avoidance.

In the manufacturing industry, excess capacity was available from reduction in war support production and was being turned to producing more and more commercial goods. The country had just begun a period of economic expansion and times were relatively good, making the fairly expensive airplane ticket an option for more travelers.

At the commercial airlines, flying was still an exciting thing. At the helm of these air transport companies were names like Jimmy Doolittle, Howard Hughes, and Bob Six. These air pioneers still liked airplanes because they were airplanes. Air transport was definitely a business by now, but the airplane itself was part of the package to these people. These folks were looking forward to the first commercial jet aircraft, already being designed at Boeing, Convair, and Douglas.

The US major airlines had a company, Aeronautical Radio, Incorporated that was almost entirely devoted to satisfying the communications need of the commercial airlines. ARINC, as it was casually known then, had been founded in 1929 by the five major airlines of the day to provide radio services in support of the growing air mail service that was fueling the growth of these companies.

One of the problems that was bothering the technical gurus at the airlines was costly and underperforming electronics gear on their airplanes. Most of these electronics were built around tubes and were supplied by the aircraft builders. They wee causing delays, cancellations, and high cost of operation. Just after the war, ARINC had formed the Aircraft Radio Engineering Committee (AREC) to oversee the standards that had been developed for the military through ARINC and were now moving into the commercial aircraft realm. For reasons not clear in the record, this committee was replaced in 1949 by AEEC, who took over the existing standards as well as some new ones being developed

by AREC. Their charge was to produce a body of radio standards, in conjunction with the Minimum Performance Standards being developed by RTCA, then the Radio Technical Commission for Aeronautics. They were given five years to do the job. AEEC would develop the standards and turn them over to ARINC for publication. AEEC used a subcommittee approach to produce this first set of standards, which ARINC published as Characteristics with numbers starting at 500, the early ARINC 500 standards.

In addition, the group maintained close liaison with RTCA, staffing many of their Special Committees that were developing the Minimum Performance Standards that would become requirements under CAA rules. They also completed and maintained earlier standards which were critical to the availability of choice in selecting electronics for the airplanes they bought. These were mostly numbered in the 300 series and few remain today.

One of the earliest standards and the one that began the freedom of choice mantra was the ATR racking standard. This came out of the military support ARINC had provided and led to one of the earliest post-war radio sets, the ARC 1. By the time AEEC took on the maintenance task for these standards, several versions of racking had been defined, including 3/4 ATR, and 1 ½ ATR sizes. Also a short ATR version of each was available in the standard. Their first update was to add ½ ATR in both short and long sizes to the standard. Although the racking (and associated connector) standard took care of form factor and fit, there were still problems limiting interchangeability. The 500 series of standards was intended to define the function of the unit so that interchangeability could occur.

Manufacturers were not happy with this concept, feeling it would limit their ability to be creative and produce new and better products for the market place. The airlines noted in response that even with a very definitive control head standard in place, two manufacturers had made the squelch control so that it worked in exactly opposite ways. This was what the airlines were trying to correct. In the early years of AEEC, only airline engineers were allowed to be involved in the standards development process. When the industry recognized the value that the supplier engineers could add, they were allowed to participate as observers. The interest in AEEC quickly expanded after this change and standards were rapidly developed, approved, and used by industry.

The Value of Standards to the Various Players

Although standards had been a part of aviation from fairly early on, due to the need to operate in common areas, both in the air and on the ground, standards really developed for aviation electronics (avionics) during the war years. These standards were brought to the commercial airplane after the war and used with success.

The standards were valuable to the airframe builders because they could put a standard “hole” in their airplane and connect it to other systems with wire from a standard connector, knowing that the signals would be there and how they would work, regardless of who built an electronics unit to fill the hole. This was possible due to the racking

standards maintained by AEEC, the functional standards for the equipment, also developed and maintained by AEEC, and the Minimum Performance Standards developed by RTCA.

Since the airlines bought much of the electronics on the airplane in contracts separate from the aircraft purchase, the avionics developers could build to these standards and compete with others to get that business. If they lost a bid with one, there were several others to try. This reduced their risk, their product development costs, and allowed them to compete successfully.

For the airlines, the ones who drove the standards, their costs were lowered through shared development costs and lower prices due to competition in the market place. It also helped that these electronics were being added to existing aircraft and that the various airframe manufacturers were somewhat in step with new airframe developments.

The Second Round of Standards

The early 500 series of standards and the very early 400 standards, along with a few of the earlier 300 standards, were enough to drive the significant increase in electronics on the first generation of commercial jet aircraft. Technology, however, was moving rapidly in electronics. The introduction of the transistor as a replacement for tubes was already showing up in the first generation jets. The reduction in size, weight, and power of this technology, increased the necessity for a different racking standard to accommodate the more compact size.

Work got under way to develop the BTR rack. This ultimately became ARINC 404, one of the most valuable standards developed by AEEC. They didn't, however, do it alone. The cooling system for these new boxes was developed by SAE. ATA was developing standards for documentation for the electronics. RTCA was still producing their Minimum Performance Standards. These groups worked closely together, with some of the same people working in more than one of the areas of development and all taking close note of the others' work.

During this period, industry interest in the standards work of AEEC, measured by attendance at their general Session, dropped off significantly. The announcement of the development of wide body jets by Boeing, Douglas, and Lockheed turned this interest around. ARINC 404 was rushed to completion and a new series of 500 Characteristics was begun to provide form, fit, and function standards for the new and improved avionics these aircraft would use. Interest remained high, again measured by attendance at the General Session, until the work was completed in 1972. As the standards work went back to maintenance of the new standards and development of only a few new standards, the interest again waned.

The Third Round of Standards

When Boeing announced the development of their 757 and 767 family of jet aircraft, they also announced that the electronics on the airplane would be digital. The wide-body avionics had signaled this by converting analog signals to digital inside the box before processing and back to analog before leaving the box. AEEC had been working on a means of communicating digitally between boxes during their slack time after the wide-body standards development effort was successful.

The industry once again pulled together to produce standards for these new avionics. This was the birth of the 600 and 700 series of avionics. The racking standard that had started out as a military standard and had morphed into ARINC 404 was again updated to allow for the significantly increased functionality inside a single box and the higher level of interconnection that would be required. This became ARINC 600, a standard which has been continuously maintained and will still be used in the new generation of aircraft. The digital interface was perfected by Boeing and became ARINC 429.

Meeting the time needs of Boeing required significant effort and the industry once again responded, developing the core 700 series standards in only eighteen months. Interest in AEEC once again spiked. By 1984, most of this work was complete and interest in AEEC standards development again began to decline. Although this was the first time that airframe manufacturers weren't in step with new airframes, the standards were still highly successful and used on other airframes as they came on line. The same win-win-win philosophy that had made the first standards successful was still in play at this time.

The Changing Face of Commercial Aviation

At the time of the foundation of AEEC, aviation was still in a formative stage. It had suffered a decline while the war raged and was just coming into its own. Most of the population still had never flown in a commercial airliner. There were several potential suppliers of airframes that had moved from war production back to the commercial world. All of them were in the US. The number of suppliers of electronics was still growing to fill the new market niches in avionics and other commercial electronics. Airlines were flying with fuel costs of only a few cents a gallon. Wages were still in the under $10,000.00 a year range, even for pilots.

The first shock to industry came with a surge of fuel prices in the early 1970s. This brought about a major upheaval in what had been a well regulated and smoothly growing industry. In fact, the health of the industry was so strong that even this upheaval didn't reduce the call for deregulation of the industry which finally occurred in 1979. These shocks drove the remaining airlines to become more businesslike. Their suppliers were already there.

A combination of fear of litigation and high costs to certify avionics systems began the end of the era of buyer furnished equipment. By the time of the introduction of the Boeing 777, seller furnished equipment (SFE) was all but totally in place in the avionics world.

Another major airframe player had entered the scene. Airbus Industries began to provide competition to the dominant two remaining US airframe manufacturers, Boeing and McDonnell/Douglas; it brought with it a surge of European avionics suppliers to compete with the dwindling number of US avionics suppliers that SFE had caused.

Unlike past new airframes, AEEC did not heavily participate in new standards for the Boeing 777. The key standard was a replacement for the venerable ARINC 429 bus, called ARINC 629. This standard, unlike those for the 757/767 series of jets, did not go on to be used on competitor's aircraft.

Higher fuel prices and surging salaries worked to force airlines to greater and greater efficiencies. This in turn required aircraft that could make a return on investment in the new flying world. Boeing acquired McDonnell/Douglas and then there were two. Several of the avionics suppliers left the market or merged, making the winner-take-all mentality of SFE more palatable to the remaining larger manufacturers.

Aeronautical Radio also changed over the years. Airline services business is now a small part of the total revenue generated by ARINC. The group, Industry Activities, which is charged with supporting AEEC activities as well as other airline related committees, is the smallest division in ARINC and, in fact, the only group remaining under the umbrella of the original Aeronautical Radio Company.

The Board of Directors has also changed. In the early days the members of the Board were technical airline senior management. Today, although for the most part still airline people, they represent the more mainstream business aspect of the airlines as well, coming largely from financial and operation backgrounds in the airlines.

The Fourth Round of Standards

The one remaining area of BFE avionics is the cabin. After considerable debate, AEEC decided to expand into writing standards for this area. Following the work in support of the Boeing 777, this and maintenance of existing standards was the main work area for AEEC. Interest again waned.

Cabin entertainment standards don't hold the interest of a broad spectrum of the industry engineers and attendance at AEEC general Session reflected that during the early nineties. Coupled with good economic times, interest seemed to improve in the last half of that decade, however, and several new standards were started in support of what was seen as the next generation of avionics.

The Latest Airframes and AEEC Standards

The world of large commercial airplanes has now been reduced to two airframe manufacturers and only a handful of major avionics suppliers, both equally divided between Europe and the US. Each designed their latest airframes and the avionics pretty much outside the standards arena, only using existing standards of AEEC or standards already developed by other standards bodies. New design was proprietary and accomplished between the airframe vendors and their avionics suppliers. Although AEEC was developing some foundation standards that could be used in these airframes and the entire industry was participating, the standards were not used in the actual design, perhaps because they came too late. The new standards became a menu of options to reflect the independent decisions of the two airframe manufacturers rather than the traditional standard that drove earlier avionics and airframe developments.

The standards that are being used are the more traditional standards developed for BFE equipment, mostly cabin entertainment systems. This seems to have come as a surprise to the airline people involved in AEEC standards. It, again, is just a continuation of what happened with the Boeing 777 and the subsequent aircraft introduced by Airbus and McDonnell/Douglas before its merger with Boeing.

The Question is Answered

Today the airlines that were so instrumental in starting and supporting the growth and prestige of AEEC and its ARINC standards are struggling to survive in a very different world. They are in an era of very high fuel prices, high labor costs from contracts negotiated when times were good, and from serious competition from Regional Airlines who are enjoying the same benefits of jet aircraft introduction into their market that the legacy carriers enjoyed in the late fifties.

The two major airframe manufacturers are engaged in a great struggle for dominance in a world where their product is not the only solution to moving passengers. Their customer has changed from the legacy airlines to financial houses that buy airplanes and lease them to airlines. These customers want a cheap and plain aircraft with no extraneous bells and whistles, the so-called “vanilla airplane”, so they can easily move them from one customer to the next.

The few avionics suppliers who are left see the airframe manufacturers as their customer rather than the airlines. Just as the airframe suppliers are squeezed by their new customer, they also are squeezing the last dollar of efficiency from their suppliers. Standards don’t always contribute to the lowest dollar solution.

In today’s world, those who matter no longer see the traditional standards developed by AEEC as a win for them. The legacy airlines have much larger problems to deal with; the regional carriers are making profits without standards. No one in either group would strongly support a new standards development group like AEEC. Likewise, the manufacturing side has seen that the regional suppliers are doing well without developing

standards for themselves, are being pressured to cut every dollar of fat from their product, and are even more competitive with the number of customers reduced. ARINC is very busy growing and trying to prosper in other fields of endeavor and would see little value to such an operation.

The answer seems quite clear. If someone tried to form AEEC today, they would find little support.

What About the Future?

Has AEEC and its standards setting activity become irrelevant? It is true that it played little part in setting the technical directions of the avionics on the aircraft currently in design, the A380, The 7E7, and now the A350, just announced. If the key value of the standards was providing freedom of choice when airlines picked the avionics, then the only place where this still occurs is in cabin entertainment.

AEEC, however, may have found equally good success in developing foundation standards, like 404, 429, and 600. Some of the new standards that are considered as foundation for the next generation of avionics still have value and will be used. Among these are ADN as a replacement for 429.

Many of the already developed standards are still covering avionics being built and need periodic or regular maintenance and update. Good examples are ARINC 424, 429, and the various radio and data link standards.

However, for AEEC to reassert its role as the technical leader of new avionics systems appears not to be easily accomplished in today's world. For AEEC to prosper for the next fifty years, it will need to reinvent itself to remain relevant.