

# A Y-AEROTOW

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Presented at the XXI OSTIV Congress, Wiener-Neustadt, Austria (1989)

On November 15, 1987, at the Bern-Belp Airport in Switzerland, a two-seater ASK-21 was towed up to 800 m AGL by two Robin towplanes. This was the first flight of this kind in the civil sector.

## HISTORICAL BACKGROUND

During World War II, the German "Luftwaffe" achieved aerotows of heavy Me321 transport gliders with three Me110 ("Troika-Schlepp") towplanes and of one DFS 230 glider with five He 72 "Kadett" towplanes.

## NOTION

Since 1986, the idea of a so-called Y-tow has been discussed in a humorous way by a few club instructors and tow pilots. The reason for the laughing matter: Why not invert the classic double tow with two gliders and one tug to a two-tugs-one-glider-tow? In spite of the cabaret laughter, careful investigations showed that in no way would legal or club regulations be infringed by such a trial.

## REQUIREMENTS

Technical, infra-structural, meteorological and personal considerations for a realistic possibility of undertaking such a Y-tow showed the following:

**Technique:** In addition to the two Robin club towplanes and the two-seater ASK-21, special care was necessary for the tow ropes. It also would be very important to have a clear radio link between the three pilots. The use of a two-seater glider would enable photographic records to be made by a second occupant.

**Safety:** Cooperation with tower personnel, a take off on a hard runway and having other flight activity temporarily reduced were other requirements to be met.

**Meteo:** Calm air up to 1000 m AGL would be desirable.

**Personnel:** Pilots with great experience and outstanding actual training, with a very high level of mutual understanding and with a well operating ground crew were mandatory.

**Infra-structure:** Precise theoretical and practical preparation, mental training of pilots and crew and exact briefing on Day-Y would also be necessary.

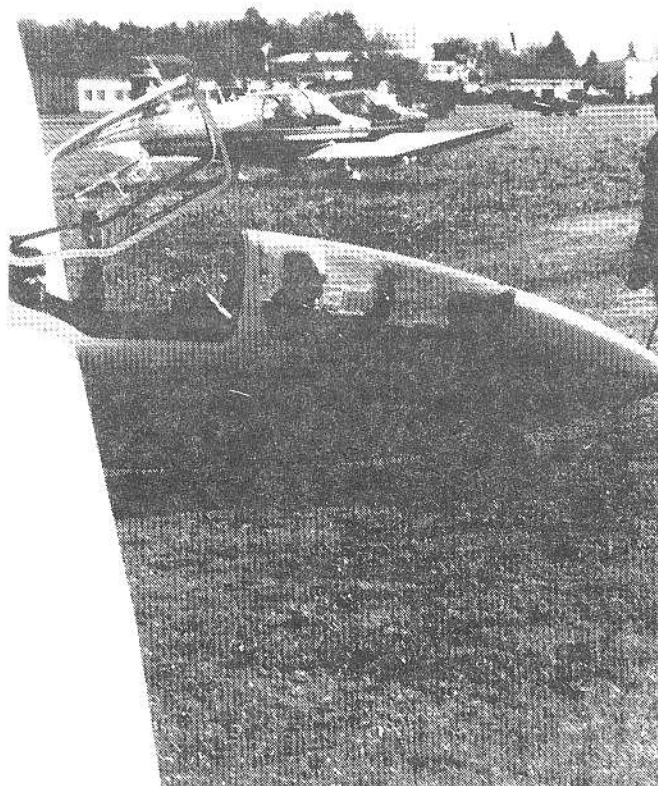
## INTENTION

Besides the pleasure of precise organization and undertaking something uncommon, there was the intention of pure research, collection of all kinds of measurements, leading perhaps to further possibilities for example in Ultralight aviation or short take-off of heavy gliders, and to possible unexpected outcomes, and finally, the publication of the results.

## REALIZATION

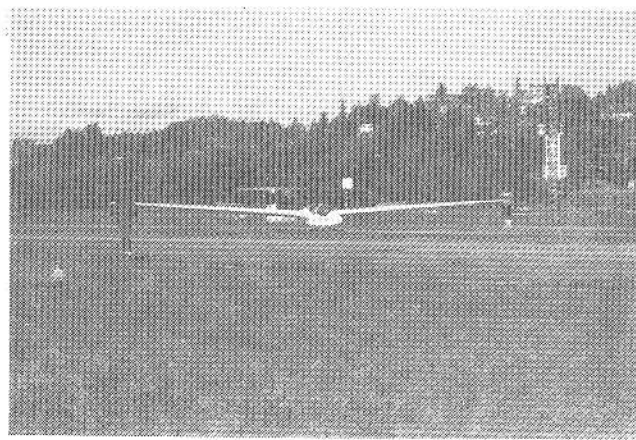
On Saturday, November 15, 1987, all conditions were met and the trial took place with the following personnel: Tug pilots - Marleus Master, Hans Nietlispach; glider pilot - Hans Hebeisen; glider photographer - Eduard Rupp; ground photographers - Ch. Hammerschlag, M. Inabit.

The progress of the trial is illustrated by a series of photographs.



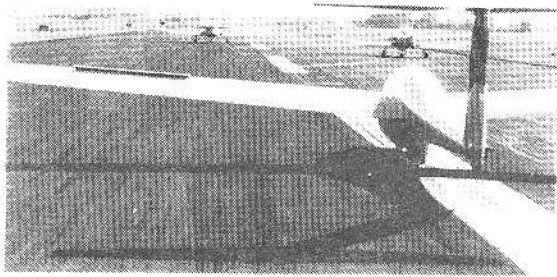
**Photo 1.**

After coordination with the tower, all take-off preparations were made east to the concrete runway. The pilot responsible for radio communication with the tower was the pilot of the Robin in front. A few seconds after tower clearance, take off was executed. The three pilots were all very experienced glider pilots, tug pilots and instructors.



**Photo 2.**

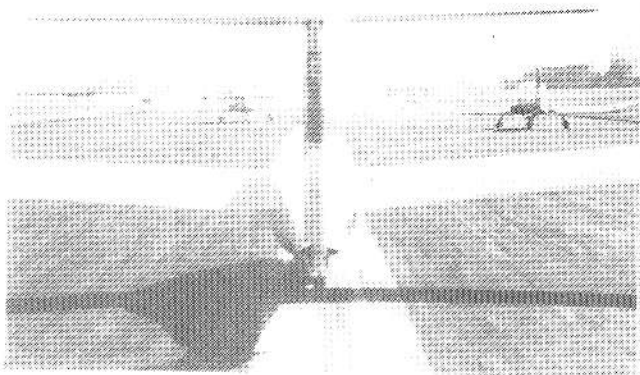
In order to avoid any risk, take off was made in direction 14 with a runway length of 900 m. In the opposite direction 32, the Y-tow would have passed the ILS-GP ground station at a low height. This would have been 60 m distance from the runway centerline, visible on the photo east of the ASK-21.



**Photo 3.**

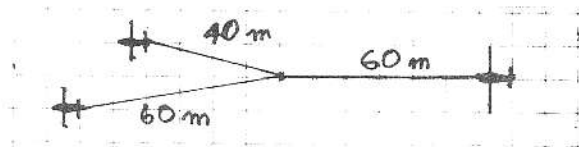
As far as could be seen, everybody was carefully lined up for the Y-tow. The rear rope from the ring to the two-seater lay straight on the centerline of the runway. But, as we could see later from the photo, the right Robin was too much to the right and the left Robin in front was too close to the centerline of the runway, so that a slightly distorted Y was formed. Three observations followed: firstly, the wisdom of Lord Brabazon \*\* was not yet operating; secondly, the "test-manager" in the right Robin could hardly realize such a feature; and thirdly, the enthusiastic glider pilot found it not worth speaking of. We had discussed extensively at the briefing our general insurance for all three pilots and the possibility of immediate emergency release.

\*\* *Lord Brabazon of Tata, Great Britain's airman license number 1, in his opening speech at the World Gliding Championships in 1954, Camphill, England: "It is always easy to be wise after the event."*

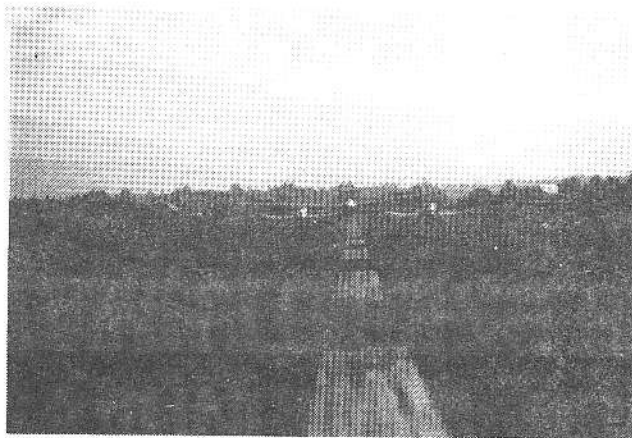


**Photo 4.**

Both 180 hp Robins set power. The ropes, from the common ring forward 60 m to the left tug and 40 m to the right tug, backward 60 m from the ring to the two-seater ASK-21, were stretched out.

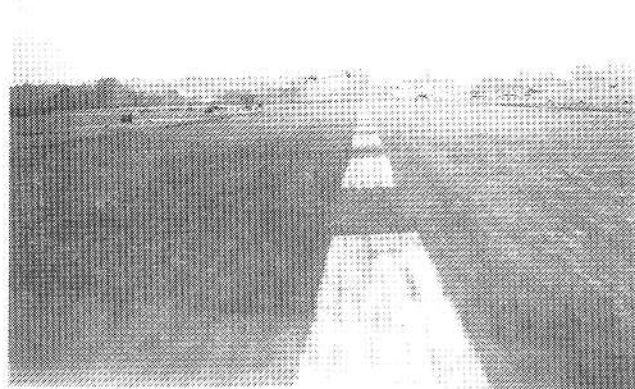


The right tug, obviously had more to pull than the left one, because the ASK-21 was located slightly too much to the left.



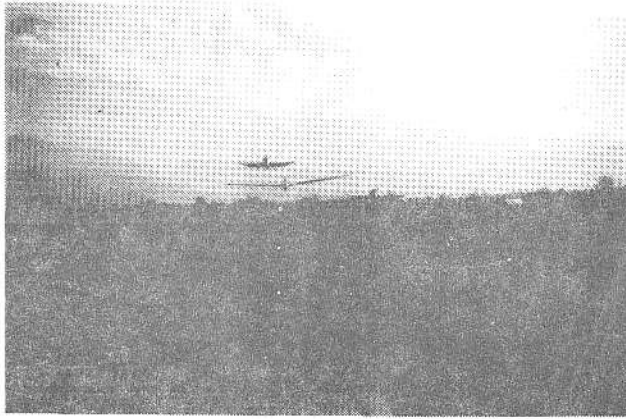
**Photo 5.**

After take off, the ASK-21 began banking slightly to the left and remained there as at the beginning of the departure. The front Robin to the left was already airborne (the shadow under the left wheel is easy to see with a magnifier), while the more highly loaded nearer towplane was still rolling.



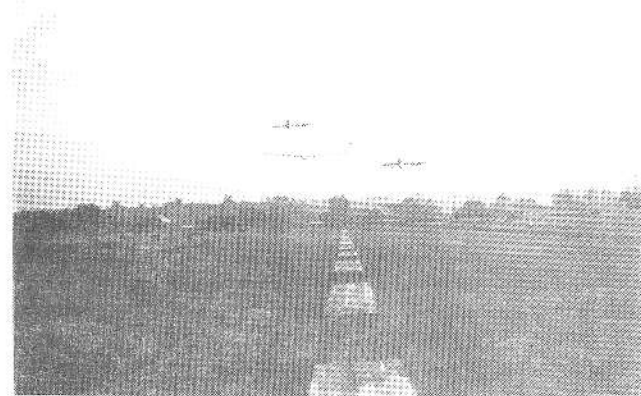
**Photo 6.**

The two-seater banked a little bit more to the left and, therefore, became still more displaced in that direction. The right Robin got more towing load, but took off without any difficulties to hold its direction. The left Robin was in a 2-3 m higher position than the right tug.



**Photo 7.**

The two-seater was drifting still more and slightly banking to the left. The front Robin was now about 5 m higher than the rear one.



**Photo 8.**

The glider began to correct its position by banking slightly to the right. The front Robin has operated since the beginning of departure as arranged on briefing with only 75% power, and was now about 6-7 m higher than the other, which was operating with 100% power. But, this deviation from the ideal flight path was not perceptible at all because of the length of the ropes (60 + 60 m left, 40 + 60 m right). As soon as the ASK-21, at about 50 m altitude, was correctly located to the right, the lower tug closed easily up to the front tug. An interesting point: Is there an automatic balance of towing loads in such a Y-tow configuration? During this first phase of the flight, not even the slightest necessity to release was felt by any of the pilots. Obviously, this was a result of the flexible system formed by the great length of the ropes. Both tugs held a wingspan distance side by side and a constant longitudinal distance up to 300 m AGL.



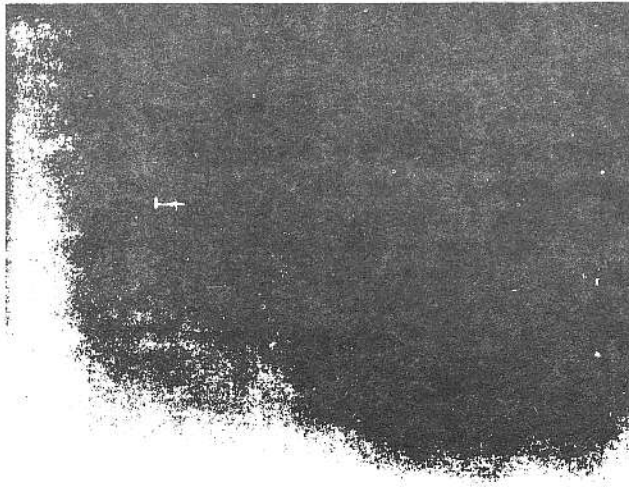
**Photo 9.**

At about 300 m AGL, the passenger/photographer in the glider asked for a better outlook on the two tugs, since the head of the pilot was not transparent. So, the Robins increased the side distance to three wingspans, without perceptible change of side forces on their tails. The magnifier clearly shows the neutral rudder position of the right Robin. Evidently, the side component of the rope load was just enough to balance the natural yawing moment resulting from the asymmetry of the propeller slipstream. For the left Robin, the two effects were additive; nevertheless, there was no piloting problem. The glider pilot was positively surprised by the smooth manner and how any differences in towing force were automatically compensated by the flexibility of the Y-system. He is convinced that the risks to fly two gliders behind one tug are much greater.



**Photo 10.**

For this 220 degree turn to the left, only 10 to 15 degree bank was set, as agreed on at briefing, because the right tug had to follow a longer, higher and faster flight path. In spite of the large distance between the tugs no piloting or rope force problems occurred, which was confirmed by the rudder position of both Robins, easily to be seen with a magnifier. The angles of the three tow rope sections are interesting. In the photo they are, of course, fore shortened by the telephoto lens.



**Photo 11.**

The photos 3 to 10 give a shortened impression by the telephoto lens effect. On photo 11, it is easy to see how safely a Y-tow can be managed. The disconnection of the Y-formation and the release of the glider was done as previously arranged in the following straight forward manner: First, the right tug released the shorter rope section. Secondly, the glider released, the left tug brought the ropes back to the field.

**RESULTS**

1. Piloting. For the first time in the civil sector, it was proven under optimal conditions, how simply a Y-tow formation could be handled. The risks and piloting difficulties were considered to be lower than those occurring with a double tow with two gliders behind one tug.

2. Force measurements. On this flight, no precise measuring of rope force was made. For pure research some data should be collected, such as take off distance, rate of climb, ceiling, forces on tow hook for different velocities and variable position of the glider, cost, etc. allowing for further clarification of all possibilities.

3. Variant. After take off, the rear tug with the short rope might release as soon as possible at safe altitude and allow the front towplane to continue alone.

4. Literature. "The Warplanes of the Third Reich, Messerschmitt Troika - Schlepp," USA. "Effort au crochet d'un avion remorqueur," Etude CEV n° 15.120, Centre d'Essais en Vol, Annexe d'Istres, France.