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OPERATION OF AIRCRAFT

NAVIGATION AND LANDING AIDS

AIDS TO PRECISION APPROACH AND LANDING: PROPOSED STRATEGY TO SUSTAIN PRESENT LEVEL OF ILS SERVICES

Λ *Indicates changes.*

Λ *This AIC replaces AIC 25Λ2 dated 96-05-15.*

1. ***Introduction***

In view of the extension of the present ILS termination date of 1 January 1998 as contained in ICAO Annex 10, to the year 2010, it will be necessary to introduce certain precautions at airports to sustain the present level ILS services beyond the year 2000. It is important to note that although the protection date of ILS will be extended that MLS has been retained as an approach and landing aid in view of expectation that an internationally accepted GNSS with augmentation as required may not be ready for Category II and III use before 2005. At Cape Town International Airport, for example, where Category III operations are provided, this level will have to be maintained until about 2005 to 2010. Should external factors degrade the level of ILS service, the installation of expensive MLS facilities will be the only alternative. Service Providers must therefore endeavor to maintain ILS to the present level of service as long as operationally possible.

The precautions to be taken by Service Providers at airports include building restrictions to ensure that signal reflections will not interfere with the ILS operations. Since the Department of Transport has in the past, before commercialization, restricted the erection of structures in the vicinity of runways at State airports to ensure the integrity of the ILS, this requirement should not put further restrictions on development.

It should however be noted that the retention of ILS may not be a 'no cost' option. Some of the ILS equipment in South Africa is close to twenty years and older. These systems are no longer produced and maintenance could present problems considering that ILS may be required until 2005 or later. It may therefore be necessary to replace some of these systems, especially if a system requires upgrading to a higher category of precision approach service for operational reasons.

2. ***Protection of ILS Services***

2.1 ***Multipath Interference***

2.2.1 ***Background***

The problem of multipath interference to ILS is well known and has been recognised since the early days of ILS. Both localiser and glide path systems may be affected although most attention in recent years has been focused on the localiser. The effects may be classified into two types:

(a) static multipath, caused by large buildings such as hangers in the vicinity of the runway;

(b) dynamic multipath, caused by aircraft taxiing close to the runway and glide path antenna or overflying the localiser antenna.

Annex 10 Standards and Recommended Practices (SARPS) lay down very tight tolerances on the ILS signal structure, particularly for Category III guidance down to and along the runway. Since the specification must be met for a combination of both static and dynamic multipath sources it is necessary to place tight tolerances on the allowable bends from both

sources. Thus, in considering the effects of static multipath from proposed new development, it is always necessary to make allowance for dynamic multipath.

*2.2.2 **Static multipath***

Clearly, the main mechanism available to prevent static multipath is to limit building development. Mechanisms exist for proposed developments to be notified to airport operators and they can be assessed for their potential impact on the ILS using computer simulation and/or engineering judgement. Potential problems are then addressed either by modification to the original proposal, changes to the ILS facility, or, in extreme cases, by objecting to the proposal. Fortunately, in most cases, development, which may affect the ILS, is within the airport boundary and there is a mutual interest in ensuring that the ILS is protected.

However, the engineers responsible for the safeguarding of ILS operations are often under pressure from developers to allow further development. This inevitably means that the ILS engineers responsible for protecting the ILS from development become involved in designing or approving buildings to a limit at which they believe there will be no significant effect on the ILS signal. There are two major risks associated with this. First, there is likely to be a gradual degradation in performance due to the combined effect of all the buildings, even though the effect of each one individually is acceptable. Secondly, there is always the possibility of an error in judgement which, in effect, allows one building too many. These problems could be intensified by the development of new hangers, which are significantly larger than existing 747 hangars.

Although static multipath problems mainly affect localizer performance there have been a number of examples where the glide path performance has been of concern. At some airports the glide path installation is close to the airport boundary resulting in constraints on proposed developments, leaving open the possibility of legal action by the developer. There are numerous examples world wide of glide paths with special set-ups required to maintain the category of operation. As a specific example, the glide path antennas sometimes have to be turned towards the runway centre line to avoid illuminating adjacent hangars.

*2.2.3 **Dynamic multipaths***

Dynamic multipaths are caused by reflections from aircraft taxiing close to the runway or overflying the localizer. Protection against such interference is provided by procedural control of the ILS sensitive areas during low visibility operations. This is effective in ensuring the safety of operations but with the penalty of limiting the movement rate. For example, at one major airport the movement rate in good visibility is thirty-nine landings per hour, but falls to fifteen landings per hour when ILS sensitive areas are protected.

Clearly the need to protect the ILS sensitive areas is not the only constraint in low visibility conditions but it is currently the major constraint. The disruption of operations becomes less acceptable as airport capacity is greatly reduced in low visibility conditions whilst appropriately equipped operator demands remain the same.

Again, although the major problem is with localiser protection, there are cases where the need to protect the glide path from multipath interference has an impact on aircraft ground movements. For example, at some airports traffic crossing an active runway must be held abeam the glide slope while landings are taking place.

Another cause for concern is the use of autoland in good visibility without the ILS sensitivity area protection being in place. This is allowed by current procedures and pilots are warned that when carrying out autolands in conditions not requiring the introduction of low visibility procedures they should closely monitor the path of the aircraft and be prepared to disconnect the autopilot if excessive disturbances occur during the approach. Nevertheless, a number of serious incidents have occurred in recent years during autolandings in good visibility.

To summarise Service Providers will have to consider the following to ensure that the level of service provided by ILS facilities is protected:

(a) It will be necessary to carefully plan building development at airports to retain the ILS at its current operational category;

(b) The lack of effective control of building development will result in a loss of operational capability;

(c) Current procedures to protect Category II/III ILS services from multipath interference during low visibility conditions must be maintained with their consequential adverse effect on movement rates in low visibility conditions.

*2.3 **Radio Interference***

*2.3.1 **Introduction***

The possibility of radio interference to ILS was recognised during the development of Category III ILS in the 1960s. At that time, the greatest threat was thought to come from industrial, scientific and medical (ISM) sources, e.g. from harmonics of radio frequency heaters.

In one State a considerable amount of research and development (R&D) defined an acceptable level of interference in the

ILS band, resulting in a requirement for the radio environment in the vicinity of Category II runways to be periodically checked. More recently the decision at the 1979 International Telecommunication Union (ITU) Conference to release the band from 100 - 108 MHZ to FM broadcasting in some regions raised questions about the compatibility of this high power service with the relatively low power ILS localizer in the adjacent band.

2.3.2 ***FM broadcasting***

At the 1979 International Telecommunication Union (ITU) Conference the frequency band allocated to broadcasting in Europe was extended to 108 MHZ, thereby broadly aligning the Radio Regulations governing the use of this band in all three ITU regions. As a consequence of this decision, studies and tests were carried out to determine the extent of any conflict between these services and the aeronautical services operating in the adjacent bands 108 - 137 MHZ (ILS, VHF omnidirectional radio range (VOR) and communication services).

It was established that under certain conditions the performance of airborne receivers could be degraded. The impact on ILS receivers was of particular concern and it was found that interference could be caused by two main mechanisms.

(a) spurious emissions from the broadcast transmitter which could not be discriminated from wanted signals;

(b) high level broadcast signals causing intermodulation and desensitisation within the receiver.

Λ To safeguard the correct operation and performance of aeronautical avionics new signal protection criteria were developed and agreed upon. These place constraints on the emission characteristics of FM broadcast transmitters and the aviation community produced new technical standards in Annex 10 for ILS, VOR and VHF communication receivers. These new standards require the localiser receiving systems of all aircraft utilising ILS facilities at international airports to comply with the new specifications by 1998 (see Annex 10, Volume I, Part I, Chapter 3, section 3.1.4).

With proper frequency management preventing intermodulation interference from FM broadcast was possible. However, with the introduction of more FM transmissions, the possibility of interference will increase and consequently will become more difficult to confine.

3. According to a recommendation by the Africa Planning and Implementation Regional Group (APRIG) ILS should be maintained up to the year 2010. It is anticipated that with proper planning and the necessary precautions, it will be possible to comply with this recommendation in South Africa.

COMMISSIONER FOR CIVIL AVIATION