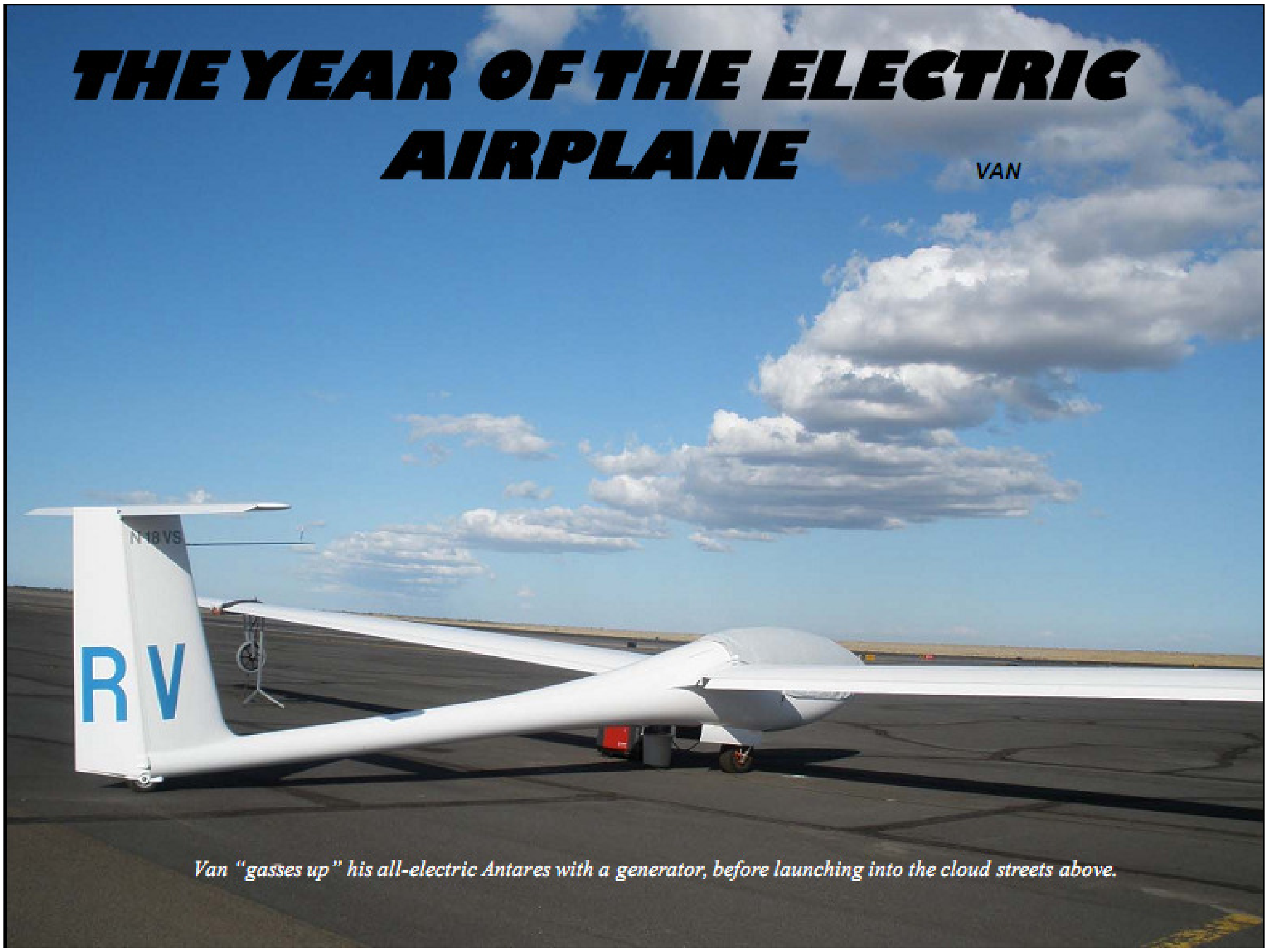


Van "gasses up" his all-electric Antares with a generator, before launching into the cloud streets above.

You don't have to be attuned to the inner circles to know that there has been a lot of buzz in the aviation media about electric powered airplanes. From this, one might conclude that the electric airplane has finally arrived and that the old joke about "needing a really long extension cord" can finally be retired. Although we at Van's have been following progress in this field for the past couple of years, my interest became more personal now that I own and fly an electric airplane of my own. A couple of months ago I took delivery of a self-launch sailplane called the Antares 20E. To my knowledge it is the only production electric airplane in the world. I am gaining first hand knowledge about the care and feeding of an electric airplane and trying to compare this experience with the press releases that I read about other electric airplanes.

I'm finding some disparity.

THE ELECTRIC AIRPLANE THAT I KNOW

The Antares 20E is a state-of-the-art high performance sailplane well suited for sport and competition soaring. It has a 20-meter span (66') and an empty weight of 1050 lbs. Its max. L/D of 56:1 is achieved at 70 mph and its min. sink is just under 100 fpm. It has a 42 Kw (56 HP) brushless motor mounted on a retractable mast similar to the retractable engine systems which have been used on gasoline powered self launch sailplanes for many years. Its empty weight is higher than comparable self-launch sailplanes primarily because there are 200 lbs. of lithium-ion batteries carried in long cavities in the inboard portions of the wings. Battery charging is accomplished by plugging into a 110v source or a portable generator. The charger is installed in the fuselage along with the other electronic stuff. (for details Google: Lange Aviation gmbh)

Electric power for a self-launch sailplane is perhaps the best entry level aviation use for electric power. Because a sailplane needs only enough powerplant endurance to take off and climb to altitude, a limited motor run time (battery capacity) is acceptable. For instance, the Antares 20E has a climb capability of 9000 to 10,000 ft. This is enough for an initial climb, usually not over 3000 ft., and then 2 or 3 in-flight re-starts. An in-flight "save" usually requires only enough climb to get to another lift source, hopefully within a few miles. If the pilot runs totally out of lift away from the home field, he can "cruise" or climb/glide for around 50-70 miles back to his home field on the remaining battery energy. On a full charge, the Antares manual claims a range of just over 70 miles in continuous motor operation cruise mode, or just over 100 miles in the sawtooth (climb/glide) mode. Presumably the cruise mode range is less because of the drag of the powerplant mast, whereas in the climb/glide mode, the majority of the distance is covered while gliding in the clean configuration. It's certainly not as much climb/range as with a gasoline powerplant system, but that is the limit of current battery technology.

There are limitations unique to electric airplane that the "electric pilot" must consider. For instance, power available decreases as battery energy lowers. The manual recommends that take-offs not be performed when the battery power is less than 65%. It is possible to take-off at a lower battery energy level, but the take off distance will be longer. Battery energy is sensitive to battery temperature. For this reason, the battery packs are wrapped with heating blankets that warm the batteries to a safe temperature range before charging or use. This, of course, consumes some of the energy stored in the battery.

Why have electric rather than gas powerplants in a self-launch sailplane? Powerplant reliability, smooth quiet running, and ease of operation are a few of the reasons. Two-stroke gasoline engines are widely used because they are small and light. However, they have proven to be high maintenance items and reliability is not as good as we've come to expect with 4-stroke aircraft engines. Operationally speaking, starting and engine extension/retraction are multi-step functions. Numerous accidents have resulted from concentrating on engine system operation and neglecting basic flying. I have found that the single-lever, computer-controlled motor extension/retraction/speed control of my Antares is almost sinfully simple by comparison. However, it takes a lot of computer stuff in the system to make this happen, and I wouldn't have a clue how to fix it if something malfunctioned.

THE ELECTRIC AIRPLANES I DON'T KNOW

OK, that's what I know about electric airplanes from actual experience. Now, the aviation magazines are telling us of soon-to-be-available electric powered light aircraft. Performance numbers are being quoted. Based on my 55 years of experience reading aviation magazines, I know better than to accept the printed word as absolutely accurate. I am now trying to evaluate these reports against my firsthand knowledge and experience, and share these thoughts with you.

Variations on the theme. Both the Chinese Yuneec, above, and , Randall Fischman's Electraflyer 2, below, are basically motorgliders — currently the most appropriate use of electric power.

Two of the new aircraft getting most attention are the Yuneec e430 and the ElectraFlyer-X, both two-seat composite aircraft of motor glider configuration. Both have motors with HP ratings in the mid-50s, similar to my Antares. However, though these are two-seat aircraft, their airframe weights are considerably less than the Antares. This is because the Antares has a very long, heavy, strong wing needed for high performance and competition flying and because it has a high Vne needed for competition flying. Both the Yuneec and the Electra Flyer appear to be optimized to be flown as low performance (by soaring standards) motorgliders or loiter-cruise powerplanes. As such, shorter wingspans and lighter airframe weights are possible. So, the mission profile really dictates the resultant airframe. As mentioned above, if a self-launch sailplane is the best application for the limited endurance of present day electric power systems, then the motor-glider would similarly be a suitable application.

While a high performance self-launch sailplane usually does not need to re-start its motor during an all-afternoon cross-country flight, a motorglider would need to run the motor much more often under similar atmospheric conditions because of its much lower soaring performance.

Flying, staying aloft on minimum power implies flying a low airspeed where aerodynamic drag is at a minimum. For drag to be minimized, induced drag must be minimized as well as parasite drag. For this, a high aspect ratio wing like that of a sailplane is necessary. To maximize the flight endurance of any airplane, it must be flown at the speed that requires the least energy output. For instance, the Yuneec lists a cruise speed of 60 mph. Based on the estimated wing load and span loading of this aircraft, 60 mph would be the approximate speed for minimum flight power requirement. A rough approximation of power required to fly at this speed is 10-12 HP. This is indeed a low figure and is a tribute to the efficiency of the airframe. On the other hand, from the pilot's perspective, 60 mph is about the cruise speed of a 40 HP J-2 Cub. How exciting is that?

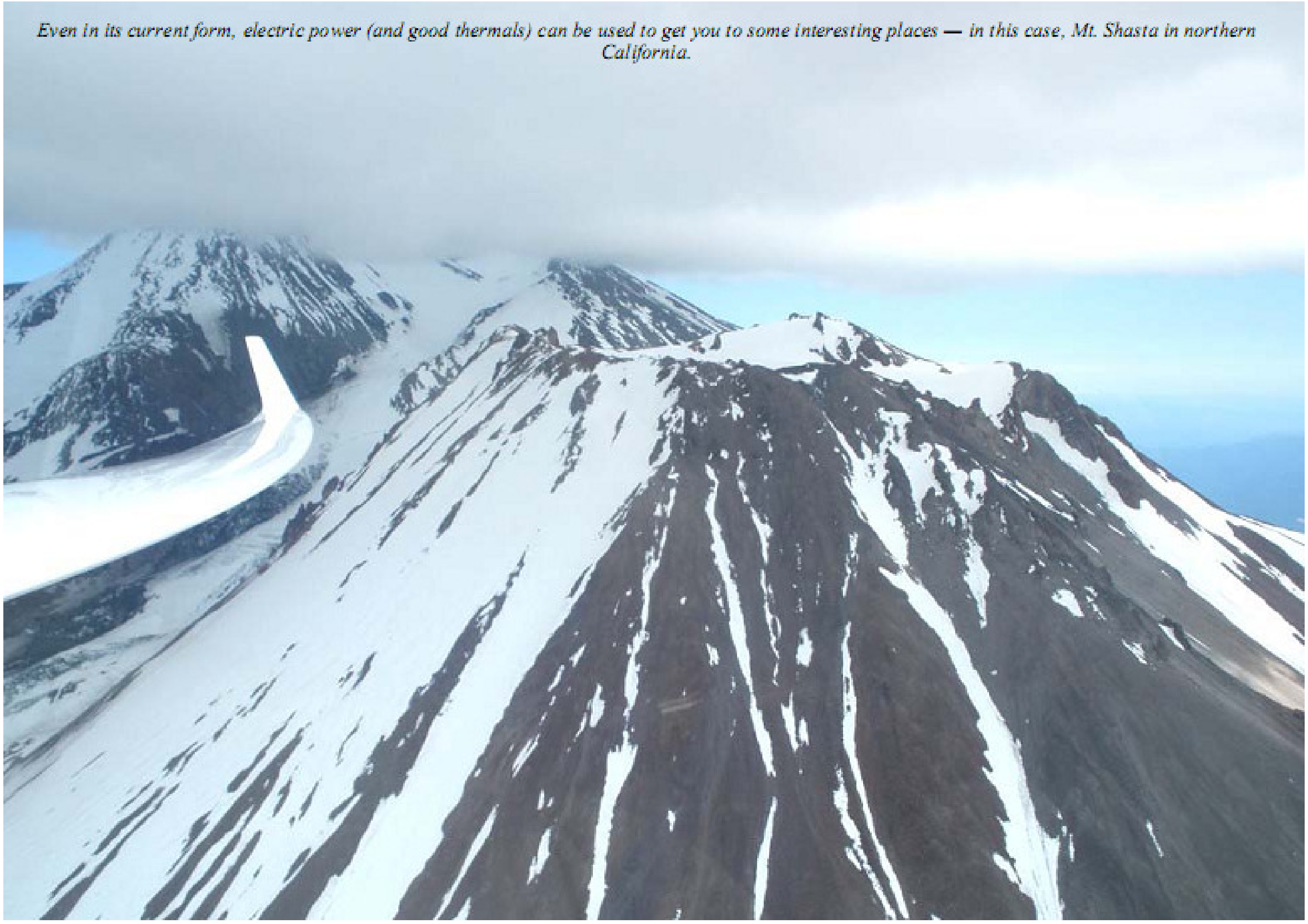
While a very low drag airframe will fly (level) on low power, it still requires lots of power to climb. The basic HP formula applies (1 HP = 33,000 ft/lb/min.), so a disproportionate amount of the battery energy is required to climb to any reasonable cruise altitude. It's alarming how fast the energy meter in my Antares winds down at climb power.

Planes of this type will realistically cost over $100,000. That's a lot of money for a plane that cruises at 60 mph and can only fly for only a short time. Sure, the cost to "refill" the batteries will be minimal, but buying gasoline (2 gph or less) for a 60 mph plane is not very expensive either. Battery packs will need to be replaced at some point, and that will be quite expensive when compared with the cost of 2 gph fuel consumption. Penny wise and pound foolish? I don't believe that the initial market for these aircraft will be based purely on economics, but rather on novelty, bragging rights, and the desire to support new technology. They might even attract a new clientele to flying: the more "greenish" people who may be turned off by the noisy, fuel hungry, lead polluting airplanes we know and love.

SPEED AND RANGE

Speed and range are the two performance parameters most often quoted for the electric airplanes. The duration of the Yuneec is stated in some magazines as 1 ½ to 2 hours, and its cruise speed as 80 mph. The Yuneec brochure lists its cruise speed as 60 mph with similar duration. Another source lists the duration at 80 mph being less than half the duration at 60 mph. This I find more believable based on my experience and my knowledge of aerodynamics, as the drag at 80 mph is almost twice that of 60 mph. So, I think that we must be careful of what we read. (Example: an RV-4 can be flown on 4 gph, and can also go 200 mph. It just can't do both at the same time).

Despite my skepticism about some of the performance claims, I hope that they will successfully demonstrate the practicality of electric sport aircraft. I hope that we can soon get some meaningful pilot reports or flight test data on these airplanes. Right now I'm not sure. If the claims prove true, I'd run right out and get a "plug-and-play" motor system and design an airplane around it. Otherwise, we'll just have to wait and see.



Even in its current form, electric power (and good thermals) can be used to get you to some interesting places — in this case, Mt. Shasta in northern California.

SOLAR CHARGER?

Almost without exception, everyone I talk to about my electric sailplane assumes that I recharge the batteries with a solar charger. If it were only that simple! Actually, the charging *is* simple because the aircraft has a built-in charger to which I connect 110 Volt AC, either from the electric grid or a gasoline powered generator. A full charge (80%) requires around 9-10 hours. A small solar panel, like you might see on a camping trailer, produces so little current that charging would require many days -- if not weeks. Powering a 56 HP motor is entirely different than supplying current for radios and avionics; a lot of kilowatts are needed. The auto industry know this only too well. It is struggling with the issue of carrying enough batteries to provide a totally electric powered car with enough range to be practical, even for a daily commute of 50 miles or so.

SUMMATION:

I enjoy the operation of my electric powerplant on the Antares sailplane. I look forward to the day when I can operate an electric powered sport aircraft in a similar fashion and enjoy the simple powerplant operation and smooth, quiet flight.