

## Analysis and design of a new control system for aerodrome azimuthal guidance – The SAGA

SAGA, as seen in Figure 2, is a product that provides visual guidance of azimuthal offset during approach to an airfield. The system is usable both by airplanes and helicopters and is often installed where no other larger landing systems exist, for example on small helipads on rooftops or secluded mountain villages. The installation is quite simple, just place the two lighting units on either side of the approach axis, as shown in Figure 1.

When a pilot approaches an airfield runway or a FATO (Final Approach and Take Off area), lights are seen simultaneously if approaching inside a  $\pm 0.45^\circ$  angle of the approach axis. If outside this angle but inside a  $\pm 15^\circ$  angle of the axis, the closest flash is seen before the other one, creating a flowing light effect, to guide the pilot to the correct approach. When flying outside the  $\pm 15^\circ$  angular sector the flashes are no longer visible.

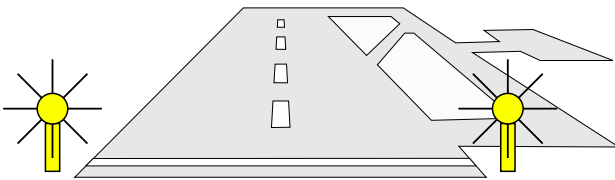


Figure 1: Azimuthal guidance by two rotating light beams located on either side of runway.  
– Gives the pilot a flowing light effect.

As the old control box was designed in the early '90s, the standards and regulations have evolved quite a lot since then. This old control system is both unnecessarily expensive, not designed according to current standards and some components are soon to be, or are already, discontinued.

Power feed and communication systems can handle most standardized techniques used on airfields. The fault system consists of one part connected to the control tower, if present, and one part showing the status of both units in each unit's control box.

All design choices are made with the general airfield requirements in mind. The electrical inputs are specified to handle lightning strikes, the enclosure is IP-67 (water and dust resistance) classified and corrosion protected.



Figure 2: A SAGA unit

The electronics of the SAGA can work in a wide temperature range, from  $-40^\circ\text{C}$  to  $+55^\circ\text{C}$ . To be able to withstand more extreme cold, that occurs in some part of the world, a heater module can be installed in the electronics box on demand.

To ensure the pilot reacts to as small an azimuthal offset as possible, the delay between the flashes of the units has to rise fast when just moving a little bit from the approach axis. By reducing the speed of the motor in the SAGA unit's head logarithmically the delay between the flashes is increasing fast enough to ensure a safe guidance to the approach axis.

This new control system is not just better than the old and operating according to specification, it is also a lot cheaper than the old system. As the new design has a lot of cost reduction optimizations the production cost has been reduced by over 50%.

To read more about this, see the report "Analysis and design of a new control system for aerodrome azimuthal guidance" [1].

## References

- [1] J. Arnsby and M. Kjellsson, *Analysis and design of a new control system for aerodrome azimuthal guidance*. Master's Thesis ISRN LUTFD2/TFRT-5920-SE, Department of Automatic Control, Lund University, Sweden, June 2013.