

# Safety Bulletin

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## Unexpected autopilot behaviour on ILS approach when intercepting the glide path from above

The Dutch Safety Board are investigating an incident that occurred at Eindhoven Airport in 2013. The incident involved a sudden pitch-up manoeuvre by the aircraft's autopilot system followed by a rapid drop in airspeed to a near-stall (stick shaker) situation. The crew regained control of the aircraft and carried out a go-around. During the investigation, the Board has become aware of similar events. A common factor linking these events was discovered to be the M-Array antenna which is in use around the world, including Australia.

Flight tests were conducted to measure the M-array antenna signal and determine the 'glide slope field' characteristics above the 3 degree glide path while established on the localizer. Analysis of the measurements shows that between the 3 and 9 degree glide path, the signal strength changes. For the pilot this can result in observable movement of the ILS glide slope marker on the primary flight display. At this time two important characteristics of the M-array ILS antenna 'glide slope field' have been identified:

1. a signal reversal was always present at approximately 9 degree glide path
2. a signal reversal was sometimes present at approximately 6 degree glide path.

Depending on the glide slope field, signal reversal occurs occasionally at 6 degrees, and always at the 9 degree glide path. This reversal activates the glide slope capture mode after which the autopilot follows the glide slope signal without restrictions. During flight tests the reversal resulted in the automatic flight control system commanding a severe pitch-up. Immediate flight crew intervention was required to regain aircraft control.

Furthermore, the flight tests have shown that commonly available information on false glide slope (internet, manuals and literature) does not necessarily reflect glide slope signal characteristics of all ILS antenna types in use worldwide. For example, in some aircraft manuals it is noted that a false glide slope signal can be identified by a higher than normal descent rate. This particular description does not accurately reflect what happens when a false glide slope of an M-array antenna is captured.

Thus far the investigation has revealed that aircraft from four different manufacturers operated by different airlines have experienced a pitch-up upset caused by a false glide slope either under test conditions or during operation.

**It is important to note that the characteristics observed are not limited to the M-Array (capture effect) glide path but are also present on other glide path antenna types.**

This investigative information has led Airservices to issue this Safety Bulletin to address the following safety concern: **to generate awareness of different ILS signal characteristics and the potential of aircraft pitch-up upset due to capturing a false glide slope, which can lead to stall conditions.**

### **Information for pilots: what can you do?**

Pilots should be aware of the ILS glide slope signal characteristics and the dangers accompanying flying in the area above the 3 degree glide path during the approach. In particular, aircraft behaviour while flying on autopilot with the glide slope mode armed should be noted.

Pilots should not accept an approach that will cause them to intercept the glideslope from above.

### **Information for operators: what can you do?**

Operators should consider the need to implement additional operational procedures or provide additional guidance in order to mitigate the risks of unexpected autopilot behaviour when on ILS approaches.

If after reading this Safety Bulletin you think a similar occurrence has taken place within your company, please contact your investigation authority agency and provide any relevant information of the event.

### **Information for Air Traffic Control; what can you do?**

Adhering to prescribed navigation procedures reduces the flight crew workload and will position the aircraft to intercept the glide slope from below.

### **General Information**

Instrument Landing Systems (ILS)

- Different types of ILS glide slope systems are used worldwide. Signal characteristics in the area above the (standard) 3 degree glide slope are system dependent.
- Similar glide slope capture logic in automatic flight control systems (autopilot) is used for the majority of aircraft types currently in service worldwide.
- While intercepting the ILS glide slope signal from above the 3 degree flight path with the automatic flight control system engaged, the aircraft can capture a false glide slope resulting in an unexpected rapid pitch-up command (automation surprise).

### **For further information**

In addition to the issue discussed in this Safety Bulletin, capturing the glide slope from above is a leading cause of unstable approaches. CANSO has released the following information for pilots and controllers regarding how to avoid an unstable approach:

[Flyer — Important tips for pilots/ATCOs — avoiding unstable approaches](#)

[Flyer — An ATC perspective on unstable approaches — runway excursions](#)

[Booklet — unstable approaches: air traffic control considerations](#)