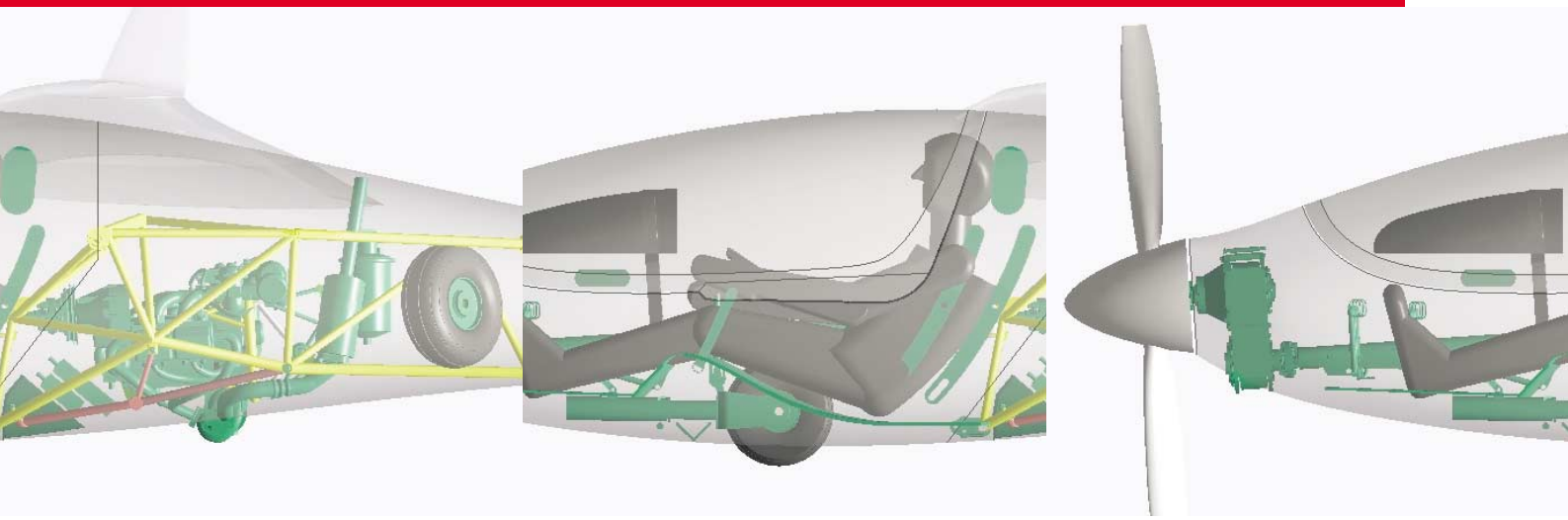
STEMME

STEMME Innovation



Innovation

Unique in the world of sports aviation, STEMME is a synonym for innovative products that deliver performance at the highest level. Proven by world record long distance soaring flights, STEMME sets new standards right from the start. Creativity and state-of-the-art methods for aircraft design, production and quality management are hallmarks of STEMME aircraft. For more than a decade, STEMME aircraft have delivered optimal flight performance and safety without compromising ease-of-use characteristics such as ground handling, ease of entrance, seating comfort, etc. The new STEMME-TSA family of **T**wo **S**eat **A**ircraft expands on the company's history of break-through innovations in each of the following areas:

- side-by-side cockpit and safety concept
- drive shaft – propeller – mid-engine
- landing gear
- fuselage
- polars and wing pressure distribution
- wing folding mechanism
- service

Side-by-side cockpit and safety concept

Unique among high performance sailplanes, STEMME pilots enjoy side-by-side seating, a configuration common among power planes. This seating configuration offers numerous advantages.

Training
The efficiency and safety of training flight students is improved through clearer verbal communication, a shared cockpit, direct eye contact, direct observation of students' behavior and actions. Dual ergonomic flight controls add additional safety.

Performance
Side-by-side seating is optimal for communication and load sharing between pilots, whether for competition, navigation, flight operations or any flight task. Improved cockpit resource management improves overall performance of the flight crew.

Flying with friends or guests
Flying side-by-side enables you to show the fascination of flight to less experienced passengers in a way that makes them feel more comfortable and safe since they can see every pilot action and better understand the situation.

Comfort
Both seats have full controls and share excellent ergonomics with pedals and seat back adjustments for pilots from 1.6 to 2.0 m (5.2–6.6 in) and a cockpit nearly 1.2 m (48 in) wide… a comfortable cockpit environment by any standard. Positioned forward of the leading edge of the wing, both pilots enjoy an unobstructed panoramic view. Entrance to and exit from the cockpit is facilitated by a low canopy frame, which is made easier still by doors on the S8 models.

Safety concept
Certified to the latest JAR 22 standards, STEMME aircraft offer the highest level of safety available incorporating features such as emergency canopy egress. The structural center console and short side-by-side fuselage length combine to achieve a new standard for cockpit stiffness and crashworthiness. As a result, the cockpit cell is constructed to withstand double the latest certification strength standards.

Costs
The side-by-side configuration of STEMME-TSA cockpits requires only one set of instruments for both pilots. This reduces avionics costs and leaves ample room for additional instruments for the same price as dual instruments in tandem configurations.

Drive Shaft – Propeller – Mid Engine

STEMME's most remarkable innovation is the patented propulsion design, consisting of a certified four-stroke aircraft engine mounted behind the cockpit, driving a nose-mounted propeller via a lightweight carbon fiber drive shaft. This light and cost effective drive shaft was brought to market in the early 1990's and enabled STEMME to position the engine in the middle of the airframe near the center of gravity with almost no cost or weight penalty.

No other powered sailplane design has combined the high performance of a sailplane with the practicality and convenience of a power plane. As a result, soaring was finally freed from local airfields and the requirement for ground handling support, creating a new class of gliders. Starting from convenient local airfields in the morning, owners fly under power to optimal soaring conditions anywhere within several hundred miles, soar all day, and still have time to return home the same day. The STEMME propulsion design makes high performance cross country soaring a convenient form of recreational, competition and record-setting flight.

The mid-engine layout offers numerous advantages. The pilot may transition between powered and soaring flight in seconds without moving any portion of the drive train. After shutdown, the engine remains safely out of the flow of cold slip-stream air, so there is no sudden thermal shock. The frontal drag is minimized yielding excellent handling qualities and optimized aerodynamics, resulting in high cruising speed and low fuel consumption.

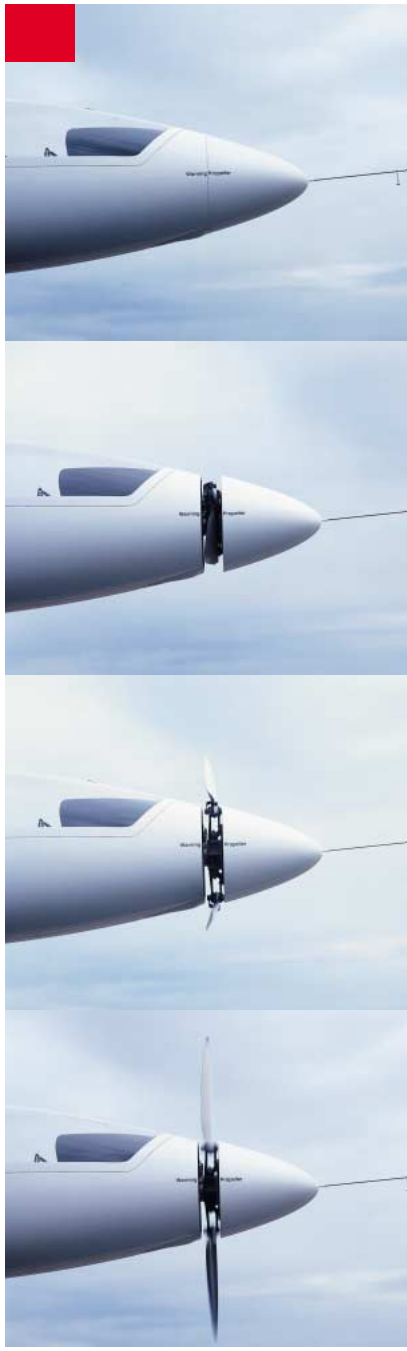
For ultimate soaring performance and a glide ratio of 50:1, the S10 is equipped with the STEMME-RETRAC-PROP completely concealing the folding propeller inside the movable nose cone. The S6 and S8 are equipped with electrical MÜHLBAUER constant speed propellers for high static thrust (for glider towing) and high cruising speeds. In feathered position they enable a glide ratio of 39:1 for the S6R with retractable gear.

Cooling air is drawn in from the lower front and exhausted up and rearward. This method of cooling is also environmentally friendly due to reduced noise emissions on the ground. The optional three blade MÜHLBAUER constant speed propeller in combination with a reduced propeller speed give an extra in noise reduction and more static thrust at the same. The result? A noise signature that meets the most stringent requirements.

From a maintenance point of view, the mid-engine layout also offers advantages. The S6, S8 and S15 engines, together with their sub-systems are installed on a sub-frame as part of the center frame. As a result, the engine unit can be removed and replaced in 15 minutes, reducing maintenance and overhaul costs. Commercial operators, in particular, benefit from the ability to receive and replace complete STEMME certified propulsion units, minimizing downtime for overhauls and repairs.

As of 2002, more than 150 aircraft are operating throughout the world. While most are quietly enabling their owners to experience the shear joy of cross country soaring, others are using the aircraft to break long-standing records. Late in 2000, for example, Mr. Klaus Ohlmann set an astounding FAI-certified world record of 2.463 km (1,330 NM) in the category "longest distance" in soaring flight using a STEMME S10VT.

In response to the overwhelming acceptance of the S10 design, STEMME now offers a family of side-by-side motor gliders in the mid class segment – the S6 and the S8. The unpowered S2 is also available to address the demand for a side-by-side glider. The overall conclusion: The clear benefits of the STEMME mid-engine layout are proven. Owners enjoy a host of advantages including improved performance, decreased fuel consumption and minimal noise levels.



Landing Gear

Landing gear design is compromise. Weight and aerodynamic drag must be minimized, yet strength, ground handling and aesthetics have to be maximized. Once again, STEMME incorporates innovative design to address this conundrum to achieve optimal results.

The S6 and S8 are available with fixed or retractable tricycle landing gear with steerable nose wheel. The retractable gear employs the well-proven S10 electrical extension and retraction mechanism. Backup extension is provided by a manually activated gravity free-fall.

Spring and damping are realized by special non-linear elements, which contribute to safe and comfortable take-off and landings even on rough surfaces conditions. For strength, the main landing gear structure is directly connected to the center frame.

The wheel track of 2.0 m (6.6 ft) together and wheelbase of 2.0 m (6.6 ft) yields excellent ground handling. The comparatively large main wheels give extra flotation and shock absorption for unpaved runways. The hydraulic wheel brakes are taken from the S10 – with combined activation by a single hand lever.

The S2 sailplane also enjoys a uniquely optimized landing gear design. The S2 design is especially robust to meet the requirements of flight training. The main landing couples a large wheel 380 x 150mm (15 x 5.9in) with considerable shock absorber travel of 75 mm (3.0 in). A fixed nose wheel of 260 x 85mm (10.2 x 3.3in) yields easy ground handling. To improve safety, the main landing gear is placed at an aft c/g position, ideal for new students and gusty winds. Similar to other STEMME aircraft the wheel brake is activated by a hand lever mounted on the control stick. Pilots transitioning from the S2 to other STEMME aircraft will find the transition simple and easy, thanks to the common placement of controls and cockpit configuration.

Fuselage

Designing optimal fuselage geometry for a single plane is a study in contradiction – to do so for an entire aircraft family is a real challenge to all disciplines of the development team.

The fuselage has to combine:

— slender and streamlined form for low drag;

— low weight;

— high stiffness;

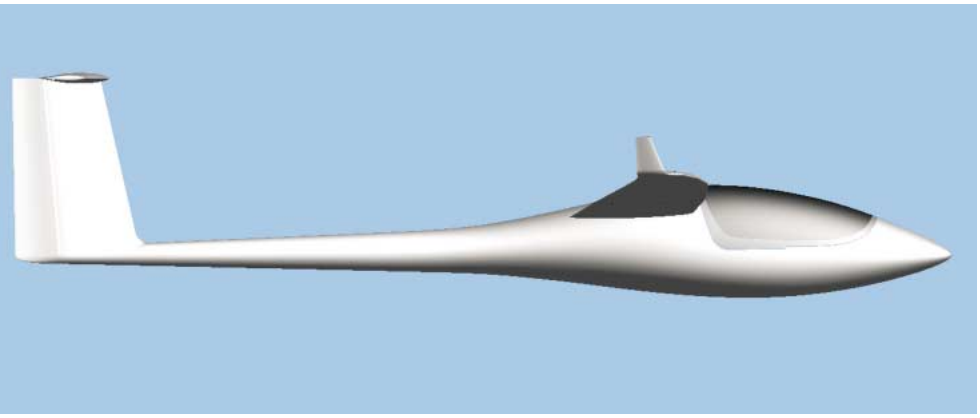
— large volume;

— spacious cockpit for ergonomic seating positions and excellent view, for small and tall passengers alike;

— easy entrance; and

— an attractive shape.

The STEMME team turned to state-of-the-art 3D-CAD software to find the best geometry for the TSA family. The final aerodynamic optimization, especially the fuselage-wing junction, was done by Prof. Boermans, known for his work in glider aerodynamics at the Faculty of Aerospace Engineering at Delft University of Technology in the Netherlands. The resulting design is highly aesthetic and, once again, confirms the adage that “an airplane that looks good flies well”.



Some of the low drag fuselage design elements include laminar airflow to the greatest extent possible. Much like a single seat sailplane, the side-by-side STEMME permits laminar airflow over a high percentage of the whole fuselage length. Aft of the pilot seats, the fuselage narrows to a slender tail cone to minimize turbulent wetted area. This reduction in diameter is done smoothly to avoid flow separation while also yielding sufficient space for all mechanical systems and a sizable baggage compartment.

The high wing position offers optimal wing aerodynamics, ensuring the wing upper side is free of fuselage influence. The fuselage camber line is optimized to follow the wing-induced airflow. This is another step to minimize fuselage drag.

Close attention was given to the cabin frame to minimize gaps that spoil laminar airflow. Close inspection of the design reveals large radius gaps as a means to reduce airflow parallel to joint sections, a technique which avoids a large area of wedge shaped turbulent flow. This is another detail to minimize fuselage drag. Taken together, these and scores of other fine details in design and workmanship yield a remarkably low drag airframe which opens the door to truly high performance cross country soaring.

STEMME pioneered application of high quality paint to replace conventional high maintenance gel-coat surfaces. STEMME was the first glider manufacturer to use a paint finish instead of gel-coat. As anyone who owns a sailplane with a gel-coat finish knows; if the plane is flown regularly, the gel-coat finish deteriorates in a few years. The STEMME paint finish lasts many times longer and isn’t as prone to surface cracks that plague gel-coat finishes.

Polars and Wing Pressure Distribution

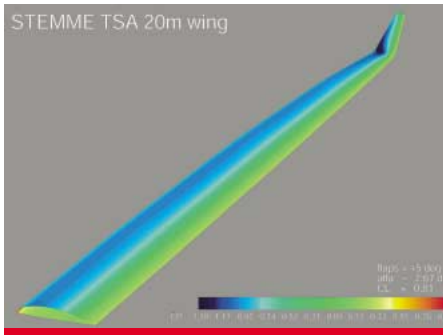
Manufactured to a tolerance of only a few thousandths of an inch, the STEMME-TSA wings are a work of art in themselves. Although of different spans, the S2, S6, S8 and S15 share the same basic wing geometry and flap design. For the new STEMME-TSA aircraft family new state-of-the-art wing, profiles were designed by Prof. Boermans at Delft University of Technology to obtain nearly ideal pressure distribution along the wingspan to minimize drag at all flap settings.

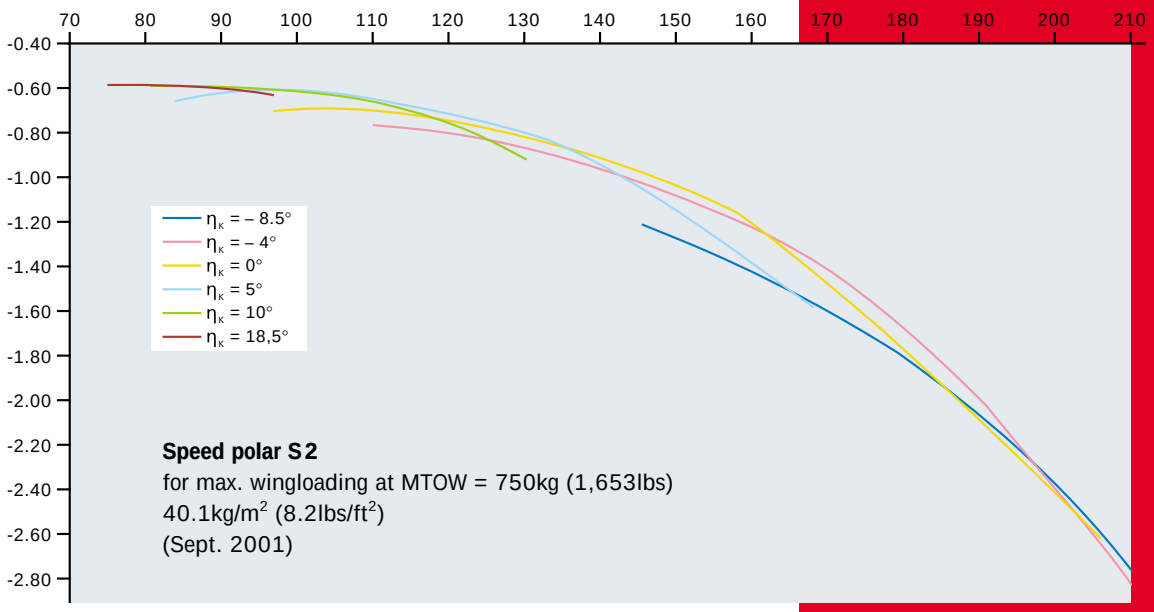
High attention was paid to the fuselage-wing junction to minimize interference drag and special profiles were developed for the wing region closest to the fuselage to take into account the unavoidable turbulent airflow in that region.

Enormous attention was focused on flap design. When landing, the inner wing flap deflection is greater while the outer section is less. The resulting extra inboard high lift coefficient combines with more roll control for docile landing characteristics. Not merely for landing, however, properly designed sailplane flaps optimize flight performance throughout the aircraft speed range. The objective is to permit low minimum sink rate, high maximum glide ratio and low drag for high cruising speeds. This goal was achieved in the STEMME-TSA family of aircraft. When equipped with retractable landing gear, the ROTAX 914F powered S6, S8 and S15 motor gliders deliver astonishing cruise speeds in excess of 300km/h (162kt) TAS.

Flap travel for the S2 has been carefully refined to permit highly competitive performance when the full range of flap configurations are used, yet excellent all-round performance when only using the 5° flap setting. The result is high enough performance to meet the expectations of the most demanding competition pilot, yet low workload for students learning to soar. This remarkable combination is especially well suited for flying clubs and commercial operators, because the S2 is equally at home on basic training flights as the most ambitious soaring task. The S2 is really a twin seat glider for everyone.

The result of all this aerodynamic fine-tuning is optimized aerodynamics over a wide range of flight regimes from narrow circling at low airspeeds in thermals to high speed cruising without need for cumbersome, high maintenance and expensive techniques such as active boundary layer control. Instead, owners of STEMME-TSA aircraft enjoy an ideal mixture of high performance and practical aircraft suited to daily use.





Speed polar S2
for max. wingloading at MTOW = 750kg (1,653lbs)
40.1kg/m^2 (8.2lbs/ft^2)
(Sept. 2001)

Wing folding mechanism

All STEMME aircraft can be ordered with an optional folding mechanism, which reduces the wing span to 7.2 m (24 ft) [S 6 and S 8] or 9.2 m (30 ft) [S 2] or 11.2 m (37 ft) [S 10] with minimal effort. Dividing the wing at a span of 6 m (20 ft) results in a wing middle section of 100 kg (220 lbs) and two outer wings of 50 kg (110 lbs) each, which is similar to single seat gliders. This light weight allows one person to easily fold the outer wings. Strong enough to support the wing during taxi, the wing folding mechanism enables all ground operations to be performed single person, similar to that of single engine power planes.

Service

The best part of sport aircraft flying is flight time – needless time on the ground is wasted time. Therefore it was a high priority objective in the development of the STEMME-TSA sport aircraft family to minimize inspection and repair effort to save time and cost.
The solution is a unit concept for several subsystems. The engine, for example, is assembled with all it's accessories on a sub frame, which is pre-assembled and tested before installing in the fuselage. This engine unit can be removed and replaced in 15 minutes. The same is true for the structural parts of the landing gear and the propeller-gear-driveshaft unit.

This concept enables manufacturer overhaul and repair by express shipment, with all it's advantages of certified high quality standards, reasonable costs and short aircraft ground time.

STEMME GERMANY offers its customers in Germany a one workday factory exchange service. Online weekday technical support is available 12 hours per day for all customers. STEMME and ROTAX factory trained mechanics are available throughout the world.

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