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GROB AIRCRAFT CONSTRUCTION: THE G 110 FLIES

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16. Abstract Description, specifications and test flight performance of the G 110 are provided. The G 110 completely incorporates modern GfK construction techniques which heretofore have been developed and perfected for the construction of sailplanes. The G 110 is a prototype of a GfK constructed motorized aircraft and shows much promise for the future of German aviation.		
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February 1982--An historic date, not only for Grob Flugzeugbau. The first motorized aircraft built entirely in the modern GfK shell structure fashion started on its successful maiden flight. */262

Test pilot Horst Philipp carefully approached the calculated take-off speed. The G110 reacted readily and sensitively to the foot controls, stayed cleanly on track and showed none of the vibration which can pass through the landing gear to the frame. The experienced pilot realized that the plane wanted to rise, scrutinized the air speed indicator, and accelerated a bit more in the interest of safety. With a slight pull on the stick, he carefully raised the nose of the airplane--and the little monoplane flew.



Equipped with an 87 kW motor, the G110, with an essentially aerodynamically "clean" air frame for motor powered planes, reached flight achievements (see table) which surpass the limits of its class.

SAFE IS SAFE

The roughly 3 km long runway in Camp Lechfeld, chosen for the first flight trial over the 630 m track of the Mindelheimer factory, passed by only 5 m below the plane which rose gently with throttled engine while the test pilot communicated concise and precise data and values of the first "leap" by radio. Shortly before the end of the runway, he throttled down and landed. After taxiing the plane

*Numbers in margin indicate pagination of foreign text.

back and carefully checking it, the G110 was ready for its next start. As the plane showed no abnormal behavior in its first long jump, this flight will be a "proper" one including a normal climb at the start and an extended local flight. The flight lasted 35 minutes.

EXPECTATIONS COMPLETELY FULFILLED

Burkhart Grob and his engineering team tensely followed the first flight and the commentary of the test pilot. After landing, the tension was released with the handshake between the head of the firm and the test pilot. Both men had reason to be congratulated. In its first flight, the prototype of the first motor powered aircraft in the world built entirely in the GfK shell structure fashion had completely fulfilled their expectations. A long cherished idea had become a reality.

On the same day, after installing a copilot, the trim two-seater was flown to Mindelheim for further testing in the following weeks.

The modern GfK construction technique was developed and perfected for the construction of sail planes and has for a long time been the standard industry technique. In the recent past, many attempts have been made to realize this technique in the construction of motor powered aircraft.

The first hopeful steps in this direction led to the LFU 205, the Windecker Eagle and finally at the French Wassmer Aviation to the Atlantique and Piranha. These were also known as GfK aircraft although strictly speaking, they were built with a mixed, tubular steel-GfK technique in which metal or wood parts were replaced by plastic.

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Figure 2. The open flaps of the folding doors guarantee comfortable entry into the roomy cockpit. The panel is separated into three logical sections with flight and motor surveillance instruments as well as an avionics ledge in the middle.

Financial difficulties and politico-industrial decisions of the French state quickly ended the hopeful beginning in the case of Wassmer. The transformation of a factory based on traditional construction techniques to the GfK technology and manufacture caused great problems. Consequently, further development finally had to be given up.

Since then, apart from the Sportavia RS 180 which once again used GfK to a nominal extent, the very modern building material GfK or KfK was really used only in individual construction parts of motorized aircraft, such as the cowlings, marginal arches, landing gear covers, etc., and formed practically a kind of "border appearance".

The prerequisites for the success of a project to construct a pure bred fiberglass motor powered airplane are, if anywhere, given by Grob: On the basis of experience from building (!) GfK sailplanes and motor sailers, the Mindelheimer factory has the know-how to draw from. This is true for manufacture as well as construction. The G109, the first GfK motorized sailer, which has a model permit and whose series already exceeds the number 100, set a direction-pointing milestone.

From the outset, the factory was designed for GfK manufacture. Thus, constraints and hindrances associated with transformation do not stand in the way of investments directed toward this goal. Manufacture, construction and development grew harmoniously and organically like a box of bricks whose last brick--for the time being--is the motor powered airplane.

NEW TERRITORY

As fortunate as the provisions were with regard to personnel and technical matters at Grob for the GfK motor flight age, and as much as has been learned by sailplane construction and by the construction of the motor sailer G109--"worlds lie between a motor sailer and a motor powered airplane" (quote of Burkhardt Grob).

To be sure, it is no great feat to carry know-how gained in the construction of sailplanes and motorized sailers over to the construction of a GfK motor powered airplane. The problems here are quite different from those of a motorized sailer because a motorized sailer is more nearly related to a sailplane. At least, despite its placement in another category, the motorized sailer can be considered as a further development of broadening of a sailplane. This is made clear with regard to the building and testing rules and generally the entire administrative this and that.

Because here all applicable norms come from traditional plane construction, the development of a motor powered plane from GfK must

orient itself initially towards points which were found and fixed for construction with traditional materials.

Until then, the LBA's department for motor powered aircraft had been little concerned with fiberglass technology. Thus, the Grob engineers had a difficult time selling the product of their creativity to the LBA. "The paperwork required more work than development and building together", groaned Engineer Fischer, Grob's chief technical designer. At the same time he mentioned that the Braunschweigers have since dealt with the G110 project uninterruptedly.

Concerning the further flight tests, at Grob one looks forward to the next weeks calmly because the first flights have shown the most satisfying results with regard to ability to fly and flight behavior of the G110.

Certainly, the landing of the G110 with the crew of Grob and the firm's test pilot at the firm's airfield in Mindelheim (illeg.) was awaited by the weekend shift with tension--and fittingly celebrated on the same evening...

FIRST PERSONAL IMPRESSIONS

A short week passed between the first flight and the visit of the Aerocourier editorial staff to the plant. I, therefore, had the opportunity to photograph the G110, to make some tests and to fly around with test pilot Horst Philipp.

SPICK AND SPAN

The trim craft whose subdued stripes effectively underscored the white plastic made a satisfying first impression. The streamlined and elegant plane effectively showed the possibilities of a structure built of plastic with a large cockpit and slender fuselage,

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trailing wing assembly and graceful tripod landing gear. Round and nicely formed transitions from the fuselage to the wings and to the tail unit hint at the aerodynamic quality of the plane. The upper surface is smooth as is only possible with GfK. Only the gangway on the lower surface for entering the plane is roughened to avoid slipping.

The fuel tank covers are set into the surface to prevent drag. Apart from the landing gear, the only projection one sees is a tiny grip on the fuselage for opening the cowl. Ailerons and flap slots are minimal as are the transitions from the motor cover and the folding doors to the fuselage.

FIRST OFFSPRING OF A FAMILY

There is a lot of room under the motor cowl which, as is well known, is programmed for "growth". The G110 with the Lycoming O-235M1 (87 kW/118 PS) engine is only the predecessor to a family of motor powered planes.

The PS 160 version with the same airframe will quickly follow. The 4-seater G111 is already on the drawing boards.

CONSTANT SPEED--NO SWINDLER

The Hoffmann-Verstell propeller necessarily belongs to the concept of the G110 since in this category very high trip speeds are made possible because of the aerodynamic quality of the plane. Such speed could hardly be achieved with a fixed prop.

MANAGEABLE

The folding door concept of the G110 has proved to be very manageable. Only one hand is needed to open the door. The gas pressured spring which holds the door is so arranged that the door will not fall closed when released in the half state. (illeg.) and one doesn't get in his way.

The folding doors are also absolutely tight in high speed flight. This is a small matter but by no means so trivial as one might believe, requiring all kinds of "technical tricks" to realize it.

COCKPIT LAYOUT

I sit in the right seat and recognize that the cockpit has more room than is apparent from the exterior. The shell seats, whose back rests have a removable cushion to allow room for a parachute, are at least as comfortable as those of a middle class car. The seat adjustments allow even "giants" to comfortably stretch their legs in the cockpit. Considering the large luggage compartment behind the seat, one is almost inclined to speak of wasted space. With an empty weight of 560 kg and a maximum gross flying weight of 900 kg, the weight arrangement allows an addition of 340 kg. This fact together with the room in the cockpit have led to considering the addition of children's seats to the G110 (2+2 seater).

The G110 has stick steering corresponding to its proposed use as a travel, school, sport and light work airplane. The view forward is remarkable. One can see the ground only a few meters in front of the steering wheel. It is easy to steer. I know sailplanes which are more difficult to steer!

Thanks to the reasonable space and correspondingly generously dimensioned panel, there is sufficient room for extensive instrumentation. The trustworthy and easy to survey triple guidance originates from the vertical avionics ledge in the middle. The control levers for the motor, the trim and the flap levers sit on the middle console. The prototype has an altogether pleasing and appealing cockpit layout proving once again that function and design can harmonize with one another throughout. One must only strive for this from the outset.

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GROB G110 DATA SUMMARY, STATUS AS OF JANUARY 1982

producer		B. Grob Flugzeugbau, Mindelheim
model		G110
motor		Avco Lycoming O-235-M1 TC 223
power	kW	87
	PS	118
with propeller	U/min	2800 HO-V72G const. speed
crew		2
wingspan	m	10.6
length	m	6.9
wing area	m ²	12.2
spread		9.2
profile		Eppler E 789
cabin measurements:		
length	m	1.7
width	m	1.28
height	m	1.15
empty wt.	kg	560
max. fuel	l/kg	140/100
live wt.	kg	240
added wt.	kg	340
max. takeoff wt.	kg	900
surface load	kg/m ²	73.5
max. baggage	kg	40
max. allowed speed	kts	189
	km/h	350
max. speed in normal flt.	kts	140
	km/h	260
maneuvering speed	kts	118
	km/h	220
trip speed 75%	kts	130
	km/h	240
fuel consumption at 75%		
power	NM	648
	km	1200
consumption at 75% power	l/h	25
consumption at 100 km		
flightline		10
stalling speed		
flaps in	km/h	95
flaps out	km/h	80
max. climb rate	m/s	4.8

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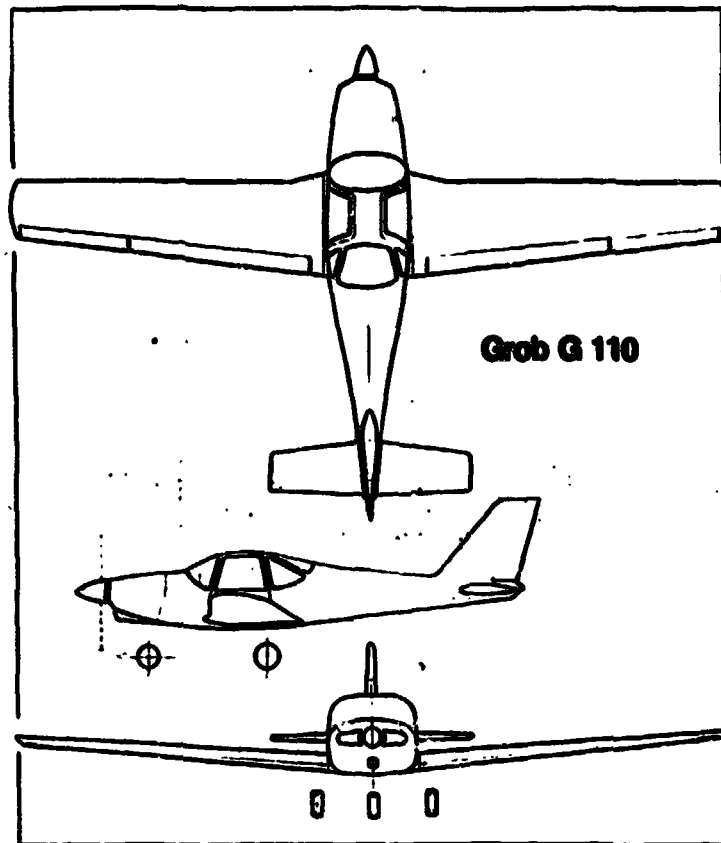
takeoff distance at height NN		
concrete	m	210
grass	m	250
takeoff distance over 15m obstacle		
grass	m	530
	m	470
landing distance over 15 m obstacle	m	420
<u>landing roll out distance</u>	<u>m</u>	<u>200</u>



A handshake from the company chief after the successful first flight: Burkhart Grob congratulates test pilot Horst Philipp.

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FIRST FLIGHT IMPRESSIONS

Test pilot Philipp took his seat on the left side. We both wore parachutes. He even wore a jet helmet "out of principle" as he said. I sign the necessary release forms and become conscious that I am sitting in a prototype which had not been flown even a week ago and which still doesn't have 10 flights under its belt.

We go carefully through the check list, start the motor and taxi away. In taxiing the G110 can be steered playfully easily with the tips of the feet.

Quickly the plane accelerates. Even before the cross runway (200 m) we have audible signs that we have reached the take-off speed. Because the air speed indicator has not yet been calibrated, we let the plane accelerate a little more.

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The experience gained in building over 2000 GfK sailplanes was used in the development of the G110. The G110 will be publicly introduced to the ILA in Hannover in 1982.

Then with flaps at position 1 (15°) and a registered speed of 120 km/h, we climb into the sunny Allgau sky. Horst Philipp lets me take the stick as a sign that he trusts the G110 not to misbehave.

The G110 reacts sensitively to each motion of the steering, but flies stably when the steering is released. Longitudinal rolls in which the plane maneuvered very well showed good rudder tuning.

Meanwhile, the G110 was trimmed to horizontal flight and its power reduced. I observed the trip indicator which quickly climbed to and remained steady at a power setting of 2200 revolutions per minute and a plate pressure of 20 inches corresponding to about 65% of full power.

In landing, Horst Philipp chose a speed higher than the planned 100 km/h. We touch down with flaps at position 2 (40° in the prototype) and the difficulty remaining on the ground. "Clearly", said

Philipp, "for this trip, the ground effect with low wing monoplanes and the 40° flap placement, the flattening out takes relatively long. In addition to which the extraordinary aerodynamic quality of this plane makes it fast even in falling flight".

Everything has two sides, but in this case, one cannot be unhappy with Grob. Certainly, it is easier to raise the resistance through corresponding landing aids than to reduce resistance to achieve higher trip speeds.

"First, we will calibrate the trip indicator to have exact information about the planned 100 km/hr flight. Then we will slowly approach the 60° flap position", said Horst Philipp to questions about further procedures to be followed in investigating the landing behavior. The problem will be solved if the starting procedure remains safe at higher flap positions.

GREAT PIECE OF LUCK

Meanwhile, the trip indicator has been calibrated and the landing speed determined. It lies slightly under 80 km/hr, a remarkable value for a motor powered plane. The trip speed at a power setting of 75% lies at 240 km/hr according to the calibration. The maximum speed at this time in horizontal flight is 260 km/hr.

Although these values are excellent for the G110 class plane, Burkhardt Grob feels that by improving the cowling and carefully adjusting the prop they will be able to tickle some more out of it.

That at this early stage in the testing they are thinking of "fine details" proved to me what Horst Philipp, who is careful in judging, said to me after our first short flight: "The plane is a great piece of luck in completely fulfilling out expectations. Everything points to confirmation of calculations in the flight tests. No great difficulties are to be expected".

The model permit procedure is going well. In 1982, the plane will be publicly introduced to the ILA for the first time. If everything goes well and several things indicate this will be so, series production can begin in late summer of 1982.

From autumn on the G110 may appear in our airports. And one could wager that soon quite a few G110's will be bustling about in the skies of West Germany and also abroad. The G110 could open a new chapter in German aviation history.