CHARGED WITH POTENTIAL

ELECTRIC EMPOWERING A NEW VISION OF FLIGHT TRAINING
FORGING A NEW PARADIGM IN AVIATION INVOLVES PURSE, PEOPLE, PAPERWORK, AND PATIENCE. TO GO THE EXHAUSTIVE DISTANCE, WORK OF THIS MAGNITUDE REQUIRES A GROUP EFFORT AND A LEADER WITH AN UNSHAKEABLE FAITH IN THE NEW VISION. JOSEPH OLDHAM IS THE VISIONARY AND DRIVING FORCE BEHIND THE SUSTAINABLE AVIATION PROJECT (SAP).

Over the last few years, the SAP has procured more than $1 million in grants to purchase the largest concentration of electric aircraft in the western hemisphere, established a network of chargers at multiple airports, performed almost 200 hours of validation testing, and submitted a petition of exemption to the FAA to allow electric aircraft for flight training.

The SAP is the first project of its type in the world. It is all the more remarkable that it’s happening in the agricultural Central Valley of California, a region that faces significant challenges with unemployment rates and poor air quality. The SAP has given rural communities the opportunity to unite around the goal of creating aviation career opportunities for their youth and residents.

Ever humble, Joseph is quick to downplay his part in the project. “Without this community, without this county, without the belief that these people had in this thing, this would have gone nowhere,” Joseph said. “I would have just been somebody who had an idea. A lot of people have ideas, but it takes more than just having an idea to turn that idea into reality.”

BLAZING AN ELECTRIC TRAIL

Launched in 2016, the SAP is composed of a consortium of public entities that include CALSTART, a nonprofit organization working with businesses and governments to develop clean transportation solutions, and the cities of Mendota and Reedley, California. Funding for the project was provided by the Fresno County Transportation Authority Measure C to demonstrate the viability of electric aircraft to lower the cost barrier for flight training and reduce aircraft noise and emissions.

Four Pipistrel Alpha Electro aircraft were built at the factory in Italy and delivered to Fresno Chandler Executive Airport in March 2018. The Alpha Electro has the same airframe as the Pipistrel Alpha Trainer, a special light-sport aircraft powered by a Rotax 912 engine, but with an electric powerplant. The four SAP Alpha Electro aircraft were issued experimental airworthiness certificates for flight testing to prove compliance with ASTM standards for electric powerplant reliability.

NEW VISION

“Pipistrel’s vision was that these things would operate out of a single location, not out of multiple locations,” Joseph said. A strategically placed network of chargers at local airports would allow the Alpha Electros to fly beyond the traffic pattern. Electric chargers were installed at Fresno, Reedley, and Mendota airports to support flight testing and future flight training operations.

In 2018, Joseph founded New Vision Aviation, a nonprofit educational flying club, and partnered with the cities of Reedley and Mendota to manage operations of the aircraft.

The Alpha Electros are capable of performing all maneuvers needed to train sport pilots to proficiency requirements as well as a considerable segment of private pilots’ requirements. The 50-60 nm range limitation with reserve is capable of meeting the cross-country requirements for sport pilot training provided there are chargers located at the airports where the cross-country flights originate and land.
The first step toward an FAA exemption that would allow the integration of electric propulsion into flight training was to gather data.

“This is really early technology,” Joseph said. “We’re learning how these aircraft would actually operate in a flight school environment.”

New Vision Aviation’s fleet also includes a Pipistrel Alpha Trainer that would enable data to be collected while comparing the same airframe (with reciprocating versus electric powerplants) in flight training operations.

Joseph, a pilot for 40 years and a member of Committee F37 on Light Sport Aircraft, was the test pilot. He flew the four Alpha Electro aircraft more than 2,500 nm and 175 hours during 17 months of testing conducted in various weather conditions and temperatures.

One of the airplanes completed 111 hours of endurance testing in simulated flight training operations specifically focused on the electric powerplant and battery system without any failure.

“The hundred-hour testing was really to prove that the propulsion system was as reliable or durable as a piston counterpart,” Joseph said. “We proved that it is.”

Testing Discoveries

Joseph noted some operating characteristics involving temperature that are unique to the electric aircraft compared to its combustion engine counterpart.

The Alpha Electro pilot’s operating handbook (POH) sets a maximum ambient air temperature limit of 40 degrees Celsius (103 degrees Fahrenheit) to fly the aircraft. Joseph asked Tine Tomažič, director of research and development at Pipistrel, why.

“He said, ‘Well, that was as high as we could test it in Slovenia,’” Joseph said.

Pipistrel also placed a battery takeoff temperature restriction of 40 degree Celsius to ensure that the battery systems don’t reach the upper threshold of the 49-degree Celsius safety range.

When summer temperatures in Fresno climbed above 90 degrees Fahrenheit, the hot weather began to impact the test program. Creative solutions were required so that test hours could continue to accrue. Initial concerns revolved around the battery temperature, but the limiting factor turned out to be the temperature of the power controller, the device that converts the electric power from the batteries and delivers it to the motor.

On hot days, the power controller could overheat quickly doing touch-and-goes. By using less power on takeoff and climbing during cruise, less amperage runs through the power controller, keeping temperatures lower. This procedure has been tested on many days at or above 100 degrees Fahrenheit and has become standard operating procedure on high-temperature days.

Another heat-related issue was that the battery temperatures would exceed 40 degrees Celsius while being charged in a hot hangar. Once the batteries became hot, they took overnight to cool, which limited flights per aircraft to one to two per day.

Joseph devised a solution to air-condition the batteries while they charged. A small air conditioner designed for cooling computer servers circulated cool air around the battery packs during charging, which allowed another flight immediately after charging.
**PIPISTREL ALPHA ELECTRO SPECS**

**AIRCRAFT MAKE & MODEL:** Pipistrel Alpha Electro

<table>
<thead>
<tr>
<th>Specification</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LENGTH</strong></td>
<td>21 feet, 4 inches</td>
</tr>
<tr>
<td><strong>WINGSPAN</strong></td>
<td>34 feet, 6 inches</td>
</tr>
<tr>
<td><strong>HEIGHT</strong></td>
<td>6 feet, 9 inches</td>
</tr>
<tr>
<td><strong>MAXIMUM GROSS WEIGHT</strong></td>
<td>1,212 pounds</td>
</tr>
<tr>
<td><strong>EMPTY WEIGHT</strong></td>
<td>832-843 pounds</td>
</tr>
<tr>
<td><strong>USEFUL LOAD</strong></td>
<td>380-369 pounds</td>
</tr>
<tr>
<td><strong>SEATS</strong></td>
<td>2</td>
</tr>
</tbody>
</table>

**POWERPLANT MAKE & MODEL:** Electro 60  
**POWER:** 60 kW  
**BATTERY CAPACITY:** 21 kWh  
**PROPPELLER:** 71-inch, fixed-pitch regenerative propeller  
**TAKEOFF DISTANCE:** 492 feet  
**Rate of Climb:** 1,300 fpm  
**CRUISE SPEED/POWER CONSUMPTION:** 85–90 knots, 22 kW  
**ENDURANCE:** 45–78 minutes with reserve  
**RANGE AT CRUISE:** 70 nm  
**CEILING:** 16,500 feet  
**LOADS:** +6g/-2g  
**CHARGING TIME:** 80–100 minutes using Pipistrel 15 kW charger  
**AVERAGE ELECTRICITY COST PER FLIGHT:** $4

- $V_{M}$: 135 knots
- $V_{S}$: 43 knots
- $V_{sl}$: 37 knots

The discoveries from flight testing the Alpha Electros under conditions and a mission different from their provenance yielded a wealth of valuable information. These findings were the genesis of the New Vision Aviation supplemental flight training operating rules supplement to the Pipistrel Alpha Electro POH.

**ATTRACTING INTEREST**

**Flight testing for** the FAA petition for exemption was not only an opportunity to gather data from real-life operations, but also attracted the attention of interested parties from around the world. Aircraft manufacturers, battery engineers, pilots, and future students from the United States, Europe, Australia, and South America are expressing an interest in these green, state-of-the-art aircraft.

Joseph believes that exposure to aviation at a young age is key to getting more people on a pathway to an aviation career. The SAP and its mission to inspire youth in aviation careers captured the attention of Boeing. In August 2019, a team from Boeing HorizonX came to Fresno to meet with Joseph.

Michael paying his passion for aviation forward to the next generation.
“The hundred-hour testing was really to prove that the propulsion system was as reliable or durable as a piston counterpart. We proved that it is.” — Joseph Oldham

ABC’s Good Morning America aired a segment in January 2020 featuring the SAP and the Boeing flight simulator program.

“This is not only a way to help bring people out of poverty, but it’s also a way to fill the pilot shortage and bring diversity into aviation,” Joseph said. “And this all happened because of the electric aircraft.”

The Association of California Airports invited Joseph to bring an Alpha Electro to Sacramento on February 26 to display on the steps of the state capitol for the 2020 California Aerospace & Aviation Days.

“California has the potential to be a leader in the infrastructure and to keep moving electric aviation forward,” Joseph said. “We have so many companies here with resources that are working on developing the aircraft as California pushes towards zero emissions for transportation.”

“If you’re going to find the people that are going to fill in this void in the pilot community, a lot of them are going to come from disadvantaged neighborhoods,” Joseph said. “But they will not come from those neighborhoods unless they know that there’s an opportunity.”

To support this endeavor, Boeing has provided flight simulators for three elementary school districts in Fresno County.

“It’s really cool when you’re listening to these kids talk about how they didn’t realize that aviation could be a career path for them, but now they want to become pilots,” Joseph said. “And because they’ve been exposed to the simulators and they’re flying them, they’re actually very good. They’re really, really good.”

Above: SAP routes between regional airports.

Right: Air conditioner cooling of battery packs while charging allows for a flight immediately afterwards on hot days.

Photography courtesy of New Vision Aviation, Beth Stanton
FLYING THE ALPHA ELECTRO FOR THE FIRST TIME

BY BETH E. STANTON

Always an opportunist to fly cool new airplanes, I asked Joseph if I could come to Fresno and be a crew member on one of his test flights in the Alpha Electro. I had never flown a light-sport aircraft, let alone an electric fixed-wing aircraft. Simulated flight training in the Electros often required a crew member to replicate weight and monitor the controls like a real training scenario. Since I’m an experienced pilot, he agreed to the mission. As a bonus, I’d also get to fly the gas-powered Alpha Trainer. I was eager to see how they compared not only to each other, but also to other GA airplanes.

First up was flying the Alpha Trainer. Predictably, it had the usual noise, vibration, warmup time, and spooled-up takeoff roll as any GA aircraft. Right away, I noticed the fabled sensitive LSA control inputs. Having flown aerobatic airplanes, I acclimated to the light controls almost immediately. I appreciated the simple, modern design of the carbon fiber cockpit and glass panel as I maneuvered above the checkerboard farmland of the San Joaquin Valley.

After landing, we pushed the Alpha Electro out of the hangar. It was a novelty for the preflight inspection to include checking the state of charge (SOC) of the battery packs as opposed to fuel and oil. After turning on the master, avionics, power controller switch, and throttle switch, the coolant pump whirred, but the prop didn’t budge. Moving the throttle forward, the prop started spinning and the airplane made a soft bijijjeeeew sound, reminiscent of a visual noise, vibration, warmup time, and spooled-up takeoff roll of a four-cylinder combustion engine. I had never flown a light-sport aircraft, let alone an electric fixed-wing aircraft. Simulated flight training in the Electros often required a crew member to replicate weight and monitor the controls like a real training scenario. Since I’m an experienced pilot, he agreed to the mission. As a bonus, I’d also get to fly the gas-powered Alpha Trainer. I was eager to see how they compared not only to each other, but also to other GA airplanes.

First up was flying the Alpha Trainer. Predictably, it had the usual noise, vibration, warmup time, and spooled-up takeoff roll as any GA aircraft. Right away, I noticed the fabled sensitive LSA control inputs. Having flown aerobatic airplanes, I acclimated to the light controls almost immediately. I appreciated the simple, modern design of the carbon fiber cockpit and glass panel as I maneuvered above the checkerboard farmland of the San Joaquin Valley.

After landing, we pushed the Alpha Electro out of the hangar. It was a novelty for the preflight inspection to include checking the state of charge (SOC) of the battery packs as opposed to fuel and oil. After turning on the master, avionics, power controller switch, and throttle switch, the coolant pump whirred, but the prop didn’t budge. Moving the throttle forward, the prop started spinning and the airplane made a soft bijijjeeeew sound, reminiscent of a spaceship taking off.

“If I got ahold of one of these things, I would just taxi around the airport stopping and starting, pretending to be the Enterprise,” I said. We giggled like children.

At full throttle, the Alpha Electro jumped off the runway faster than the gas–powered version. As we cruised around the valley, I noticed that it had more docile handling characteristics compared to the gas–powered version. Joseph said that the electric motor has smoother power than a four-cylinder combustion engine. I was careful to keep coordinated flight, as any tiny amount of drag decreases efficiency (and time aloft). It was surreal to glance at the SOC reading as opposed to the familiar fuel, engine, and oil gauges.

Joseph has flown with a few dozen crew members during the flight testing phase, and I was the first person to fly both versions of the Alpha trainers back to back. Coming in to quietly land on long, floaty wings was an experience I’ll never forget. I won’t forget because once these babies are certified for instruction, I’m going to be first in line to get checked out to fly them.

Top: Beth gets a lesson from Joseph on the importance of keeping the ball centered.

Bottom: Battery state of charge (SOC) instrumentation (right) in the simple, state–of–the–art, carbon fiber Alpha Electro cockpit.