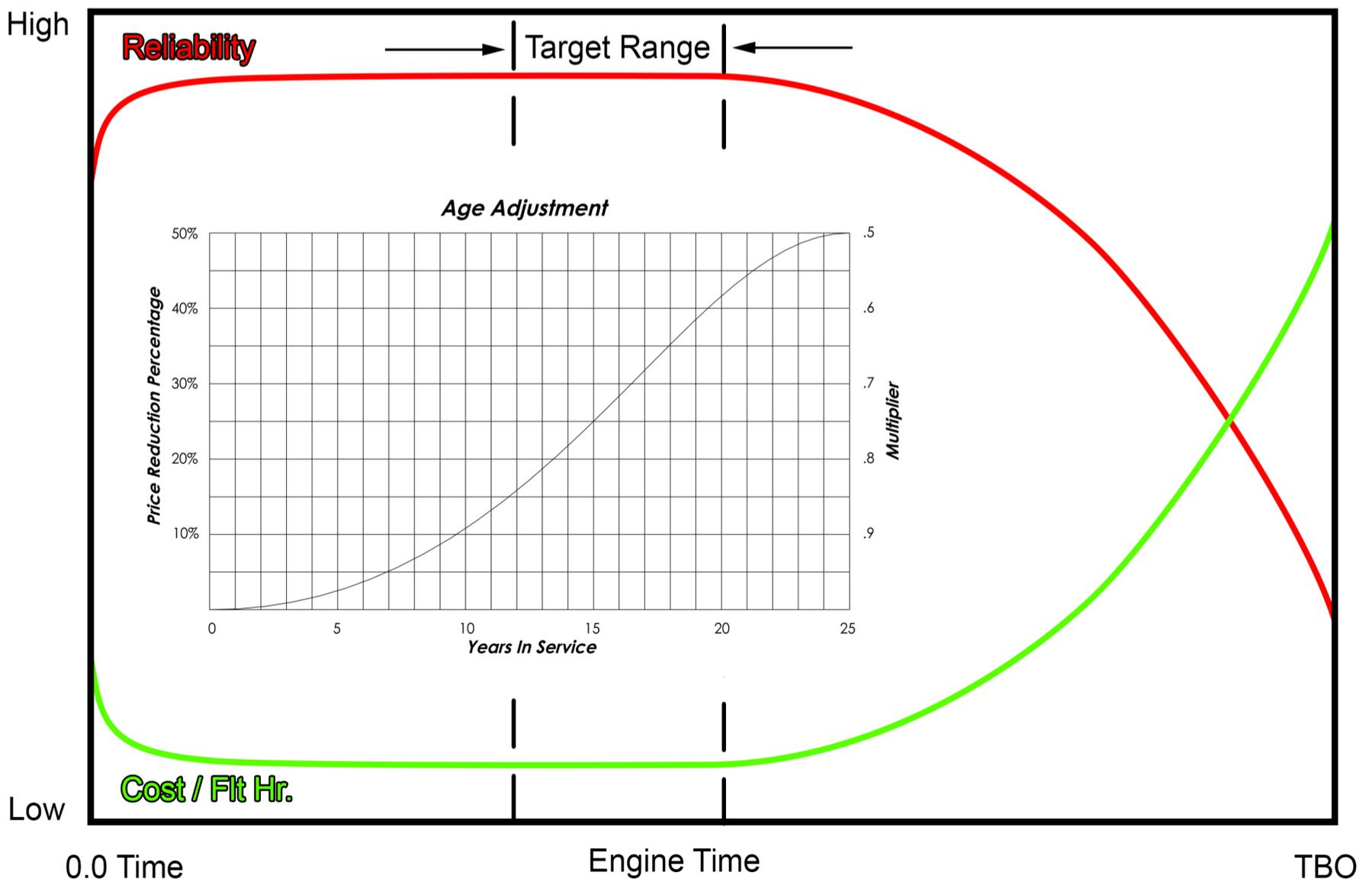


For decades now, we have been advocating for an engine replacement scenario that has garnered significantly reduced operating costs. We call this scenario the Rainbow Aviation Formula (RAS formula).

This all started some 25 years ago while discussing maintenance philosophy with one of our more well-to-do customers. The topic was centered around the subject of how to maintain reliability as the hours on his engine began to accumulate. What came out of this discussion was an experiment that continues to this day with extraordinary and surprising results.

The premise of this construct is based on the principles that a new engine with low hours is going to be more reliable than an old engine with high time. Fig.1 When an engine is new the amount of maintenance necessary is limited to simple things like oil and filter changes. However, as an engine ages, we get into that area where we start having to accomplish major tasks on items like cylinders, carburetors, magneto's,

The RAS Early Engine Replacement Concept



*Figure: 1 The RAS Early Engine Replacement Concept*

gearboxes, starters, and exhaust systems. These tasks can involve thousands of dollars. And even the little items like spark plugs, hoses, and wiring can nickel and dime an owner to death.

After many years of working with specific customers utilizing our formula and tracking their maintenance costs. We have been able to come up with comparisons to the traditional maintenance paradigm where customers operate their aircraft until the engine is no longer economically viable to repair. The results were not only obvious, but shocking. One customer was so impressed by the results, he had us replace his Lycoming O-360 on his Cessna 172 (with a Penn Yan Conversion), 6 times over a period of 10 years. This customer flew a considerable amount of cross-country, night, and IFR flight, and really appreciated having a factory new Lycoming engine installed every couple of years. Initially, not for the cost savings, but rather for the sense of confidence that went along with that new “bulletproof” Lycoming engine. After seeing the financial rewards of early engine replacement, the choice for him was a no-brainer.

So, let’s look at how this process would normally play out. We would typically wait until the O-360 engine would have around 800 hours on it and then advertise it for sale utilizing our formula. Fig 2 Now, the key to this working successfully, is to leave the engine on the airframe. Remember, any engine removed from an airframe

## ***RAS EARLY ENGINE REPLACEMENT FORMULA***

$$\frac{\text{New Engine Cost}}{\text{TBO}} = \text{Basic Cost per Flight Hour}$$

$$(\text{Engine Time}) \times (\text{Basic Cost Per Flt Hr.}) = \text{Value Consumed}$$

$$(\text{New Engine Cost}) - (\text{Value Consumed}) \times (\text{Age Multiplier}) = \text{Sales Price}$$

*Figure: 2 RAS Early Engine Replacement Formula*

has only a core value. Never remove the engine from the airframe until you have the money in the bank. By leaving the “new” engine installed on the airframe, a prospective customer can come and fly the airplane, “hear” the engine, do compression checks, borescope, oil analysis, and oil filter inspection. Basically, do anything to feel 100% confident that the engine is in excellent condition before deciding to buy. The hallmark of any good negotiation is finding a “win-win” scenario. And the goal here, is to make both parties happy with the decision to purchase an 800 hour engine.

Let's be clear. We are using the engine for the timeframe of high reliability and low operating cost and then selling the engine to avoid the high operating cost and low reliability. So, why in the world would anyone want to buy "this" engine. Think about "our" demographic. And when we say "our" demographic, we are talking about the experimental aircraft crowd. The group of people who love building and flying, but whose budget is often limited. To the builder on a budget, the thought of a 2 year old, factory new, Lycoming engine, with 800 hours on it, is a godsend and a no-brainer. No one has been inside the engine screwing it up. It's going to be reliable. And the best part is, it's a fraction of the cost of a new engine. In our experience, there are far more people wanting to buy these engines than there are people wanting to sell them. The experimental aircraft builder is perfectly suited for dealing with these higher time engines primarily because they can do the work themselves.

The interesting part is that once you get over the hump of purchasing the first engine, and getting rid of it in the "target range", the cost of the next new engine is subsidized by the sales of the first engine. You will soon see that the actual cost per flight hour will diminish to the point that you can pay the cost of the new engine installation and then some. The fact that you will always get to operate a new engine, with its subsequent reliability, is the icing on the cake that really makes this a valuable exercise. Think of it as having the perpetual reliability of a new engine without additional cost.

There is virtually no cost to this early engine replacement concept. Put an ad on barnstormers. If no one is interested in your engine you simply keep flying your airplane. Your airplane is not out of service. You can continue to fly. And if no one ever bought the engine, it would be no different than before you place the ad. As you accumulate hours, the formula still holds true. As the engine accumulates time, the price is reduced per the formula until we hit the "core" value of the engine.

The "target range": This is somewhat subjective, and every engine is a bit different. We have our own target range for each engine based on experience. The goal is to get rid of the engine before any significant maintenance may be required, while simultaneously identifying the sweet spot for selling. Selling the engine too early doesn't amortize the cost of the engine removal and new engine installation. In addition, there isn't enough depreciation in the engine to make it tantalizing for the buyer. Waiting too long to sell the engine has a psychological effect on the purchaser. Not enough hours left on the engine to leverage the concept. And too many unknowns. You can tell if you have waited too long and or have too many hours on the engine because the number of interested buyers drops dramatically. And although we have identified our target range for the Lycoming O-360 of around 800 hours for this article, we are reluctant to willy-nilly identify the target range for other engines. Many of these engine manufacturers find our analysis contrary to their desired reputation, and as a result, we attempt to keep from ruffling too many proverbial feathers. This being

said, an engine like the O-360 is a very easy engine to sell because of its wide variety of suitability in different experimental aircraft. You may find that some engine models because of their low sales volume or applicability to experimental aircraft have a much more difficult time taking advantage of our early engine replacement concept. But even with weird engines, the cost to advertise is negligible. And, as a result, what have you got to lose. Also, keep in mind we use this formula almost exclusively when talking about the purchase of a factory new engine. The ability to translate this formula and concept to an overhauled engine is not nearly as reliable. The high degree of variability from one overhaul shop to another makes it an unreliable premise.

If you're unsure about this, look around and you will find many correlations with other commerce. This is the same concept that the rental car companies use. By renting new cars, the necessity for heavy maintenance is virtually eliminated. The satisfaction of the customer goes way up when you ensure reliability. And having a product with a manufacturer warranty significantly reduces the risk and liability. As the car ages and approaches the limitations of the warranty, the rental car companies sell off the old inventory and replace it with new. It simply makes economic sense. Oh, we're sorry, were you under the impression that the rental car companies love you so much they just wanted to make sure that you had a nice new car every time that you showed up? Awww, to be naïve again. All joking aside, it really is a premise that makes economic and logical sense from so many different standpoints.

Now, we realize this isn't going to be for everyone. And it certainly doesn't have to be. It works best when we are using modern consumer type aircraft engines with a relatively high turnover or sales volume rather than experimental engines. And having an airplane that we put a considerable amount of time on each year seems to work better than engines that sit year after year. We have put together dozens of deals for customers using our formula. The formula doesn't have to be cast in stone, but over years of doing this, we found that it's pretty fair for both parties involved. We have used the formula for Continentals, Lycomings, and all of the Rotax engines, both the 912, as well as the 2 stroke engines.

It's fun to put together these kinds of deals, because in these cases, both parties are pretty excited about the possibilities. One owner gets to fly behind a brand-new engine, and the other can now afford that engine to complete his new handcrafted flying machine. It's hard to think of a more natural symbiotic relationship for the experimental aircraft world.