

UNITED NATIONS INTERNATIONAL MEETING ON THE APPLICATIONS  
OF GLOBAL NAVIGATION SATELLITE SYSTEMS  
Vienna, Austria 12 – 16 December 2011



# GNSS AVIATION APPLICATIONS AND PROGRAMMES IN MADAGASCAR

*Presented by: Harvey LEKAMISY, M.Sc., Eng  
Chief of Air Navigation Department  
Madagascar Civil Aviation Authority*

# Contents

- Madagascar at a glance
- GNSS applications in civil aviation
- Programs in Infrastructure
- Specific Programs Involving GNSS
- Cooperation and partnership with Other Institutions and companies
- Conclusion and Recommendation

# Madagascar at a glance

- Located between Indian Ocean and Mozambique channel, Madagascar is the fourth biggest Island in the world.
- Geographic coordinates: 20 00 S – 47 00 E
- Area: Total 587,040 Sq. Km where land: 581.540 Sq. Km and water:5,500 Sq. Km.
- Area comparative: Slightly less than twice the size of Arizona



# GNSS applications in civil aviation

## 1/6

- National Law (GNSS/GPS Implementation)

As we know each state must authorize the use of GPS/GNSS within its own airspace and also specify types of routes based on operational environment – oceanic, en route, non precision approach; stand alone , or overly. And this is in compliance with SARPs and ICAO regional Plan including airworthiness approvals

Since August 16<sup>th</sup>, 2006, Madagascar has approved and adopted National Law setting the conditions for installation of GPS equipment on board aircraft and the use of GNSS within Madagascar airspace (Décision n° 57/DG.ACM/DANA/SNA/06).

# GNSS applications in civil aviation

## 2/6

This National Law specifies the use of GPS/GNSS for different phases of flight:

- Oceanic, en route, terminal area, non precision approach and RNAV approach procedures are allowed;
- Vertical navigation is not permitted.
- Installation must be approved and certified for intended IFR operation (airworthiness approvals).

# GNSS applications in civil aviation

## 3/6

### Available infrastructures

Total Navaids in Madagascar	Aerodromes in Madagascar
LOC: 26	CAP:
VOR/DME: 04	International aerodrome : 07
DME: 03	National aerodrome : 48
VOR: 01	Private /restreint aerodromes
<u>PA</u>	Private aerodrome : 57
PA runways: 03	Restreint aerodrome : 27
ILS CAT-II: 03	

# GNSS applications in civil aviation

## 4/6

- Current status of GNSS implementation

Area Navigation (RNAV) instrument approach procedures based on the use of GPS signals, have emerged as a very cost effective method for aircraft navigation into airports that do not have, ground-based navigation aids (NAVAIDs)

- Now Madagascar have published:

- 03 RNAV/GNSS Approach Procedures (Antananarivo, Mahajanga and Toamasina international aerodromes)
- 01 RNAV/GNSS approach procedure (Private aerodrome of Moramanga) and
- 01 RNAV/GNSS approach procedure is currently being developed at Betainomby aerodrome.

# GNSS applications in civil aviation

## 5/6

### GNSS Implementation Strategy

Through the extension of the European Geostationary Navigation Overlay System (EGNOS) the strategy for the introduction of GNSS for civil aviation use includes augmented GNSS to support specific air navigation operations (AFI GNSS strategy):

- Phase I (up to 2012): The strategy allows the use of basic GNSS (GNSS augmented with ABAS) from en-route down to non-precision approaches (NPA); and as a supplemental-means navigation for TMA. Existing ground infrastructure remains intact.

# GNSS applications in civil aviation

## 6/6

- Phase II (2013 - 2016):
  1. Sufficient capability to meet en route navigation requirement everywhere in the AFI Region. GNSS will continue to be used as a principal en-route navigational aids. Navigational aids will accordingly not be replaced, subject to consultation with the users.
  2. Sufficient capability to meet TMA navigation requirements everywhere in the AFI region. GNSS is approved as the sole-means for TMAs, taking into account technical and legal developments, and institutional aspects.
  3. Capability for approach with vertical guidance (APV1) in the whole AFI Region
    - Phase III (Beyond 2016): Full APV/LPV certified services and maximized APV/LPV availability. it is assumed that at least two constellations of satellite navigation will be available.

# Performance-based navigation (PBN) concept

- PBN encompasses Area Navigation (RNAV) and Required Navigation Performance (RNP)
- GNSS is part of the PBN enabling infrastructure
- GNSS centered performance-based navigation enables a seamless, harmonized and cost-effective navigation service from departure to final approach that will provide in safety, efficiency and capacity.
- Recognizes the ability of modern aircraft to operate safely and efficiently using a variety of on-board systems and external signals.
- An End-to End Air Transportation System based on Performance Standards rather than specific technologies or equipment.

# Programme in infrastructure: "AFREF PROJECT"

- Fundamental to the implementation of GNSS is the use of a common geographical reference system. ICAO adopted the WGS-84 Geoid Reference System as that Datum, and many States have implemented or are implementing the system.
- Madagascar has its own reference system which is called Laborde.
- And the primary goal of the African Geodetic Reference Frame (AFREF) project is to unify the horizontal and vertical geodetic reference systems, datum and reference frames in Africa in support of the ideas of the New Partnership for Africa's Development (NEPAD).
- It means "UNIFICATION OF AFRICAN REFERENCE FRAMES"
- Technically the most important part of AFREF realization is the establishment of national GPS network.

# Specific programme involving GNSS

## Pilot project under EUPOS coordination

- This pilot project consists to establishment a DGNSS reference station system, demonstration project (cf. UN General Assembly document A/AC.105/876: Report on the Applications of GNSS Technologies for sub-Saharan Africa countries, Lusaka, 26 – 30 June 2006).
- DGNSS Reference Station Network with 4 Reference Stations
- Realization of the Project: depends on the support and sponsoring of the involved companies (EUPOS, LEICA System, Trimble)
- Host country provides: local for CC and 1 or more compatible computers
- Project to revive as soon as possible

# Cooperation and partnership with other institution and companies

SIRAJ PROJECT: A strong component of the international Cooperation programme concerns the cooperation between Africa, Arabic peninsula and Europe. In that framework, the European GNSS Agency (GSA) approved the SIRAJ project.

SIRAJ goal is to evaluate the opportunities linked to EGNOS service extension to the areas covered by the ACAC (Arab Civil Aviation Commission) and ASECNA (Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar), in the civil aviation domain, by implementing concrete actions in support to the EGNOS introduction in those areas.

- The first workshop/meeting related to this cooperation was held in Dakar, Sénégal, on 12 -13 july 2011 at ASECNA premises. For more information, please visit the [www.gsa.europa.eu](http://www.gsa.europa.eu) and <http://siraj.ec.pildo.com>

# Conclusion

- Now GNSS application has a good progress in Madaga mainly in civil aviation, telecommunication, mining and extraction, mapping and surveying.
- With the implementation of various new CNS/ATM systems, Madagascar will be able to provide safe and efficient air traffic services while keeping pace with the growing air traffic requirements as per ICAO plan
- Even GNSS technology is not applied in other domain, GNSS is seen as a factor to improve competitiveness of the most vital sectors.
- Due to its geographical situation Madagascar has a great needs of GNSS technologies (number of aerodromes, lack of terrestrial infrastructures, etc.....)
- In accordance with the AFI Strategy Plan, GNSS implementation in Madagascar will be carried out in an evolutionary maner, allowing gradual system improvements to be introduced.

# Recommendation

*We suggest:*

- The establishment of an International GNSS Organization at international and regional levels.
- It may be formed on the lines similar to ICAO, ITU and IMO.
- Regional planning must be established mainly for AFREF project.

Thank you for your  
kind attention

Contact information:  
E-mail1: harvey@acm.mg  
E-mail2: hglekams@yahoo.fr  
Tel: +261 20 22 224 38  
Fax: +261 20 22 247 26  
Mobile: +261.3297.728.53

“Fit in your needs in GNSS technologies”