Arlington Sisu 1A:
Rise and Demise of America's Most Successfull Competition Sailplane and the Beginning of the Era of Fiberglass

by Russell E. Lee

Photographer Sandor Aldott captures Al Parker soaring his Sisu 1A sailplane between towering cumulus clouds above Odessa, Texas, in 1963. (Credit: Sandor Alex Aldott©, Master of Photography.)

Sisu - ('see-sue') A popular Finnish word with no precise English equivalent that describes a unique blend of will and tenacity. *Sisu* "refers not to the courage of optimism," wrote Aini Rajanen in *Of Finnish Ways* (Barnes & Noble, 1984), "but to a concept of life that says, 'I may not win, but I will give up my life gladly for what I believe.'... *Sisu* is the only word for the Finns' strongest national characteristic."

Leonard A. Niemi designed the most successful high-performance sailplane design in American history and he named this aircraft *'Sisu'* to honor his Finnish heritage.[1] Pilots flying the *Sisu* set world and national records and conquered soaring competitions for a half decade until an onslaught of 'fast-glass,' high-speed sailplanes designed and built in Europe entirely from marble-smooth, fiberglass-reinforced plastic, drove the *Sisu* into obsolescence. It is ironic that the laminar-flow airfoils like the one that Niemi used on his *Sisu* had to migrate across the Atlantic Ocean to reach their ultimate potential in the hands of the designers of European sailplanes.

Government action at the end of World War II helped to set the stage for Niemi to begin designing his *Sisu* seven years later. Almost as soon as hostilities in Europe ceased in May 1945, War Department officials offered for public sale hundreds of surplus military training sailplanes. Soaring schools welcomed this deluge of inexpensive two-seat trainers in good or brand-new condition but the sale landed a body blow to American sailplane manufacturers and designers because it eliminated their incentive to spend the time and money required to develop new designs. Even moderately skilled pilots could successfully compete in soaring contests when they flew any one of these surplus gliders (U. S. Army TG-1, '-2, '-3, and '-4 or the U. S. Navy LNE-1). The government sale robbed designers of any incentive to invest their time, money, and effort in new designs that could outperform the surplus ships and reinvigorate the market.[2]

Ross Johnson RJ-5 Inspires Design of the *Sisu*

Near the end of the decade, Richard H. Johnson became convinced that it was possible to design a sailplane that a competent pilot could fly farther for every foot of altitude lost than any other motor-less aircraft in the world. He believed that new airfoil technology was the key to this leap in performance. In 1948, Johnson signed a contract with Harland Ross to attempt to design and build a sailplane with a 40:1 L/D (lift-to-drag ratio, a key measure of a sailplane's performance). To achieve this figure required four years of hard work to test, modify, and then retest different techniques and ideas. Dick Lyon, an engineer employed by the Hughes Aircraft Company, suggested using a new laminar-flow airfoil developed specifically for use in low-speed applications by the National Advisory Committee for Aeronautics. The team had to adopt a

number of other aerodynamic refinements to reach the magic number 40:1 but this airfoil contributed much to attaining the group's goal. By the mid-1960s every important designer of high-performance sailplanes used laminar airfoils but Johnson's team was the first.[3]

In December 1949, Ross and Johnson moved the half-finished sailplane to Mississippi State College in Starkville. Johnson had discussed the project with Dr. August Raspet, head of the school's Aerophysics Research Laboratory, and he had agreed to help develop the new aircraft. The Ross Johnson RJ-5 began flying in July 1950 and colleagues and students helped Raspet to analyze the design. Based on their findings, the Raspet team modified the sailplane to increase performance with dramatic results. The following month, Johnson flew the RJ-5 and won the U. S. National Sailplane Championship. He repeated this performance the following year and then set a world distance record of 861 km (535 miles) that remained unbroken for 13 years. By the summer of 1952, a pilot could fly the RJ-5 a distance of almost 41 feet for every foot of altitude lost.[4]

Leonard Niemi's inspiration to design and build the *Sisu* dates to 1951 when he heard about Johnson's 861-km world distance record but the special knowledge he needed to design the *Sisu* came from Raspet's research on low-speed aerodynamics and laminar airfoils, a body of work that began in 1945:[5]

> "If the RJ-5 could be described as the catalyst [to design the *Sisu],* then the research papers on low speed aerodynamics generated by Dr. Raspet should be regarded as the agents which combined to provide the aerodynamic configuration of the *Sisu.* Aerodynamically the *Sisu* is a direct product of the study of Dr. August Raspet's published research."[6]

A year after Johnson's record flight, Niemi started to design and build the *Sisu* 1. He seems to have had no prior experience designing sailplanes but he had earned the general experience and qualifications required for the work. Niemi began learning the aircraft mechanics trade when he attended a technical high school in Buffalo, New York, followed by six years spent working as an aircraft mechanic for Bell and Curtiss-Wright when both of these aircraft builders called Buffalo home. After a stint in the U. S. Army, Niemi attended the University of Michigan and earned a B. S. in Aeronautical Engineering. He then worked four years as a stress analyst and design engineer at Bell Helicopter in Ft. Worth, Texas, before he began working on the *Sisu* in 1952.[7]

Designing and Building the *Sisu* Prototype

Like Johnson and his team, Niemi devoted considerable attention to designing the wings of the *Sisu* 1 to generate the greatest amount of lift with the least amount of the inevitable byproduct, drag. He used a 653-418 laminar-flow airfoil developed by the National Advisory Committee for Aeronautics, and he added a touch (2.92 degree) of forward sweep to the wings to cause span-wise airflow inboard toward the center section. This thinned the boundary layer at the wingtips and allowed the ailerons to continue to bite the air and provide the pilot with control during a stall. Most designers build washout into their wings by twisting the outer sections near the wingtips around the lateral (pitch) axis, rotating the outer wing several degrees leading edge down and trailing edge up. This causes the wingtips to fly at a lower Angle-of-Attack than the inboard sections of the wing to preserve roll control during a stall. Niemi eschewed this technique because even slightly twisting the wings increases drag. He also made

Al Parker points a wingtip at the sky as he sails his Sisu above the flat and arid scrub of west Texas. (Credit: Sandor Alex Aldott©, Master of Photography).

the swept forward wing pay an extra bonus in the way that it met the fuselage behind the cockpit. A straight wing would have intersected the fuselage in the middle of the cockpit and forced Niemi to build a complex and heavy internal structure to securely fasten the wings together while also allowing space for the pilot.[8]

To reach the full potential of a laminar airfoil to reduce drag, the surface of the wing had to be extremely smooth and Niemi took great care to design and build the wings with this goal in mind. He was concerned not only to brace the wing against buckling and deforming under flight loads, but he also needed to strengthen it to withstand the laborious process of filling the surface with contour paste and sanding it smooth. He met these requirements by using a monocoque structure covered with relatively thick aluminum wing skins. This approach made the wing quite heavy. After describing the various wing components, including these thick skins, in detail in the March-April 1956 *Soaring,* Niemi felt compelled to explain to any readers who judged the wing "...extraordinarily heavy but the unit weight of 2.82 pounds per square foot is reasonable considering the aspect ratio of 23.1, the ultimate load factor of 10.5, and that large span [sic] flaps are incorporated. Since the resulting wing surfaces are perfectly stable under all flight and atmospheric conditions [sic] the small difference in weight over a more conventional design is considered weight well spent [sic]."[9] By unit weight, Niemi was referring to the static weight (2. 82 lb) of each square foot of wing and in total,

Cumulus clouds mushroom like ripe cotton as Al Parker dips the wing of his Sisu 1A sailplane. (Credit: Sandor Alex Aldott©, Master of Photography).

the wings weighed almost 305 lb. This was a substantial figure for a sport sailplane of that era and the *Sisu* wing loading was also high at 6.58 lb/sq. ft. but neither these weights, nor the 775-lb total empty weight, were unreasonable when compared with other contemporary high-performance sailplanes. The first European sailplane designed to employ a laminar airfoil was the Haase-Kensche-Schmetz HKS-1 that first flew in July 1953. The three German designers equipped this airplane with two seats but its tremendous mass often dictated that just a single pilot could fly in competitions. At 972 lb, the HKS-1 nearly doubled the *Sisu's* empty weight and there was less than a pound of difference between the German sailplane's wing loading and the American design yet the HKS-1 only managed a 38:1 L/D. The French first flew the Breguet 901S *Mousette* in 1956 on laminar wings but its 35:1 L/D placed it well below the *Sisu's* performance level. The 901S was 84 lb heavier with only a pound-and-a-half lighter wing loading than the *Sisu.*™

Niemi closely examined other aspects of his design with an eye toward reducing drag wherever possible. A conventional empennage is composed of a vertical stabilizer and a rudder that intersects a horizontal stabilizer and an elevator. Niemi opted for a vee-tail on the *Sisu* that combined the functions of rudder and elevators into 'ruddervators' and eliminated one entire conventional appendage and the drag this surface would have generated. It might appear that this layout would lessen drag by one-third compared to the conventional configuration but in practice, it is sometimes necessary to enlarge a vee-tail to maintain adequate control and Niemi was compelled to do this in the early 1960s when he redesigned the *Sisu* for factory production. There are other benefits to the vee-tail such as less weight and ease of construction, and a vee-tail rises well clear of ground obstructions. This can be an important consideration if a pilot is forced to land in rough terrain. Niemi also configured both the tow hook and the main landing wheel mounted under the cockpit to retract into the fuselage, another measure that lessened drag considerably.[11]

Niemi worked almost six years designing and building the prototype *Sisu* with help from George Coder. In his original concept, Niemi intended to sell kits to build the sailplane but the first flight in 1958 was so successful that he decided to modify the design and sell finished and ready-to-fly *Sisu* aircraft built in a factory.[12]

Prototype Flight Trials

Niemi first flew the *Sisu* 1 on 20 December 1958 at the airport in Grand Prairie, Texas, and he spent the following spring and summer flying within 25 miles of the field to satisfy FAA operating restrictions on amateur-built aircraft. His first unrestricted cross-country flight occurred during the Labor Day weekend but it ended in "a violent ground loop resulting from trying to mentally avoid a mesquite bush and stalling at the same moment. The ship virtually landed side wise [sic]. The mid-section of the fuselage and one wing was [sic] buckled and the landing gear was all but uprooted. "Niemi and George Coder repaired the aircraft with just enough time for Coder to pilot the sailplane in the 1960 U. S. National Soaring Competition. Neimi wanted to measure the *Sisu's* performance and handling under contest conditions, and he hoped to compensate Coder for "the many hours he spent behind a bucking bar during . . . construction."[13]

Niemi lent the *Sisu* to Richard Johnson who conducted test flights during the late summer of 1960 to precisely measure performance. All the tests took place in the still air of dawn to obtain the most accurate results. After a towplane released Johnson and the *Sisu* 1 at 9,000 ft, he flew at various airspeeds and noted the time required to descend 500 feet. Johnson had installed several devices on the airplane to verify the correct airspeed and scrub all data of instrument errors, and before each flight, he noted the temperature from a U. S. National Weather Bureau station located a few miles away. Johnson took these steps to ensure the accuracy of his test results.

What Johnson discovered during his tests compelled Niemi to drastically modify the *Sisu's* flap arrangement. In contests, pilots will congregate in the most powerful thermal they can find and attempt to out-climb each other before abandoning it to search for another thermal that lies preferably in the direction they wish to go.[15] Stall speed limits a sailplane's climbing performance and those aircraft that can fly at a slow speed without stalling can often turn tight circles to 'core' the strongest lift. When Johnson circled the *Sisu* in thermals, he noted the onset of turbulent buffeting, the first warning of approaching stall, at the rather high airspeed of 55 mph but Niemi had provided the flaps for this situation to lower the stall speed, without substantially increasing drag, allowing the pilot to fly tighter circles. Unfortunately, Johnson discovered that:

> "In an effort to improve its climb performance, both +5 and +10 degree flap settings were tried but without significant results. For each 5 degrees of flap deflection the buffet onset speed appeared to decrease approximately 1 mph, but the ship's sinking speed also increased such that little if any increase in climb performance was noted."[16]

Johnson had discovered that the air flowing over the top of the flap was separating at an unacceptably high airspeed and

becoming turbulent with loss of lift that could quickly lead to a full stall as speed decreased. The *Sisu's* high stall speed without flaps was an acceptable tradeoff to achieve high wing loading, a specific design goal that Niemi sought to tailor his sailplane's performance to match the extraordinary soaring conditions that characterize the southwest region of the United States. Some of the largest and most powerful thermals in the world form in this area and the heavy wing loading allowed a pilot to fly her *Sisu* very fast between thermals but to be truly competitive, she also needed a sailplane that could slow down to circle tightly in small thermals and Niemi's flap design did not allow this type of performance.

Prototype *Sisu* 1 to Production *Sisu* 1A

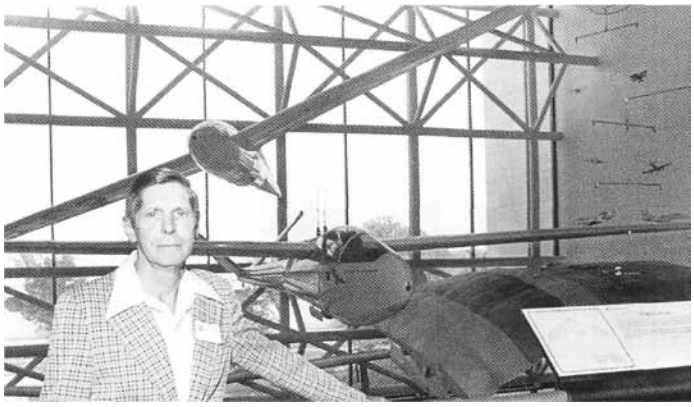
Niemi, Johnson, and other pilots had flown the *Sisu* over 100 hours by the end of 1960 and all of them had come away with reasonably objective opinions about what was good and bad about the aircraft. Based on these observations and anticipating the start of factory production, Niemi began designing an improved version that he designated the *Sisu* 1A. Niemi's decision to abandon the plain flap and adopt a slotted flap was the most significant change that he made to the new design. He believed this modification would improve slow speed performance because:

> "A slotted flap provides accelerated flow through the slot and over the flap which delays [airflow] separation, with a consequent reduction in drag at the same time [that] produces a much greater [lift] increment than is obtainable with a plain flap."[17]

By lowering drag and boosting lift, the slotted flap reduced both forward speed and sinking speed without increasing descent rate or stalling and allowed the *Sisu* pilot to turn tighter circles in smaller thermals.

Niemi had coupled aileron action with flap deployment on the *Sisu* 1 and he wisely left this feature unchanged as he upgraded the design. It worked like this: when the pilot dropped the flaps to the maximum 20 degree setting, both ailerons also drooped 10 degrees. As the ailerons drooped, a slot opened between the wing trailing edge and the aileron. The ailerons now doubled as slotted flaps to help reduce speed and maintain lift. These slotted 'flaperons' also functioned to minimize induced drag but even in full flaperon mode, they continued to answer the *Sisu* pilot's call for control about the roll axis and function as normal ailerons.[18]

Niemi used a vee-tail that produced less drag than a conventional cruciform empennage and stood clear of brush and rocks during landings off the airfield. The bulged tips of both "ruddervators" (surfaces that combine the control actions of rudder and elevator) contain weights to balance these control surfaces and reduce any tendency for them to flutter. (Credit: Mark Avino/SPS NASM).



The first sailplane to fly beyond 1,000 km (620 miles) in a single flight is suspended behind its designer, Leonard Niemi, inside the west end gallery of the Smithsonian National Air and Space Museum in August 1978. Museum staff at the Steven F. Udvar-Hazy Center will exhibit this important aircraft in 2004. (Credit: Smithsonian National Air and Space Museum).

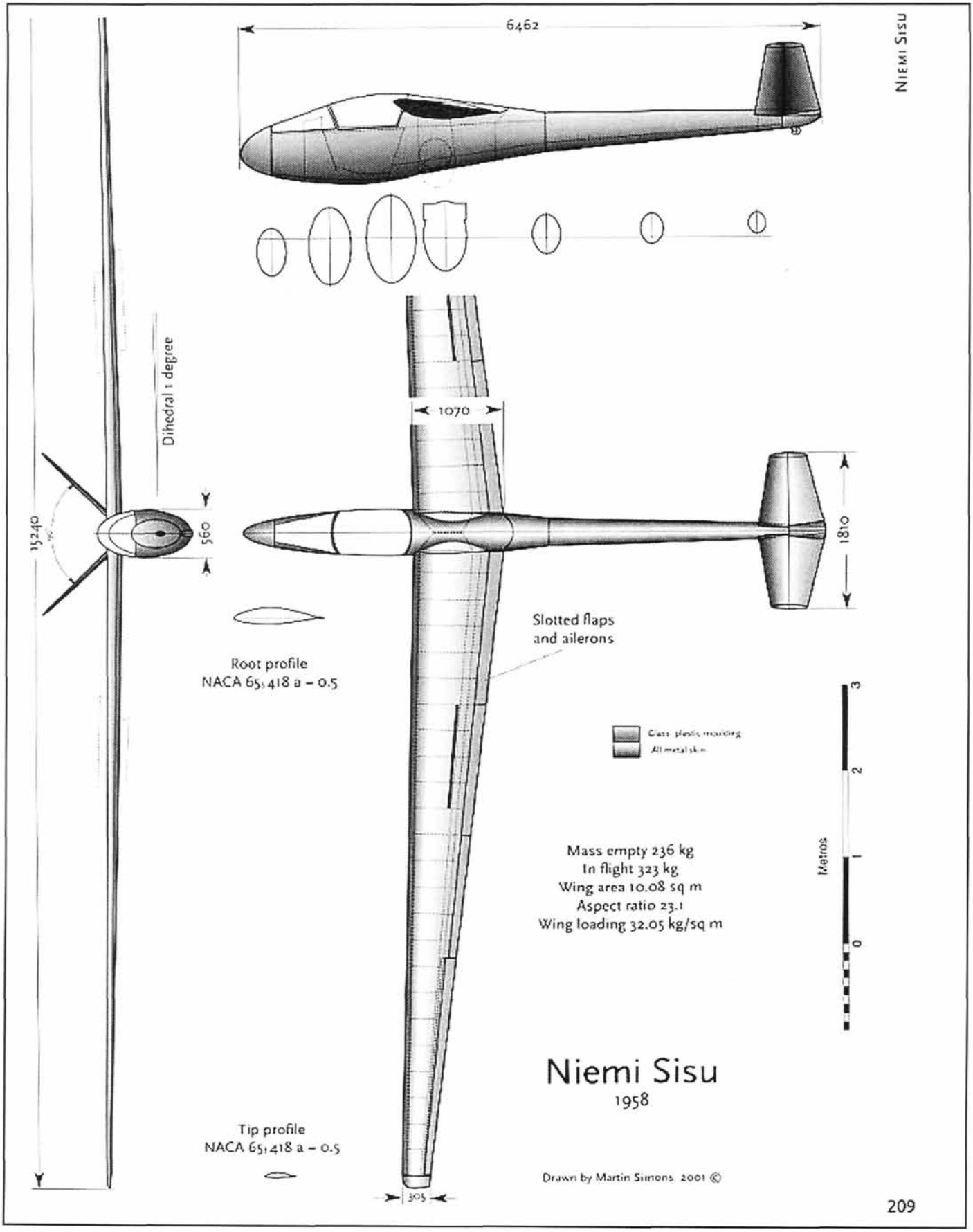
Niemi enlarged several sets of control surfaces on the *Sisu* 1A - both ruddervators on the vee-tail and the spoilers - and he increased by one degree the dihedral angle of the wings to compel the sailplane to more strongly resist a tendency to spiral dive during instrument flying. Richard Johnson had commented specifically on the *Sisu* l's anemic spoilers which could neither smartly reduce the airplane's speed nor expeditiously alter its glide angle.[19]

The original monocoque wing construction was easy to build but too heavy and more difficult to repair so Niemi adopted a "plate/stringer" method to build the inboard half of each wing on the production model but he left the outboard sections as monocoque units. Plate/stringer construction made the wings stronger and lighter, and allowed increased useful load to accommodate heavier pilots, extra oxygen, or other optional equipment. Niemi was careful to retain the thick non-buckling skin that could preserve the precise shape of the laminar airfoil.

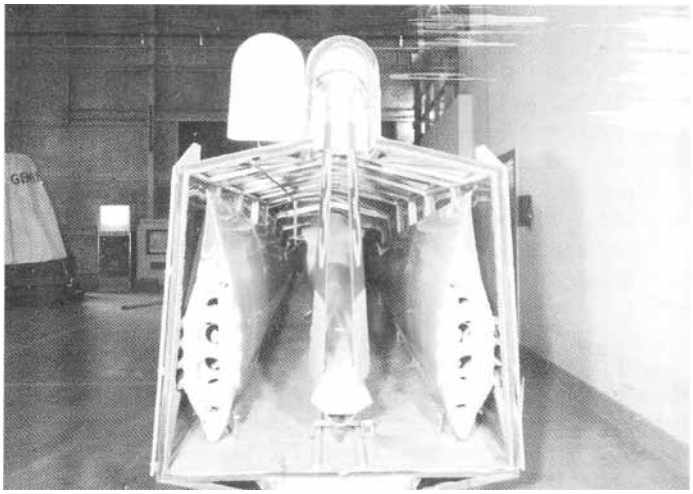
Pilots who had flown the *Sisu* 1 must have raised a chorus about that sailplane's rather cramped accommodations so Niemi both broadened and deepened the cockpit. He also widened the instrument panel and moved it farther away from the pilot, and he made provisions to install radio and oxygen equipment at the pilot's discretion. With all these changes Niemi hoped to increase the sailplane's performance and make it more practical and appealing but only by flying the aircraft in varying conditions could anyone accurately determine whether he had succeeded. The designer must have eyed with anxious anticipation the first *Sisu* 1A as it rolled down the assembly line during fall 1962.[20]

Production Begins

Crafts persons began producing the first *Sisu* 1A at the Arlington Aircraft Company located in, and named for, the north Texas plains city where Niemi was living in October 1960 when he and Phillip J. 'Jack' Baugh created the firm. Baugh was a retired air force pilot and a sailplane enthusiast who financed the project as a way to contribute to the American soaring movement. The factory soon rolled out the first four *Sisu* 1A sailplanes in rapid succession and eager pilots quickly snapped them up, largely thanks to the articles about the *Sisu* 1 that had appeared in *Soaring* magazine begin-



Rather than twist the outer wing leading-edges down to maintain aileron control during a stall, designer Leonard Niemi swept the Sisu's wings slightly forward to induce span-wise airflow that thickened the boundary layer over the center section to stall this area before the wingtips. (Martin Simons© drew this three-view drawing for his book Sailplanes 1945 - 1965 (Eqip, 2002)).



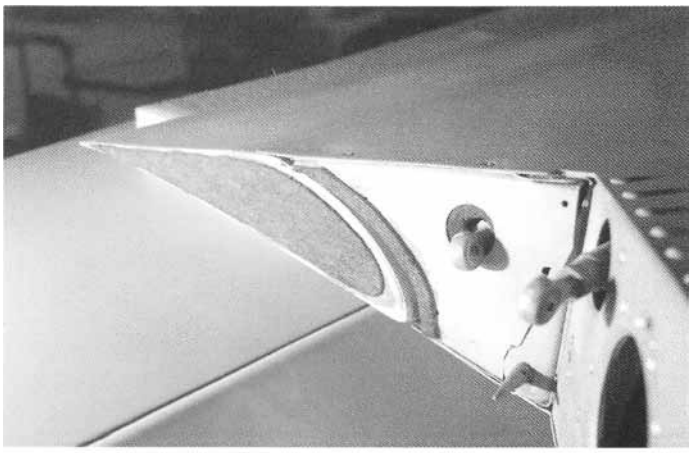
Many sailplane trailers not only serve to contain and protect sailplanes that are hauled long distances behind automobiles, but they also function like hangers to store the aircraft between flights. The Arlington Aircraft Company manufactured trailers like this one designed specifically for the Sisu. The vee-tail folded neatly to fit inside its special compartment. (Credit: Smithsonian National Air and Space Museum).

ning in 1956.[21]

Neimi published "A Report on the *Sisu* 1 and *Sisu* 1A Sailplane" in the February 1961 issue and among the 1,800 or so words that he wrote, one statistic must have burned hot in the imaginations of many soaring pilots: L/D MAX. = 41. 4 @ 62 mph. This was a startling figure, not only because it matched or exceeded the best sailplanes of the day, but also because Richard Johnson, a national soaring champion, had confirmed it during flight tests. The improved, factory-built *Sisu* 1A promised even better performance so there can be little mystery about why soaring pilots bought these sailplanes as soon as the factory completed them.

None of these glowing reviews mentions the critical aspect of owning a *Sisu* that may have helped to speed this aircraft into obsolescence. Purchasing and accepting delivery of a new *Sisu* 1A was only an interim step for owners who wished to soar a machine that could exceed the performance of nearly every other sailplane in the world. To achieve the dazzling flight performance figures quoted in magazines, the aluminum skin covering the aircraft had to be extraordinarily smooth. Owners had to pay particular attention to the wing skins because even minute irregularities could disrupt the fragile airflow around the laminar airfoil and rob the wing of its low drag properties. To achieve this finish, an owner or his helpers first applied filler paste "to every rivet and structural seam," allowed it time to dry, and then carefully sanded the paste smooth by hand. The sanding phase of this treatment sometimes required "hundreds of hours of extra work" to complete. When affordable sailplanes equipped with laminar airfoils, constructed from fiberglass-reinforced plastic that required no additional finish work by owners, became available from Europe in the mid-1960s, the market for metal sailplanes such as the *Sisu* rapidly disappeared and *Sisu* production ended in 1965 following the sale of the tenth aircraft.[22]

The following capsule histories and pilot commentaries about the prototype *Sisu* and the ten production airframes offers a fresh perspectives about owning and flying this interesting aircraft.

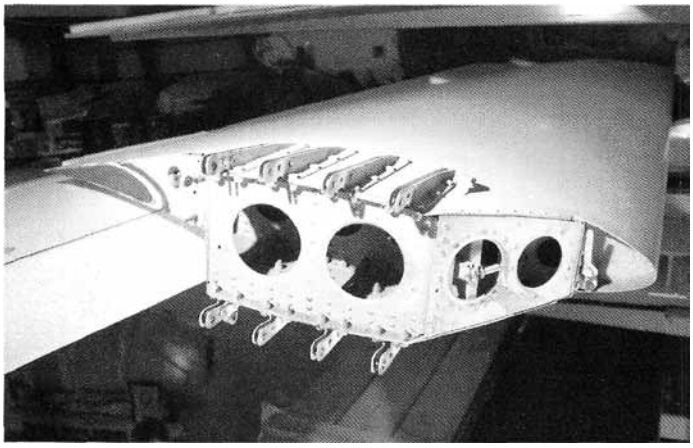


Perhaps it was Professor Joseph Cornish and his test pilot, Sean Roberts, who glued these thin sections of dark felt onto the root ends of the flaps when they evaluated Sisu 1A N1100Z at Mississippi State University in 1963. By closing this thin gap between the flap and the fuselage, they eliminated another source of performance-robbing drag. (Credit: Mark Avino/SPS NASM).

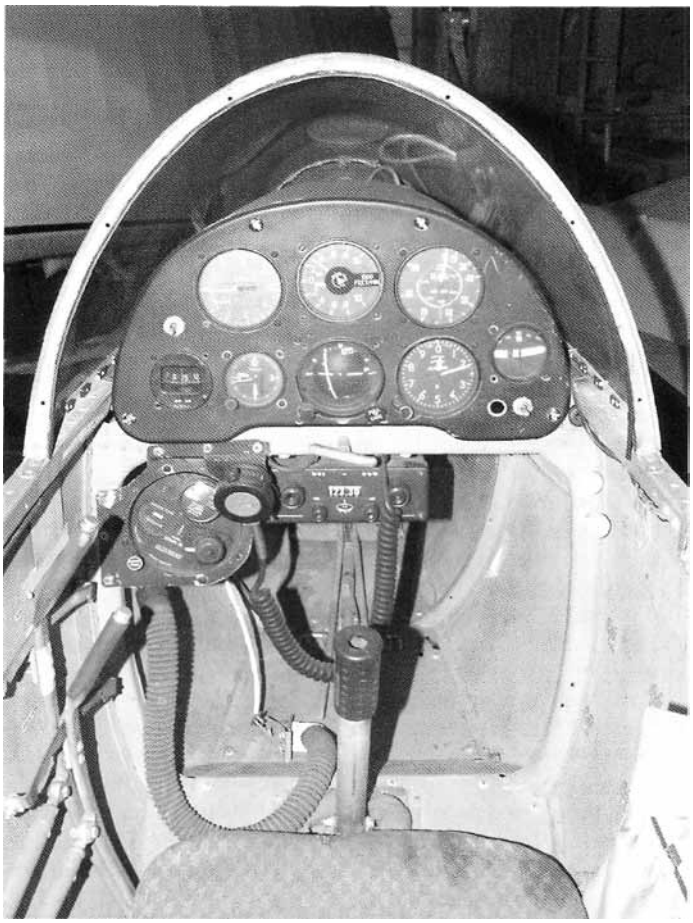
Sisu 1 and 1A Operational Histories

The first *Sisu* to reach private hands was the prototype *Sisu* 1 built by Niemi and Coder and registered with the Federal Aviation Administration as N7983A (serial number 000). Two years after completing this sailplane in fall 1958, Niemi sold it to John Ryan (elected president of the Soaring Society of America in 1964) about September 1960 and Ryan flew this airplane to victory at the 1962 U. S. national meet held July 24-August 2 at El Mirage, California. Ryan sold the sailplane to Jerry Robertson late in 1964 or early 1965 after Ryan purchased a production *Sisu* 1A (serial number 108 and registered N1110T) in December 1964. The first production *Sisu* 1A was assigned serial number 101, and first flown 19 October 1962. The factory had built the aircraft for fashion photographer Gleb Derujinsky, who accepted it in late spring 1963 and registered the sailplane N6390X. He described owning a *Sisu* as a pleasant mix of "easy handling and easy maintenance." Richard Johnson borrowed this sailplane and flew it in the 1963 World Soaring Competition held in Junin, Argentina, February 10-24, but he placed well behind the contest winners."

Crafts persons at the Arlington Aircraft Factory completed the second *Sisu* 1A (serial number 102 and registered N1100Z) on 5 April 1963 for John J. Randall of Coral Gables, Florida, who promptly sold it to Alvin H. Parker in July 1963. Parker piloted this *Sisu* during many remarkable flights including the first soaring flight to exceed 1,000 kilometers, or 620 miles, as described in detail below. When he was interviewed after setting the world distance record for soaring to a declared goal on 26 August 1963 (490 miles or 789 km), Parker bubbled with enthusiasm and described how the sailplane could "gain back, in one 360 degree chandelle, the altitude lost at 120 mph IAS [indicated airspeed] between cu's [cumulus clouds] which were about 20 miles apart. . . it thermals like a [Schweizer] 1-26 and goes like hell! Len Niemi has produced an unbelievably fantastic sailplane." By 1965, many hours of experience flying the *Sisu* had tempered Parker's enthusiasm and he complained about excessive workload, in his words, "too much cockpit procedure" for the pilot and a tendency for the flaps to freeze in position after deploying them at high altitude. He remained enough of a *Sisu* fan to trade the aircraft to Phillip J.



As they assembled the sailplane for flight, ground crew aligned these eight "fingers" on the left wing root with an equal number on the right wing, and then they inserted two steel pins to lock the halves together. (Credit: Mark Avino/SPS NASM).



Al Parker spent 10-1/2 hours in this cockpit soaring 1,041.94 km (647.17 miles) from Odessa, Texas, to Kimball, Nebraska, on 31 July 1964. He scanned these instruments, the sky, and the land, searching for signs of lift - a flick of the variometer needle, the flat base and billowing cap of a rising cumulus cloud, a patch of dark earth bathed in sunlight that might spawn vigorous young thermals. Instruments and controls (left to right and top to bottom): rate-of-climb, variometer, airspeed, compass, 8-day clock, attitude indicator, altimeter, turn-and-bank, oxygen regulator and quantity gauge, radio mounted under the tow-hook release, landing gear lever, flap lever, control stick. (Credit: Mark Avino/SPS NASM).

Baugh, the chief financial backer of the Arlington Aircraft Factory, in exchange for Baugh's *Sisu* and Baugh then generously donated Parker's record airplane to the Smithsonian National Air and Space Museum on 12 July 1968 during the U. S. National Soaring Championships underway at Elmira, New York. The previous winter, Parker had towed the disassembled aircraft inside a trailer from Texas to Washington, D. C. , and delivered it to the museum.[24]

The factory assigned serial number 103 to the *Sisu* 1A that was finished in May 1963 and sold to architect A. J. Smith who then registered the aircraft as N6391X. Smith was most impressed with the sailplane's "overall high level of construction and performance" and described his most memorable flight as the one he made during the 1963 national soaring meet because "it wasn't a long flight [pilots flew farther on other contest days] but it was the longest that day and I think about the longest possible that day and that's what's satisfying." Smith took his *Sisu* to England in 1965 to compete in the World Soaring Championship but the cold and wet weather produced only weak lift which did not favor the *Sisu's* mediocre performance in such conditions and Smith finished 19th. William S. Ivans was a past president of the Soaring Society of America and an important figure in the postwar development of American soaring when he accepted *Sisu* 1A, serial number 104 (N6392X), in late June 1963. Ivans criticized the *Sisu's* slow rate of roll but he liked its "speed range and high speed performance." He proved that he could deftly wield a *Sisu's* maximum velocity when he set a national speed record in 1967 at El Mirage, California, by skimming his *Sisu* 1A across the desert at 84 mph over a 62-mile (100-kilometer) triangular course.[25]

In 1964 the factory completed the fifth and sixth *Sisu* 1A sailplanes with serial numbers 105 and 106. Dean Svec bought '105 in March and registered the aircraft as N252JB and oil well service contractor, Red Wright, bought '106 in July and obtained registration code N622W for his *Sisu*. Wright's most memorable flight required no tedious circling in thermals for altitude but relied instead on that remarkable *Sisu* speed when he soared "Odessa to Hobbs [New Mexico]-90 miles in 50 minutes-without making a turn or circle!" Wright later donated his ship to the National Soaring Museum located atop Harris Hill outside Elmira, New York.[26]

The only *Sisu* sold outside U. S. borders went north to Canada when Gordon Hicks of Rosemere, Quebec, bought serial number 107 after it rolled from the factory in August 1964. Hicks received the code CF-RNH when he registered his *Sisu* with the Canadian Department of Transportation. As mentioned above, production serial number 108 bore the Federal Aviation Administration registration code N1110T when John Ryan bought it in December 1964 after he sold the prototype *Sisu* 1 (N7983A) to Jerry Robertson of Florida. Dale May, a management consultant, bought serial number 109 probably late in April 1965 and registered the sailplane N331A but this *Sisu* was later destroyed. The chief financier of *Sisu* production, Phillip J. Baugh, bought the last *Sisu* 1A, serial number 110, probably in May 1965. In 1966, Baugh and Alvin Parker agreed to trade their sailplanes and Baugh actually owned serial number 102 when Parker delivered it to the Smithsonian National Air and Space Museum on 21 December 1967. It was on public display, suspended from the trusses, inside the aviation hanger at the Steven F. Udvar-Hazy Center when this new museum opened in December 2003. Parker continued to fly serial number 110 for many years and his son, Stephen, was still flying this *Sisu* in August 2003.[27]

Al Parker Flies a *Sisu* 1,000 Kilometers

What Alvin H. Parker accomplished forever etched the name *'Sisu'* into the pages of world soaring records and stirred much excitement among the international soaring community. Parker's *Sisu* was the second production airframe and it first took flight with Leonard Niemi at the controls on 1 May 1963. Less than two weeks later, John Randall bought the airplane on May 13. Randall made several flights and then lent the ship to Dr. Joseph J. Cornish III, a professor of aeronautics who taught at the Mississippi State University in Starkville (Dr. Raspet had passed away in 1960). Cornish assigned test pilot Sean Roberts to measure and analyze the *Sisu's* performance at a gross weight of 730 lb and his research yielded these numbers:[28]

Minimum Sinking Speed	2.2 ft per second at 55 mph
Maximum Glide Ratio	37:1 at 57 mph
Stall Speed, Flaps Up	49 mph
Stall Speed, Flaps 20 Degrees Down	37 mph
Maximum Airframe Load Factors	+ 6 G,- 4.6 G
Maximum Design Airspeeds:	
Never-Exceed	172 mph
Rough-Air Cruise	119 mph
Maneuver	119 mph
Flaps-Down and Auto/Winch Tow	94 mph

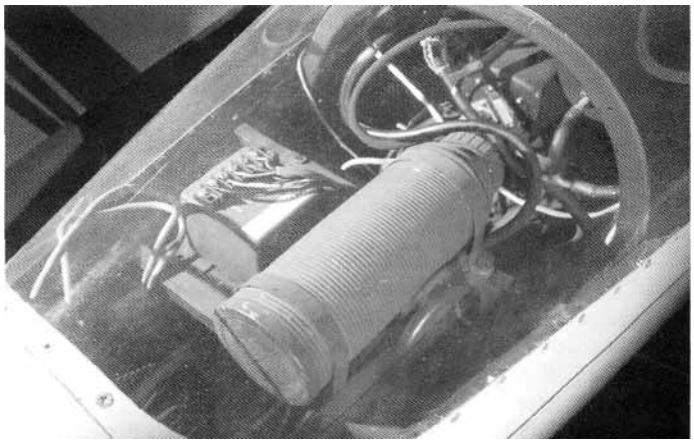
The discrepancy between the maximum glide ratios measured by Cornish and Roberts and the figure that Richard Johnson published in the February 1961 issue of *Soaring* cannot be explained by historical records available to the author. What is clear is that Cornish and Roberts believed that they could increase performance after making "further improvements in surface contours" on this *Sisu.* Specific details about this treatment are unknown but it probably entailed further refinements to the finish applied at the factory, smoothing the wing surfaces, sealing the gaps between control surfaces, and other subtle ministrations, followed by flight tests conducted by Roberts to confirm that the work was reducing drag.[29] On 21 July 1963, Randall sold his *Sisu* to Alvin H. Parker, a successful rancher and financier living in Odessa, Texas. The forty-five-year-old father of three sons, he was active in the oil business and operated a soaring flight school, and he owned a dealership that sold *Schweizer* sailplanes. Parker grew up on his father's cattle ranch and earned a degree in animal husbandry from Texas A & M University. He had spent most of his life in Texas except for a stint in the U. S. Army during World War II when he led a tank platoon in the First Armored Division and fought in Europe, North Africa, and Italy.

Parker learned to fly before the war. By the mid-1960s he estimated his flying time at about 5,000 hours piloting several different types of powered and motor-less aircraft. As a boy. he sat "...atop a windmill on Daddy's ranch watching the graceful wheeling and soaring flight of turkey buzzards and hawks" but he did not try soaring until 1949.3' He only dabbled with the sport until 1960 when he decided to seriously commit to becoming a better sailplane pilot. By 1964, Parker suffered a "burning ambition" to fly his *Sisu* 1,000 kilometers (620 miles) and set a new world distance record.[32]

One thousand of almost anything looks impressive on paper but the notion of flying 1,000 kilometers in a sailplane also bore a unique psychological weight for Americans in particular. Soaring pilots in Europe and America have always been friendly rivals. Since the dawn of modern soaring in Germany in 1920, Europeans have owned all significant soaring distance records and it seemed inevitable that 1,000 kilometers would fall to another European, as had 100 km, 500 km, and 750 km. No official attempts to fly 1,000 kilometers in a sailplane are known before Parker's flight but three German pilots had established the world record for soaring distance on 2 June 1963. Karl Betzler, Rudolf Lindner, and Otto Schauble flew three gliders from Dettingen Teck, Germany, to St. Nazaire, France, a distance of 876. 3 km (544.3 miles).[33]

Parker had spent the last few days of July 1964 studying weather reports and listening to forecasts and he believed that August 1, might be the best day to attempt the flight but after rising on 31 July at 6:00 a.m., he felt "psychologically ready for a [long] flight." After persuading his dependable ground crewman and tow plane pilot, Australian Ian Burgin, to meet him at the airport, Parker packed supplies for the journey: a quart of water and two candy bars. He filed documents to officially declare Julesburg, Colorado, as his goal for the day and then just before 10 a.m., Parker took off from the Ector County Airport north of Odessa and released from the tow plane at about 2,500 ft above the ground, or about 5,200 ft above sea level. Almost thirteen years to the day earlier, Richard H. Johnson had departed the same airport on his way to set the world record for soaring distance that had inspired Leonard Niemi to design the *Sisu.* Parker searched about but found no useable lift. He descended to 500 ft and flew into a thermal strong enough to carry him and the *Sisu* back up to almost 2,000 ft and then he glided north along the Andrews Highway. Passing the small town of Andrews, Parker rose to about 2,800 feet and "from there, I could look down on the family ranch land where I spent so many hours as a cow-puncher during my youth. If someone had told me that I would some day pilot a motor-less aircraft across this area, I would have told him he was 'loco.'"[34]

Parker pressed on northwest past Hobbs, New Mexico, leaving Texas at 11:20 a.m., as mile after mile of desert scrub passed under the *Sisu's* wings. Two other skilled pilots who had also thought the morning forecast promised the right conditions for flying far suddenly announced over their radios that the day's promise had become a bust and they were returning to Odessa. Parker's ground speed had averaged just 50 mph but he remained optimistic and between circling climbs in feeble but usable thermals, he continued to sail north-northwest. Northeast of Fort Sumner at 2 p.m., the end of his flight loomed as Parker dropped to 700 feet above the ground. He spiralled frantically searching for lift, so low that he stared eyes-level on the sheer canyon walls that clutch the banks of the Cimarron River. It is on these rare occasions and in such



This ribbed cylinder is the air reservoir that is attached to the variometer installed in Parker's Sisu 1A. It is insulated to prevent false readings due to changes in temperature.
(Credit: Mark Avino/SPS NASM).

close proximity to unforgiving terrain that experienced sailplane pilots must frantically work the slightest trace of updraft. They call it 'scratching' for lift and Parker was lucky to have recently practiced this skill. "The quiet, desperate scratching techniques of the recent national contest at McCook [Nebraka, site of the 1964 National Soaring Contest] enabled me to get up and away [from the canyon]. Placing thirty-eighth in a National Contest [with a field of forty-eight contestants] has its advantages - sometimes."[35] He was referring to his poor showing at this meet held just weeks earlier.

The lift increased rapidly and Parker guided the *Sisu* beyond New Mexico, and soared into Colorado, at 8,000 ft above broken terrain along the Purgatoire River. He glided beneath one end of a cloud while rain cascaded in sheets from the other end. crossed the Arkansas River, and passed over the town of Hugo cruising comfortably at 70-80 mph. It was time to locate, and invest in, more altitude so Parker aimed the *Sisu* for a dust devil spinning over Last Chance, Colorado. The little twister had dissipated and the lift was gone when he arrived over the town so Parker altered course toward a cloud of dust suspended nearly 2,000 ft above the ground along the edge of a thunderstorm - and found the strongest lift of the day, 1,000 feet per minute in muddy rain. Carefully skirting the storm's edge, Parker nudged stick and pedals and turned northeast toward his declared goal, Julesburg, Colorado, now a scant 65 miles off the *Sisu's* nose. He could not see the ground and flew using his instruments as the *Sisu* nuzzled the base of the storm. Some minutes passed and Parker broke out into clear air to face the most difficult decision of the flight.[36]

Another strong thunderstorm now towered between Parker and Julesburg. The pilot quickly tallied his options. He could turn to the east and fly south of the storm, abandoning not just his goal but the 1,000-kilometer distance mark as well: he could attempt a fast and steady glide through the bottom of the storm and fly straight for Julesburg - but did he have the altitude to reach the town more than sixty miles away? It was nearly 8:00 p.m. and only the highest clouds remained bathed in the setting sun. Air lifting at 400 feet per minute rocked the *Sisu's* wings and Parker spiraled to 8,300 ft, 12,300 ft above sea level. In the deepening gloom, he spotted an airport rotating beacon to the northwest and decided this must be his best destination but he had to be careful. If he miscalculated this final glide, he would have to attempt the only trick more difficult for a sailplane pilot than landing off the airport in open terrain: doing it at night. He cruised the *Sisu* at 85 mph for about fifteen minutes and reached the airport with a few hundred feet of altitude remaining. Parker banked the *Sisu* over the runway, rolled out, and touched down at 8:19 p.m. He "struggled out of the *Sisu* after those ten and one-half hours and looked around for landing witnesses. There was no one in sight - just the rotating beacon, the runway lights, and I." Some minutes passed before two men materialized and told the pilot that he had just landed at Kimball, Nebraska, 1,041.94 km (647.17 miles) from Odessa.[37]

It was a quiet finish for Parker and the *Sisu* but the remarkable flight stirred pandemonium in the aviation press. *Soaring* magazine called it the "Soaring Story of the Year - U. S. First to Break 1000 Kilometers" and Soaring Society of America President, William S. Ivans, proclaimed, "the long-awaited 1000 kilometer flight, dream of every distance flyer in the world, was finally made by .. . the redoubtable Al Parker in his sleek *Sisu.* Al far exceeded the previous world record for free distance . . . with some 40 kilometers to spare!"[38] Parker's flight had indeed set the mark coveted by pilots around the world for years. In his soaring anthology, *On Quiet Wings,* Joseph Lincoln called this milestone "for a good many years . . . the soaring pilot's four-minute mile on both sides of the Atlantic."[39] Danish pilot Harald Jensen, quipped in 1959, "we already have a 1,000 kilometer [soaring distance] club. Now all we need is some members."[40] Many people in the soaring community had doubted that any combination of pilot and sailplane could ever fly this distance. *Flight Magazine* put it this way: "Everybody in the soaring world had just about come to the point of believing that no pilot would ever be able to go over 1,000 kilometers in motor-less flight."[41] Because soaring had originated in Europe and Europeans owned nearly all the significant sailplane flight records, the American soaring community was surprised that one of its members had flown the distance. "No flight seems to have captured the imagination of American soaring pilots as has Al Parker's flight of 644 miles on July 31, 1964," reported Harner Selvidge. "What soaring pilot's heart did not beat faster when he heard the news? The struggle for world's records is a continuing international competition, and the distance record appears firmly back in our hands with a stunning margin."[42]

In retrospect, it is no surprise that an American pilot conquered the magic mark. The technology required to fly 1,000 km in a sailplane became available nearly simultaneously to American and European pilots but the strength of the soaring weather that prevailed across the plains of North America dwarfed the weather systems common to Europe. It was inevitable that the mark would fall to an American as soon as a skilled pilot and a capable aircraft rose to the challenge.

In 1966 Al Parker's son, Stephen, began flying the *Sisu* and he became the youngest American by more than two years to earn the rare and prized Diamond C badge for soaring distance, altitude gain, and endurance flying. The Parker men ultimately finished 194 flights in their *Sisu* and ten were regarded as notable cross-country journeys, each spanning an average of 649.6 km (403.5 miles).[43]

Production ends and the *Sisu* Begins to fade

Niemi's *Sisu* now ranked comfortably among the best competition sailplanes in the world. "There seems little doubt," George Moffat said in 1964, "that the all metal [sic] *Sisu* 1A is the best contest sailplane in the world today for medium to strong conditions. Such international [sailplane pilot] notables as [Richard H.] Dick Johnson, Adam Witek of Poland and Camille Labar of France agree."[44] But year after year, the price for this level of performance was escalating rapidly. A new *Sisu* 1A cost $9,700 without instruments during the first

This Operations Placard is displayed on the left side of the cockpit of Al Parker's Sisu. Weight limitations varied between each airframe, depending on the owner's preference for extra equipment, such as oxygen or radio.
(Credit: Mark Avino/SPS NASM).

year of production in 1963. Instruments suited to cross-country flying could easily add $500-1,000 and moving the aircraft any distance on the ground required a covered trailer costing $1,000.[45] Two years later a poll of *Sisu* owners revealed that their total investment in the sailplane, trailer, and instruments ranged between ten and fourteen thousand dollars. The overall impression among many *Sisu* pilots was that the airplane truly 'soared' in strong lift but its performance in weak soaring weather conditions was not as good as it should be, given the money spent and the effort demanded of the owners to finish and maintain the wings to a 'laminar-quality' smoothness.[46]

After finishing the fourth production *Sisu* in May 1963, Niemi sold his interest in the firm to his partner, Philip J. Baugh, and Baugh moved the factory to Greenville, South Carolina, and merged it with the Astro Corporation. He picked Clifton McClure III to manage Astro but wisely decided to keep Niemi on the payroll as the project engineer. McClure was a soaring enthusiast and governor of the South Carolina division of the Soaring Society of America and he intended to carry through with Niemi's original plan to obtain Federal Aviation Administration type certification for the *Sisu* design but the daunting costs of such work forced him to abandon the effort. Baugh generously underwrote production of six more *Sisus* but profits never covered expenditures and metal smiths and technicians finished the tenth and last *Sisu* 1A in 1965.[47]

> "Recently Jack Baugh and I decided to terminate *Sisu* production at the completion of ship number ten, which goes to Jack. The ship is just too costly in money and time and it just isn't worth it any more so we decided it would be better to close it off and use our energy on something with a brighter future. After all these years I'm looking forward to something new."[48]

Niemi had devoted thirteen years of his life to the *Sisu* and it was time to move on.

He was almost certainly aware of the revolution transforming the way sailplanes were constructed which had begun during the early 1950s and was about to push the focus of high performance sailplane design away from the U. S. and back toward Germany where soaring had begun almost a half-century earlier. Several of the Akaflieg teams had turned to designing and building sailplanes using fiberglass-reinforced plastic, or FRP.

After a few years spent building field experience with the new technology during the late 1950s and early 1960s, the German soaring community quickly grasped that FRP was nearly ideal for building advanced, high-performance sailplanes with laminar airfoils.

Three German FRP sailplanes entered the U. S. national soaring contest in 1965 and by 1970, pilots flying these aircraft held the top positions in all significant categories of competition soaring. The *Sisu* was no longer a viable choice for pilots who wanted the ultimate performance sailplane. The editor of *Soaring* put it succinctly:

> "America's high-water mark in sailplane design, the *Sisu* 1 A, has been around long enough for Al Parker to make three 500-mile-plus flights and break three world records. But, as one decade ends and another begins, the all-metal *Sisu* finds itself fighting on against mounting odds - a tin soldier in an increasingly hostile world of fiberglass, where the prevailing language is German. . ."[50]

The growing supremacy of FRP sailplanes from Europe soon soured the market for competition sailplanes designed in the U. S. The Schweizer Aircraft Corp. was the only American firm that still designed and mass-produced sailplanes but their traditional medium was aluminum - they did not understand the properties of FRP and were reluctant to work with it. Paul Schweizer, one of the three brothers who founded the company in 1938, listed four reasons for the company's intransigence. It would cost too much to earn Federal Aviation Administration certification of a sailplane built from the exotic material, it was thought that FRP was not crash-resistant and could not tolerate high G-loads, no one knew the service life of FRP, and it required much skilled hand-labor that was simply not available in the United States.[51]

The editors of *Flying* magazine noted several critical advantages to using FRP to build sailplanes.[52] Metal workers frequently needed months to fabricate and assemble the hundreds of airframe components used in an aluminum sailplane but a designer could usually count on two hands the parts required to build an FRP airframe. Fabricating the molds used to 'cast' the FRP parts was the most time consuming part of building a sailplane from the new material but once fabricated, workers used these molds to rapidly turn out near-finished components. The results were faster build times and reduced labor costs. The quality of the finish applied at the factory to the FRP sailplanes and the ease of maintaining it was perhaps the most important aspect of FRP sailplane technology. An FRP wing required just two components - a top half and a bottom half - and there were no seam lines or rivet heads to fill with paste and sand smooth. The owner of a new FRP sailplane accepted his aircraft with the smoothest finish possible and maintaining it required only periodic removal of dirt and insect debris using soap and water. Ironically, the Americans failed to exploit their own laminar airfoils to their fullest potential while the German Akafliegs developed the most successful applications by combining these airfoils with a revolutionary construction material.

Leonard Niemi's *Sisu* 1A represents ends and beginnings. It marked the pinnacle of, and the conclusion to, the era of high-performance sailplanes built from aluminum, and its quick fade from the field of competitive soaring signaled the beginning of the Era of Fiberglass, the reign of sailplanes equipped with laminar airfoils built from FRP that continues in the twenty-first century.

Sisu 1A Characteristics[54]

Wingspan:	50 ft
Length:	21 ft 3 in
Height:	41 in
Empty Weight	546 lb
Gross Weight	775 lb

References:

1 Donald A. Sankey, "Sailplane Presented to Smithsonian," *Sport Aviation,* March 1969,46.

2 Paul A. Schweizer, *Wings Like Eagles: The Story of Soaring in the United States*(Washington, D. C.: Smithsonian, 1988), 92. The government also sold surplus military training, scout, and liaison airplanes such as the Boeing PT-17 *Stearman* and the Stinson L-5. Civilian soaring operations bought these inexpensive aircraft and adapted them to tow sailplanes aloft.

3 Giorgio Zanrosso, *History and Evolution of the Glider, Volume III (1945-1998)* (Venezia, Italy: Il Cardo, 1998), 131-133. Johnson competed in his first national soaring contest before the war but he did not win a national

meet until 1950. He eventually became one of America's most skilled and accomplished competition soaring pilots.

4 Ibid, 133; Bob Said, ed., "Ross RJK-5," *Soaring 1983 Sailplane Directory, November 1983,*60; Martin Simon, *Sailplanes 1945-1965* (Konigswinter, Germany: Eqip, 2002), 146. Only long distances are described in the text using Metric System units, all other numerical statistics appear in the U. S. Customary inch-pound format.

5 N. a., "Design Criteria and Evolution of the *Sisu,"* undated paper in Smithsonian National Air and Space Museum (NASM) *Sisu* 1A accession file, 2, probably written by Alvin Parker or Leonard Niemi; Zanrosso, *History and Evolution of the Glider, Vol. ///*,132.

6 "Design Criteria and Evolution of the *Sisu,"* 2.

7 Leonard Niemi, "Some Notes on the *Sisu," Soaring International Yearbook 1965,*6;Leonard Niemi, ""The Sailplane *"Sisu* 1,"" *Soaring,* March-April 1956,8; "Design Criteria and Evolution of the *Sisu,"* 1.

8 Niemi, ""The Sailplane "Sisu-1,"" 8,11; "Design Criteria and Evolution of the Sisu," 2.

9 Niemi, ""The Sailplane *"Sisu-1""* 11.

10 Leonard Niemi, "A Report on the *Sisu* 1 and *Sisu* 1A Sailplanes," *Soaring,* February 1961,17; Niemi, ""The Sailplane "Sisu-1,"" 8, quote from page 11. Simons, *Sailplanes 1945-1965,*153,157; Zanrosso, *History and Evolution of the Glider, Vol. Ill,* 156,16; weight and wing loading calcula tions by the author.

11 Niemi, ""The Sailplane "Sisu-1,"" 8,11; "Design Criteria and Evolution of the *Sisu,"* 2; Richard E. Schreder, "The HP-10 High Performance Sailplane," *Soaring,* February 1961,14.

12 Simons, *Sailplanes 1945-1965,* 208; "Design Criteria and Evolution of the Sisu,"1.

13 Niemi, "A Report on the *Sisu* 1 and *Sisu* 1A Sailplanes," 4.

14 Ibid. In addition to leading the team that designed the world's first practical sailplane equipped with laminar airfoils, the Ross-Johnson RJ-5, Johnson also won the U. S. National Soaring Competitions in 1950,1951,1952,1954,1959,1963, and 1964, see Richard H. Johnson and William S. Ivans, *American Soaring Handbook Vol. 6* (Soaring Society of America, 1962), 2.

15 A thermal is a rising air mass that varies from hundreds of feet to thousands of feet in diameter but the region of greatest lift, the thermal's core, can be much smaller - see Ann Welch, *The Complete Soaring Guide,* (London: A & C Black, 1986), 83.

16 Richard H. Johnson, "Test Flying the *Sisu* 1 Sailplane," *Soaring,* March 1961,3. This was among the first of many sailplanes designed in America and other countries that Johnson meticulously analyzed. He shared his findings with other sailplane pilots in articles he published in *Soaring* magazine, see Schweizer, *Wings Like Eagles,* 302.

17 Ibid, 6.

18 Ibid. The aileron slot functioned in the same way as the slot that formed between the flaps and the wing trailing edge when the pilot deployed those surfaces.

19 Ibid; Johnson, "Test Flying the *Sisu* 1 Sailplane," 3.

20 Niemi, "A Report on the *Sisu* 1 and Sisu1 A Sailplanes," 17; Niemi, "Some Notes on the Sisu," 7.

21 Ibid; Schweizer, *Wings Like Eagles,* 205; "Design Criteria and Evolution of the *Sisu,"* 1.

22 Ibid, 2,3; George B. Moffat, "The Modern Sailplanes, Part II," *Soaring,* July 1964, 10.

23 For correct *Sisu* 1 registration, see photo in Niemi, "A Report on the *Sisu* 1 and *Sisu* 1A Sailplane," 4; Niemi, "Some Notes on the Sisu," 7; n. a., "Interview with the Sisu Owners," *Soaring International Yearbook 1965,*8-9; Schweizer, *Wings Like Eagles,* 93,196,205.

24 Original Bill of Sale for Sisu 1 A, serial # 102, preserved at the Smithsonian National Air and Space Museum; date of manufacture stamped on aircraft data plate; Niemi, "Some Notes on the Sisu," 7; Sandor A. Aldott, "490 Miles! New World Goal with the Sisu!," Soaring, December 1963,9; "Interview with the *Sisu* Owners," 9; National Aeronautics Association News Report, July 1968; Sankey, "Sailplane Presented to Smithsonian," 46; Paul E. Garber to accession file, 2 January 1968, Smithsonian NASM *Sisu* 1A accession file.

25 Niemi, "Some Notes on the *Sisu,"* 7; "Interview with the *Sisu* Owners," 8-9; Bob Said, ed. , ""Sisu-1 A," *Soaring 1983 Sailplane Directory,* November 1983, 33; Schweizer, *Wings Like Eagles,* 212.

26 Niemi, "Some Notes on the *Sisu,"* 7; 'Interview with the *Sisu* Owners," 9; Said, *"'Sisu* 1A," 1983,33.

27 Niemi, "Some Notes on the *Sisu,"* 7; Said, ""Sisu-1 A," 33; Phillip J. Baugh to Louis S. Casey, 22 December 1966, and Alvin H. Parker to Louis S. Casey, 5 October 1967, correspondence in Smithsonian NASM *Sisu* 1A accession file; Stephen Parker telephone conversation with the author, August 2003.

28 Mississippi State Univeristy's Raspet Flight Research Laboratory website at HYPERLINK "http://shrike.erc.msstate.edu/raspet/raspet/pages/cornish.tiff http://shrike.erc.msstate.edu/raspet/raspet/pages/cornish.html; "Design Criteria and Evolution of the Sisu,"4.

29 William S. Ivans and A. J. Smith received their new *Sisu* sailplanes from the factory with just a minimum of filler compound applied to smooth surface irregularities on the wings followed by a coat of primer paint, see George B. Moffat, "The Modern Sailpanes, Part II," *Soaring,* July 1964,10.

30 E. J. Reeves, "Pioneering the 1000 Kilometers," *Soaring,* September 1964,7; n. a. , "Alvin H. Parker," Soaring International Yearbook 1965,4.

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32 "Alvin H. Parker," 3-4; Alvin H. Parker, "1000 Km in *Zero Zero Zulu," Soaring International Yearbook 1964,* 3.

33 N. a., "Soaring Story of the Year! U. S. A. Clams 644-Mi. World Soaring Distance Record for Flight by Al Parker" *The Soaring Society of America Press Released* August 1964,1.

34 Parker, "1000 Km in *Zero Zero Zulu,"* 3.

35 Ibid; Parker quoted in Reeves, "Pioneering the 1000 Kilometers," 9.

36 Ibid; Parker, "1000 Km in *Zero Zero Zulu,"* 3-5.

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38 N. a., "Soaring Story of the Year - U. S. First to Break 1000 Kilometers," *Soaring,* August 1964, 7; William S. Ivans, "President's Message," Soaring, October 1964, 4.

39 Joe Lincoln, ed., *On Quiet Wings* (Flagstaff, Ariz.: Northland Press, 1972), 235.

40 Ibid.

41 N. a., "Editorials - Another Record for U. S.," *Flight* Magazine, 38.

42 Harner Selvidge, "Editorial, On Records, and the Next 1,000," *Soaring,* September 1964,4.

43 "Brief History of *Sisu* 1 A, N1100Z, S/N 102," 1. Stephen Parker was the 77th American to earn the Diamond C badge.

44 Moffat, "The Modern Sailplanes, Part II," 10.

45 Sandor A. Aldott, *"Sisu* Co. Moves East," *Soaring,* December 1963,7.

46 "Interview with the *Sisu* Owners," 8-9.

47 Design Criteria and Evolution of the *Sisu,"* 1; Aldott, *"Sisu* Co. Moves East," 7.

48 Niemi, "Some Notes on the *Sisu," 7.*

49 The Akaflieg was a group of aeronautical engineering students led by one or two university professors who worked to design, build, and test experimental aircraft with the full support and use of the facilities at a major university and the financial backing of the German government. Schweizer, *Wings Like Eagles,* 209.

50 N. a., *"A Last Hurrah for the Sisu?," Soaring,* January 1970,23.

51 Schweizer, *Wings Like Eagles,* 209.

52 *Flying* editors, *America's Soaring Book* (New York: Charles' Schribner's Sons, 1975), 47-48.

53 Fred Thomas, Fundamentals of Sailplane Design (College Park, Maryland: College Park Press, 1999), 177, translated by Judah Milgram.

54 N. a., "Specifications - Sisu-1 A Sailplane N1100Z," Smithsonian National Air and Space Museum *Sisu* 1A accession file, 1,2.