The Joy of Collecting Aircraft Clocks

(Airplane Not Included)

By Dan Burbach (CA)

My interest in mechanical aircraft cockpit clocks began when I saw a new old stock Jaeger-LeCoultre movement for sale on eBay for about $200 (Figure 1). Aware of the brand quality when it came to present-day watches, I purchased the movement and was not disappointed. It was among the last lot of movements produced in the early 1990s for installation in Boeing aircraft such as the 727. A few hundred of the Swiss movements became stranded in inventory as mechanical clocks were rapidly being replaced by those powered by electricity. Despite having been in storage for over 30 years, it came to life with a little strategic lubrication and kept very good time.

I had imagined that the matching cases for these movements were also sitting in a warehouse somewhere, and that I could track them down online or with a few phone calls to aircraft instrument servicing and parts supply companies. No such luck! First of all, the case was no simple replacement part, as it consisted of about 20 separate parts, not counting screws. Included were an air-spaced, two-element, precision-ground, polished, and multicoated crystal of about 3" in diameter, a bezel with an array of incandescent lights at 10 and 2 o'clock, and an electrical connector with associated wiring. The crystal was designed to spread the light evenly, a task it performs quite well.

After more than a dozen phone calls, I was only able to find one banged-up Aerosonic case still containing a partly cannibalized movement that a service shop was happy to sell.[1] I bought it, cleaned it up, repainted it, and installed my new movement (Figure 2). It was a nice beginning to my collection, which now numbers around 80 pieces.

Airplanes were outfitted with a clock as soon as flights exceeded several minutes. The need to keep track of time evolved from simple tasks such as watching fuel consumption to maintaining flight schedules, aiding navigation, and coordinating the various military needs related to maneuvers and battle objectives. The operational environment—extreme temperature range, shock, and vibration—demanded that the clocks be built to very high standards so that they would be reliable and maintain accuracy.

These clocks are valuable and versatile as control panel instruments because they can be easily transferred to other aircraft without modification once a plane's useful life is over. Very unusually, however, the clocks can be repurposed to serve as timekeepers on a shelf, desk, or in a car for decades if maintained. No other cockpit instrument is of much use outside of an aircraft.

A few of the important manufacturers of aircraft clocks over the years include Waltham, Elgin, Hamilton, Junghans, Omega, Sinn, Smiths, Nero Lemania, Breitling Wakmann, Aerosonic, and Jaeger-LeCoultre. Surprisingly, two companies still manufacture high-end mechanical

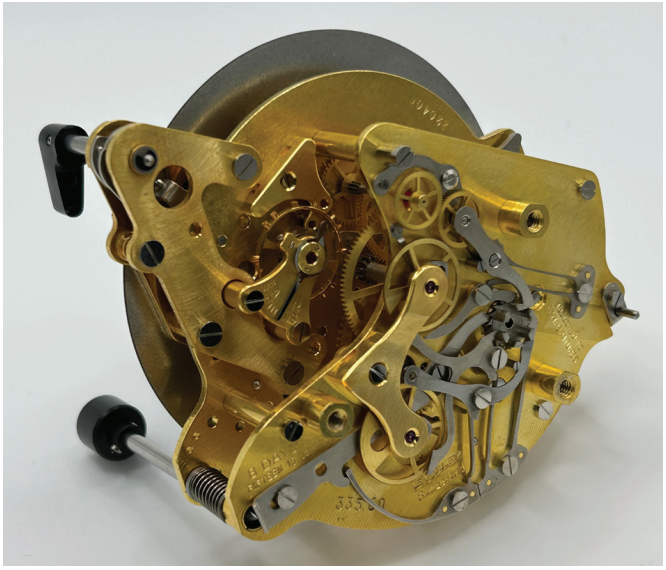

Figure 1. This Jaeger-LeCoultre movement was designed to be mounted in a lighted Aerosonic case and flown in a passenger airliner. This one is mounted in a Lucite box for display purposes. AUTHOR'S PHOTO.

Figure 2. The Aerosonic clock used in Boeing 707, 727, and 737 aircraft during the pre-digital era. AUTHOR'S PHOTO.

aircraft clocks: Waltham in Alabama[2] and Sathom/Thommen in Switzerland.[3] They retail for about $2,000 to $3,000 depending on the model. When adjusted for inflation, the original prices of most quality control panel clocks fall roughly into this range or higher. I find it quite remarkable that you can purchase these fine instruments now for as little as 10% or 20% of their inflation-adjusted original price.

WHY COLLECT THESE CLOCKS?

For those with a technical background, which seems to be a common trait among people attracted to the world of mechanical clocks, the dials are interesting and reminiscent of precision laboratory instrumentation. They are very well constructed, obtainable at mostly reasonable prices, take up little space, and lend themselves well to display or use as a desk clock.

Where do you find them for sale? Just a few years ago these clocks were found in quantity on the shelves of aircraft instrument servicing shops. When digital clocks replaced them in control panels, many of the clocks were kept in storage for years, then either scrapped or sold cheaply to collectors or vintage aircraft owners and restorers, depending on condition. Today eBay is probably the best everyday source, but patience, knowledge, and good questioning of the seller are required to increase your chances of making a smart purchase.

Many sellers are unfamiliar with clocks and just happened to pick one up in a garage sale or inherited a neglected one from a relative. They may have the ad description written by eBay's AI tool, which is usually of little use for this type of item. Some sellers claim they have no clue how to test the clock and don't want to try for fear of damaging it. Some have even stated in the description that the clock needs new batteries!

Very commonly the term "overwound" is used to describe an old aircraft clock's condition. This usually means that it is fully wound but contains hardened oils that create too much friction in the movement for the escapement to function. I have found that a polite and friendly message to the seller, explaining how to operate their clock, usually results in them trying and often finding that they indeed have a runner! They will usually even post or send you personally additional photos if requested. I recently messaged a seller through the process of purchasing a spanner wrench so he could open the back and send me a photo of his listing's movement.

Similar clocks are frequently offered on eBay at wildly different prices for no obvious reason, with the overpriced ones going unsold for years sometimes. Other sources are local estate liquidation auctions, antique stores, and national auctions such as Schmitt Horan and Fontaine's.

Figure 3. The Jaeger Chronoflite was produced during the 1930s through the 1950s and was the clock of choice for many aircraft flown by the Army Air Corps, Navy, and Royal Air Force. AUTHOR'S PHOTO.

Figure 4. Waltham and a number of other manufacturers built clocks in this configuration beginning in the 1950s, with production still going in 2026. This is a model A-13A-1 with fluorescent paint. The clock is also produced with a lighted dial and a choice of red, white, or green illumination. AUTHOR'S PHOTO.

Figure 5. An early Junghans Bo-Uk1 version 2 clock. European military planes used several iterations of this clock design. Sinn and others improved on the design while maintaining interchangeability. AUTHOR'S PHOTO.

SERVICING AIRCRAFT CLOCKS

While constructed similar to a pocket watch, the movements are generally larger in diameter but much thicker, with the parts more spread out and visible. That makes working on them a little more comfortable, as high magnification is not always as necessary as it is when servicing a small wristwatch or pocket watch movement.

There are a few watchmakers out there who specialize in the service and repair of aircraft clocks. The big challenge for the servicer, though, can be finding parts. Random parts occasionally show up on eBay, so it is always worth searching and saving that search to get daily updates if additional parts are listed. Otto Frei stocks parts for a couple of models: the Waltham A-11 and the Hamilton/Elgin 37500. Waltham sells parts on a retail basis but subject to a minimum dollar value. There appear to be multiple sources of Valjoux movement parts. For most models, however, the only source might be another clock, or a servicer who stocks parts not for sale but exclusively for their own use. In that case your only choice might be to send the clock to them for repair.

CLOCK CHARACTERISTICS

Most aircraft clocks fall into one of three categories of case design. One has a 3" (76 mm) dial, like the Jaeger Chronoflite (Figure 3). This size was standard until the 1950s, when 2" (50 mm) dial models became more common (Figure 4). The third design originates in Europe. It is also an approximately 2" dial configuration but with winder and chrono controls at or near the bottom instead of on the bezel (Figure 5). Cases were constructed of brass, aluminum, Bakelite, and more advanced polymers.

These clocks had to meet demanding specifications. The Waltham A-13A, a clock still produced to this day, needs to be able to tolerate, according to military specification MIL-C-6499 E and summarized here:

1. When subjected to -31°F for six hours, it must not gain or lose more than 15 seconds.
2. When subjected to 131°F for six hours, it must not gain or lose more than 75 seconds.
3. Subsequent to being exposed to -80°F and 160°F for 24 hours each, the clock shall not gain or lose more than 15 seconds over six hours when brought back to room temperature.
4. After being exposed to 100% humidity for 120 hours, it must maintain correct time within 20 seconds

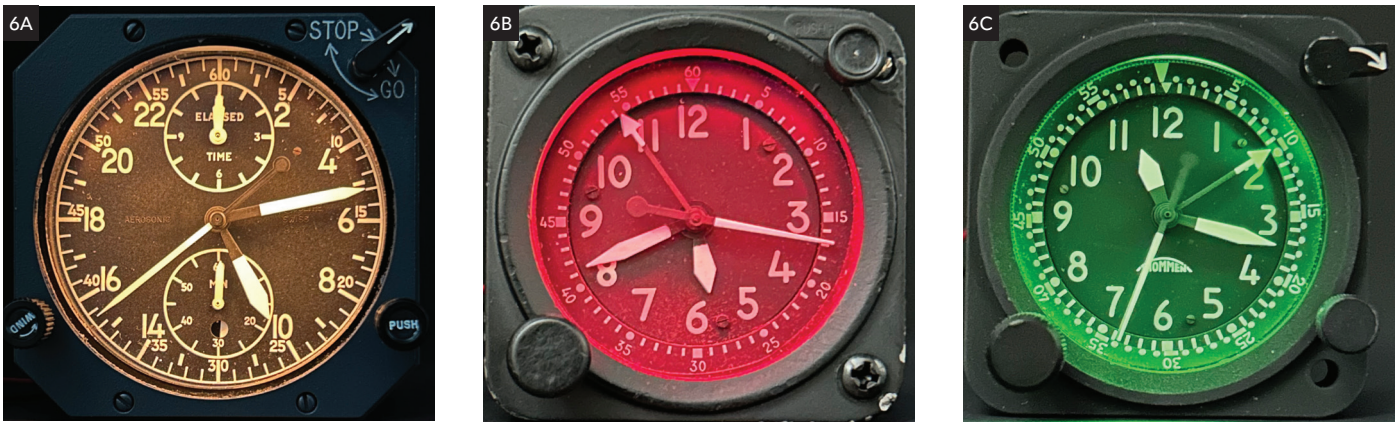

Figure 6. The three colors of cockpit lighting: **A.** Aerosonic model 88000-4102 in white; **B.** Waltham ABU-11/A in red; **C.** Thommen B18 in night vision green. AUTHOR'S PHOTOS.

over a six-hour period when tested within one hour of being removed from the high-humidity chamber.

5. It must be able to withstand a shock of 15 Gs in each of six orientations and not gain or lose more than 20 seconds during a subsequent six-hour test period.
6. The clock must be able to withstand a magnetic field of 60 Oersted for 10 seconds without affecting its accuracy. This is approximately the tolerance level of a typical mechanical wristwatch that is not designed to be especially resistant to magnetism.
7. Finally, the clock is subjected to vibration testing over a wide range of frequencies without more than a 20-second gain or loss of time over a six-hour test period.[4]

Aircraft clocks need to be able to survive and function while mounted just behind a powerful engine, through rough turbulence and landings, and regardless of whether the plane spent the night on the tarmac during the winter in Fairbanks, AK, or out in the sun all day at a Mojave Desert airport!

I am frequently asked what airplane a particular clock was used in. The answer is clocks were almost never designed for one type of aircraft. Mounting provisions were mostly standardized, so many different clock models could be used on most control panels. Since the clocks were removed for servicing and replaced on a regular basis according to their manufacturer's service manual or Instructions for Continued Airworthiness (ICA), it was convenient for technicians to not be restricted to a particular clock and could stock a number of different models so that a replacement was always on hand. Pilots were spared the need to wait for their own clocks to be serviced and recertified, a process that might take two weeks or more.

DIAL READABILITY

The dials and cases of clocks and other instruments used in aviation are almost exclusively colored black. This minimizes reflections that could interfere with accurate reading. Clocks with white dials and chrome bezels or cases were likely intended for use in cars or boats, as it is important to minimize bright reflections inside a cockpit. The hands and dial markings on the early clocks were very often coated with paint containing radium, which would glow brightly in a darkened cockpit. Radium use was phased out in the 1950s as electrical lighting of instrumentation was introduced. To light it, a connector was fitted to the back of the clock to supply usually 5 or 28 volts DC from the control panel. This made it visible independent of the cockpit lighting conditions. Clock dials without electrical lighting were often painted with nonradioactive luminous paint, similar to the "lume" used on the dials of today's watches. Lume colors were either green, yellow, or orange. Some clocks were available in the form of a basic model—plain nonluminous white paint without electrical lighting.

Although most clocks are white lighted, some have red lighting or even dual lighting, with a pilot able to choose between red or white (Figures 6A and 6B). Red light is less harsh on the eyes and does not diminish a pilot's ability to see outside the cockpit as much as white light does. That's why amateur astronomers use red lights

Figure 7. A Waltham XA made for the US Army Aviation Section Signal Corps. AUTHOR'S PHOTO.

exclusively at their telescope viewing sites. Newer analog dial mechanical clocks such as the Thommen Model B18 may be equipped with NVIS (night vision) green (Figure 6C). NVIS green is compatible with night vision goggles in that it appears dim through them and does not cause the device to reduce its sensitivity and interfere with the view outside the cockpit.

I have owned at least two dozen lighted clocks and have never encountered one that did not light up with voltage applied. Apparently the incandescent bulbs were constructed to meet very high standards.

POPULAR AIRCRAFT CLOCKS TO COLLECT

Waltham XA: Designed to be highly reliable and readable at a glance, the XA has an 8-day, 7-jewel movement with a 3" dial[5] and was produced between 1916 and 1929 for both airplanes and automobiles (Figure 7). It sold near the end of its production for about $675 in 2026 dollars. In addition to being used in a variety of military aircraft during that era, Charles Lindbergh chose this model for

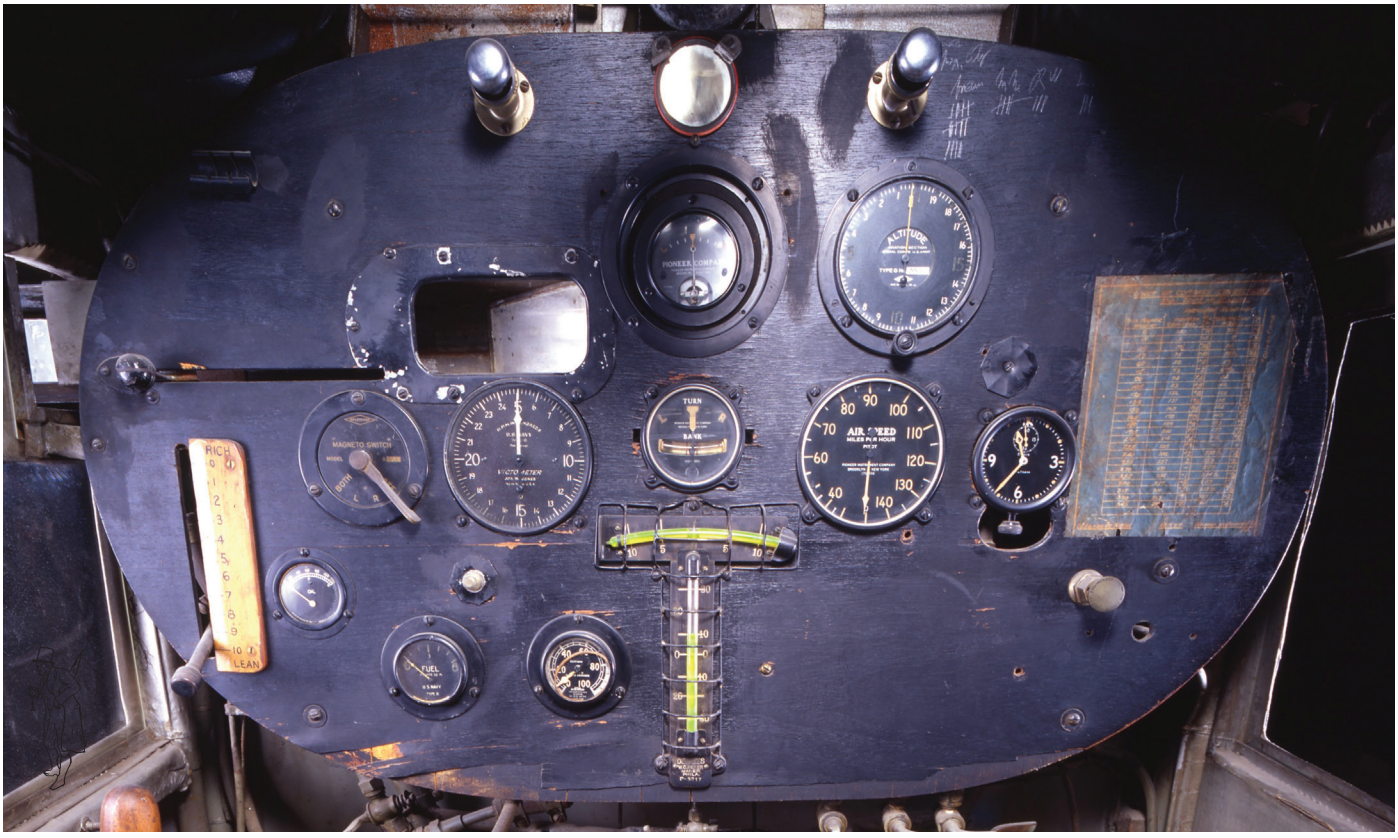

Figure 8. The cockpit of Lindbergh's Ryan NYP *Spirit of St. Louis*, showing the Waltham Model XA on the far right. PUBLIC DOMAIN, WIKIMEDIA.

Figure 9. An Elgin-Hamilton 37500, the most complicated mechanical aircraft clock ever produced. AUTHOR'S PHOTO.

Figure 10. The Z-Timer ensured that a pilot would never lose track of Coordinated Universal Time, formerly known as Greenwich Mean Time. AUTHOR'S PHOTO.

Figure 11. Breguet, the producer of some of the world's most expensive wristwatches, made its contribution to the world of aviation with a single model. AUTHOR'S PHOTO.

his *Spirit of Saint Louis,* in which he flew solo from New York to Paris in 1927. It can be seen on the right side of the control panel in photos of the cockpit (Figure 8).

Elgin-Hamilton 37500: Worried that World War II would cut off America's supply of timepieces from Europe for ships and planes, the government asked watch manufacturers to stop production of clocks and watches for civilian use and to devote all of their resources to the military. The result was some of the finest navigation watches and ship's chronometers ever produced. For aircraft application, Elgin and Hamilton teamed up and designed the Model 37500 (Figure 9), with the agreement that each company would produce about half of the clock's 417 parts, 248 of which are unique.[6] The parts would then be shipped to each other so that each company could assemble complete clocks. The elapsed time clock featured a 24-hour dial with chronograph and civil date complications. It was designed to eliminate some problematic features associated with the Jaeger Chronoflite, which had only one mainspring, wound counterclockwise with no backward ratchet (resulting in broken gear teeth due to pilots trying to wind it clockwise), and an inability to set the time backward through midnight without damaging the date mechanism. The clock is equipped with an 8-day, 16-jewel movement. Whitney's *Military Timepieces* devotes nearly an entire chapter (chapter 4) to the clock, with highly detailed drawings of the movement mechanisms, and operating, disassembly, and reassembly instructions.

Wakmann Z-Timer: The military refers to Coordinated Universal Time (or GMT) as "Zulu" time. This clock (Figure 10) has a prominent red hand that moves as an hour hand independent of any resetting of the white hour and minute hands to local time when changing time zones. This way the pilot is always aware of Zulu time for accurate execution of flight plans, maneuvers, or monitoring communications regardless of the aircraft's current location.

Breguet Type 11: The clock features an orange luminous dial with rotating bezel and 15-minute chronograph operated by the pusher below the winder (Figure 11). It is equipped with a Valjoux 551 movement. Breguet is known as one of the finest manufacturers of wristwatches. Its founder, Abraham-Louis Breguet, invented the tourbillon in 1801.

Mathey-Tissot Type 12: This clock has a 17-jewel Valjoux 555 flyback movement, meaning the second hand can be quickly reset to zero while running as a component of the chronograph feature (Figure 12).

Sinn NaBo 17 ZM: Another clock in the European style, used in German,[7] British, and Italian military planes (Figure 13). The clock features a bright green luminescent dial and hands, once powered by radioactive tritium mixed with the paint, as indicated by the red 3H symbol adjacent to the 3. The red and green accented pushers along with the orange chronograph hands make this

Figure 12. Like Breguet, Mathey-Tissot built a case and dial but relied on Valjoux for its aircraft clock movements. The parts are still available today. AUTHOR'S PHOTO.

Figure 13. This Sinn NaBo 17 was among the last of the mechanical aircraft clocks to be produced. It was used in German military aircraft for about 30 years beginning in 1980. AUTHOR'S PHOTO.

model quite a showpiece, and as a result it is highly sought by collectors. The ZMs were reworked not long after production to remove the tritium, resulting in the new model designation of 17 ZMF, with the 3H symbol removed from the dial. NaBo is an abbreviation for "onboard navigation clock" in German.

Nero Lemania AM/PM Elapsed Time Clock: This clock (Figure 14) features a large and highly readable dial and chronograph lower subdial, with the addition of an upper subdial specifying whether the hands are showing AM or PM. The clock winder is equipped with a clutch that will not allow any additional force to be applied to the mainspring once it is fully wound.

Longines-Wittnauer A-11-63-1A-ET: A rare clock that apparently was never mass produced despite evidence that it had already been advertised (Figure 15). This example is likely a prototype. The serial number suggests that perhaps only 39 were produced. The hands and numbers have the original radium paint. The clock is stunning in appearance, but a bit difficult to wind as the chronograph pushers on each side of the winder can get in the way of someone with large fingers. Also, it has a design defect that can send this clock back to the shop for repair long before it needs a service. If the left pusher (which resets the chrono) is pressed while it is running, the result is a broken part in the movement.

Civil Date Indicator Aeronautical (CDIA) Clock: Waltham manufactured about 134,000 of these clocks between September 1941 and October 1944 (Figure 16). The design is based on a double-barrel movement that was used in Waltham automobile clocks as far back as 1910.Although it did have a date indicator, it lacked an elapsed-time function. As the production numbers suggest, these clocks are very common in collections and relatively easy to find. At any given time, there are usually a few available for sale on eBay.

Waltham A-11: A very rare clock from 1944, modified for terrestrial use (Figure 17). It was designed to be taken on astronomical expeditions and is regulated for sidereal time, which astronomers use to conveniently locate

Figure 14. This Nero Lemania model has a distinctive design that when mounted makes a particularly attractive desk clock. AUTHOR'S PHOTO.

Figure 15. It appears that only a handful of these Longines-Wittnauer elapsed-time clocks exist in the hands of collectors, as they were never produced in quantity because of design shortcomings. AUTHOR'S PHOTO.

Figure 16. The CDIA clock was used in a wide variety of World War II aircraft. It was replaced by the Elgin-Hamilton 37500, which was designed with the same mounting configuration. AUTHOR'S PHOTO.

Figure 17. This rare Waltham A-11 was designed for astronomical expeditions and is regulated for sidereal time. AUTHOR'S PHOTO.

objects in the sky. The choice of an aircraft clock for this purpose is a testament to its ruggedness and ability to keep accurate time under a wide range of climatic conditions.

COLLECTING ADVICE

I find that a good practice is to place numbered stickers on all incoming clocks and keep a logbook, including all of the useful or interesting information you can gather concerning the clock. This is especially important when it comes to operating instructions, as they can vary a lot from one design to another, and damage can result with some models if controls are operated incorrectly or in the wrong sequence. A good rule to keep in mind is to never apply excessive force to a clock's knobs or pushers. Everything should work with a light touch. If not, it either needs servicing or you are trying to make it do something it was not designed to do. It is also a good practice to operate a clock two or three times a year just to keep all components loose and moving freely. That would include winding, setting, and manipulating all knobs and buttons, and allowing the elapsed time mechanism to run for a few cycles as the mainspring runs down.

You should check newly purchased clocks for radiation with a Geiger counter. You can obtain one for less than $100, and it is money well spent considering the potential hazards of radium. The presence of radium means that one must be very careful when removing the crystal. This exposes deteriorated paint dust, which is extremely dangerous to inhale. The clock should not be stored in an unventilated living space because radium produces radioactive radon gas (a carcinogen) as it decays.

CLOCK CONDITION

I have to say that the most rewarding aspect of this hobby is not at all the result of buying a high-end, fully serviced clock in like-new condition to put on your shelf. The real pleasure comes from searching for and finding that diamond in the rough, a rare or unusual clock forgotten or neglected for a generation or two, that some TLC can transform into a gem.

One note on condition. Aircraft clocks don't have to be operational for them to be collectible and enjoyable. Some collectors prefer to keep only clocks that can be made fully functional. But you can put together a very nice collection of non-runners that looks impressive and beautiful for a lot less money and worry. I have sold a number of irrepairable clocks in nice cosmetic condition and now regret it.

I hope this article has piqued your interest in these fine instruments,[8] and that you will discover more about them on your own.

Notes and References

1. *Aerosonic Corporation Overhaul Manual*, April 10, 1991.
2. Waltham Aircraft Clock Corporation is located in Ozark, AL, walthamclocks.com.
3. Thommen Aircraft Equipment is located in Muttenz, Switzerland, thommen.aero.
4. Military Specification MIL-C-6499 E Clock, Aircraft, Mechanical, Type A-13A, accessed at everyspec.com.
5. Marvin E. Whitney, *Military Timepieces* (Harrison, OH: American Watchmakers Institute Press, 1992), 16–17.
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7. *German Military Timepieces of World War II, Volume 2* (Craven Arms, Shropshire, England: Ulric Publishing, 2012).
8. For further reading, see Doug Yates, "Waltham World War I Aircraft Panel Clocks," *NAWCC Bulletin* 51, no. 379 (April 2009); Fortunat Mueller-Maerki, "Paul Ditisheim, Chronometrier," *NAWCC Bulletin* 46, no. 351 (August 2004); Konrad Knirim, "Japanese Military Timepieces of WWII," *NAWCC Bulletin* 44, no. 339 (August 2002); Konrad Knirim, "Military Watches and Clocks Part II: The German Forces after 1945," *NAWCC Bulletin* 39, no. 309 (August 1997); Konrad Knirim, "Military Watches and Clocks Part I: The German Forces until 1945," *NAWCC Bulletin* 38, no. 305 (December 1996).

About the Author

Daniel J. Burbach Sr. has been a clock enthusiast his entire life and is a member of NAWCC Ventura & Santa Barbara County Chapter 190. His interest in clocks began when he was a child fascinated by the 400-day clock his father brought from Germany, a clock Dan maintains to this day. Initially, he collected mechanical watches and marine chronometers, having gained an appreciation for them while studying celestial navigation at the US Coast Guard Academy. More recently his focus has been on mechanical aircraft clocks of all types. He has spent the last five years assembling a diverse collection of fine timepieces from a variety of sources. Currently retired, Dan has held a number of positions in different fields, including high school science teacher, analytical chemist and metallurgist, quality engineer, production manager, and financial advisor.