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POTENTIAL SAFETY ISSUE WHEN ABOVE NORMAL GLIDEPATH ON ILS APPROACHES

1. INTRODUCTION

1.1 This Aeronautical Information Circular (AIC) provides information about a potential safety issue in relation to instrument approach operations using the Instrument Landing System (ILS) ground stations used in Australia and in many other parts of the world. Specifically, the ILS ground station can generate a false pitch up signal, possibly severe and sudden, if the aircraft:

a. intercepts the glidepath from above, or
b. during an approach, goes above the normal glidepath angle.

1.2 Caution should be exercised in such situations particularly for autopilot coupled approaches.

2. BACKGROUND

2.1 In 2013, the Dutch Safety Board investigated an occurrence where an aircraft suffered a severe and sudden pitch-up upset during an ILS approach. The aircraft's airspeed dropped rapidly to a near stall situation (stick shaker), and the flight crew carried out a go-around.

2.2 During the investigation the Board found a history of similar events. Analysis revealed that the common factor linking these events was the particular ILS antenna type - M-array (Capture effect) ILS antenna.

3. THE ISSUE

3.1 The M-array ILS antenna type is used widely for ILS installations in Australia, and is in use in many other parts of the world. Accordingly, it is important for pilots, aircraft operators and air traffic controllers to be aware of different ILS signal characteristics and the potential of aircraft pitch-up upset due to capturing a false glide slope, which can lead to (approach to) stall conditions.

3.2 The information in this AIC is taken directly from the Safety Alert issued by the Dutch Safety Board.

4. DISCUSSION

4.1 ILS systems are periodically checked with a Flight Inspection in order to be certified for operational use. The Flight Inspection focuses exclusively on the 3 degree glide slope area. The signal characteristics in the area above the 3 degree glide slope were examined as part of the Dutch Safety Board's investigation. 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 localiser.

4.2 Analysis of the measurements shows that between the 3 and 9 degree glide path, 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:

a. A signal reversal was always present at approximately 9 degree glide path.
b. A signal reversal was sometimes present at approximately 6 degree glide path.

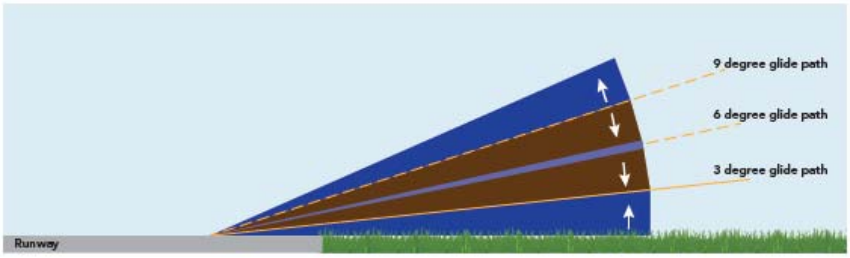

Figure 1: Cross section view of the M-array ILS antenna system. Schematic overview of the "Fly up"(blue) and "Fly down"(brown) indication.

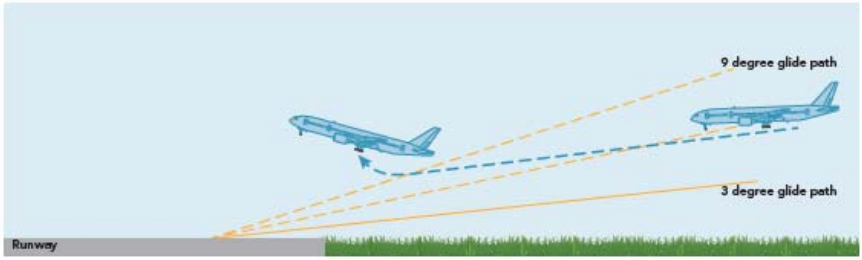

Figure 2: Example of glide slope capture with a pitch upset above 3 degree glide path.

4.3 Depending on the glide slope field, signal reversal occurs occasionally at 6 degree, 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.

4.4 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.

4.5 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.

5. ADVICE FOR PILOTS

5.1 Pilots should be vigilant for potential false glide slope signals when intercepting any ILS glide slope from above, and aware of the potential issues associated with flying in the area above the 3 degree glide path during the approach. This is particularly important while flying on autopilot with the glide slope mode armed.

6. ADVICE FOR AIRCRAFT OPERATORS

6.1 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.

7. ADVICE FOR AIR TRAFFIC CONTROL

7.1 Whenever possible, ATC should issue control instructions that will position the aircraft to intercept the glide slope from below.

8. CANCELLATION

8.1 This AIC provides information of an ongoing nature and has no cancellation date.

9. DISTRIBUTION

9.1 By Airservices Australia website only.