



DIRECTORS GENERAL OF CIVIL AVIATION-MIDDLE EAST REGION

Sixth Meeting (DGCA-MID/6) (Abu Dhabi, UAE, 1-3 November 2022)

Agenda Item 5: Aviation Safety and Air Navigation

ADDRESSING THE IMPACT ON POSITIONAL ACCURACY BASED ON THE TEMPORALITY FOR THE AVIATION INDUSTRY

(Presented by IFAIMA)

SUMMARY

This paper addresses impact on the positional accuracy based out of temporality and its relevance to the various stakeholders within the aviation industry. Position in terms of latitude and longitude for important elements of aerodrome facility such as RWY End, NAV Aids, Parking Stands etc are surveyed and not derived. The accuracy of surveying position is impacted by dynamic conditions. The paper discusses impact of temporality on surveying values achieved.

1. INTRODUCTION

1.1 The. This paper provides information about the challenges faced by various users of aeronautical data, arising out of positional inaccuracy based on temporality.

1.2 The positional accuracy of surveyed data depends on multiple factors like Instruments Used, ITRF models, Epoch used, Geographic Location etc.

1.3 Out of these factors, Epoch (which represents position with respect to time) or in other words, temporality of the positional data has a significant impact on positional accuracy achieved or aimed to be achieved by conducting terrestrial survey

2. DISCUSSION

2.1 The information presented in this paper applies to data collected (surveyed) using GNSS receivers (DGPS) and positional data obtained in WGS-84 coordinate system.

2.2 Observations were made for surveying (latitude and longitude) with following conditions:

2.2.1 Constants:

2.2.1.1 Surveying Equipment (i.e.: GNSS Receivers)

2.2.1.2 Duration of the Survey

2.2.1.3 Geographical Location

2.2.1.4 Date of Survey

2.2.2 **Variables:**

2.2.2.1 Epoch Model

2.2.2.2 ITRF Model

2.3 As stated in para 1.2 above, positional accuracy is governed by Instrument Used, ITRF Model, Epoch and Geographic Location.

2.4 The study was conducted in 2 regions (UAE and India) to identify the impact of temporality on positional accuracy.

2.5 During this study, the equipment was constant i.e.: GNSS Receiver (DGPS).

2.6 It was noticed that observation of same occupation point for same duration with same equipment (i.e.: GNSS Receivers) results:

Different values of coordinates when the observations made are processed with different Epoch

2.7 Impact of ITRF and Epoch model: Data was processed in following grid pattern: (Changes in ITRF and Epoch reference for the same Location)

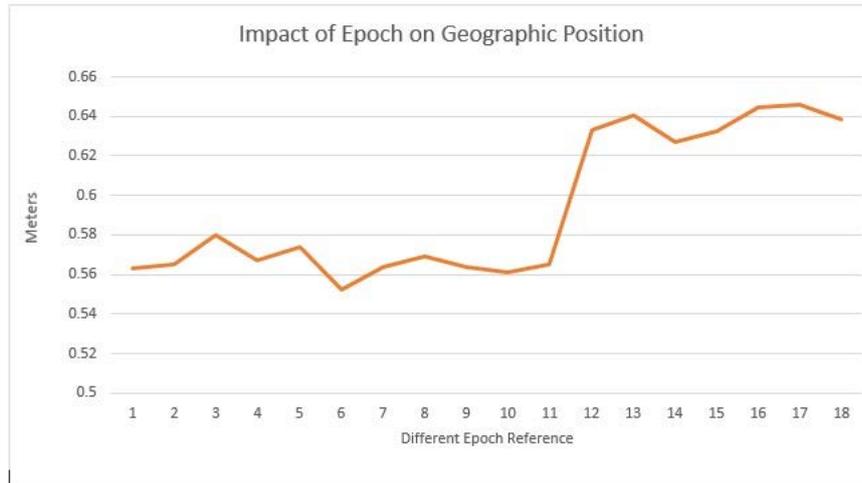
Reference	Epoch 1	Epoch 2
ITRF 1	Reading 1	Reading 3
ITRF2	Reading 2	Reading 4

There is No Difference between Reading 1 and Reading 2
 There is No Difference between Reading 3 and Reading 4
 But
 There is difference between Reading 1 and 3
 There is difference between Reading 2 and 4
(Quantitative differences in the values of readings are presented in the graph below)

Which concludes that changing Epoch has impact on the accuracy of the reading

2.8 Impact of Epoch: It is observed that Epoch which represents position with respect to time, has greater impact on positional accuracy.

2.9 Following graph represents Impact of changes in Epoch on Geographical Position.



2.10 The Para 3 of Appendix C of ICAO Doc 9674-WGS84 Manual suggests - “ITRS is a model with changing coordinates due to movement of tectonic plates on which the ground stations are located.” This statement indicates that earth’s position varies with movement of tectonic plates and tectonic plates’ movement is an activity which happens with time.

2.11 This positional inconsistency due to dynamics of earth has significant impact on the Aviation Industry. The audience influenced by this dynamics nature includes Airport Operators, ANSPs, Procedure Designers, OEMs (which produce equipments to be installed on the aircraft for GNSS based procedures), ATCOs, Pre-flight Briefing Units, Aeronautical Survey Agencies etc.

2.12 Apart from organizations, every individual responsible for Air Navigation services or involved in any of ANS support services which uses reference of positional data needs to be provided with adequate training and awareness about handling these uncertainties while using or communicating this data.

2.13 Assessment

2.13.1 It is important to have annual validation surveys.

2.13.2 Values achieved in annual validation survey will have differences because of the change in Epoch

2.13.3 These values need to be incorporated and communicated to all stakeholders (though the difference between annual survey readings would be within the accuracy limits of the ICAO specifications)

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.