



| ICAO CAIRO UNITING AVIATION

# Outcome of ACAC/ ICAO GNSS Workshop

Muna ALNADAF

*RO/ CNS*

Cairo/ 11<sup>th</sup> February 2018





# Contents

- Workshop History
- Global and Regional Developments
- GNSS Vulnerabilities





## Workshop History

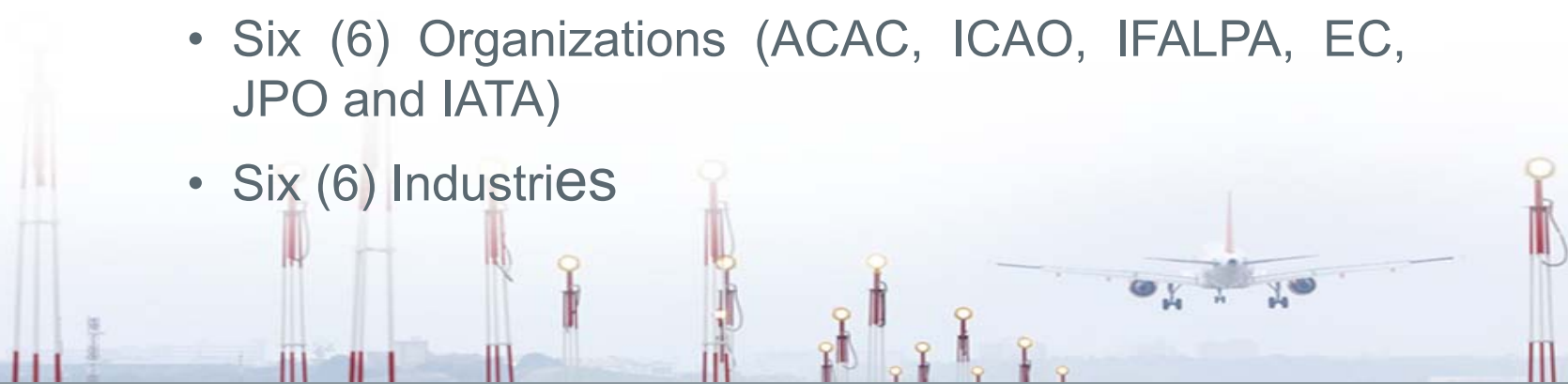
- Jointly organized between ACAC and ICAO and supported by European Commission.
- Held in Rabat, Morocco. From 7 to 8 November 2017.





## Attendance

- **Forty-nine (49) participants;**
  - Nine (9) States (Algeria, Egypt, France, India, Lebanon, Libya, Morocco, Tunisia and Yemen)
  - Six (6) Organizations (ACAC, ICAO, IFALPA, EC, JPO and IATA)
  - Six (6) Industries





# Global and Regional Developments

- MID Region Air Navigation Strategy
- MID Region PBN Implementation Plan
- ACAC GNSS Strategy





# Global and Regional Developments

- EGNOS

- Extension of EGNOS Safety of Life requires three additional RIMS.
- Five (5) ACAC/EUROMED States have already officially notified their interest in EGNOS implementation (Algeria, Jordan, Lebanon, Libya, and Tunisia).





# Global and Regional Developments

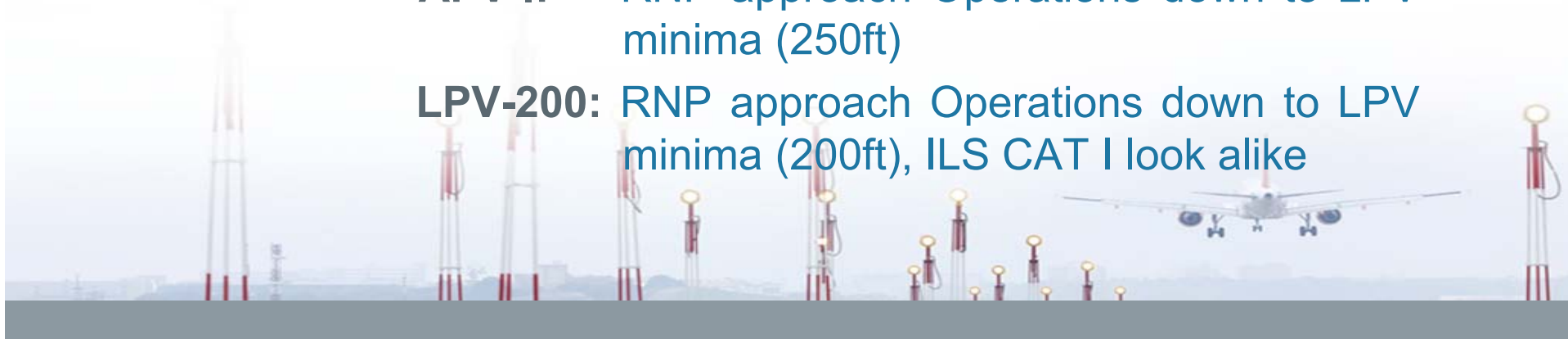
- EGNOS

- EGNOS provision of SoL Service includes:

**NPA**

**APV-I:** RNP approach Operations down to LPV minima (250ft)

**LPV-200:** RNP approach Operations down to LPV minima (200ft), ILS CAT I look alike

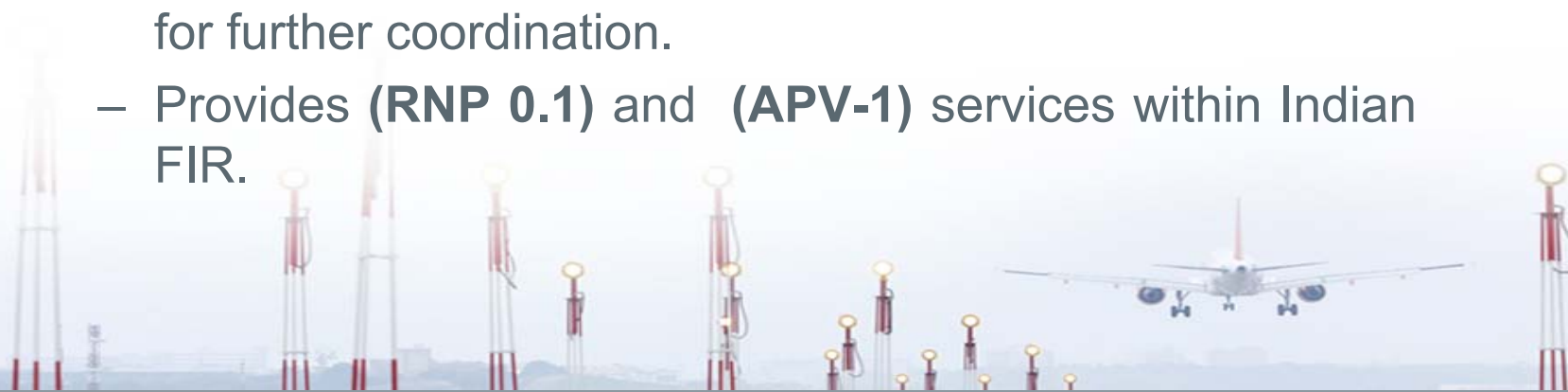




## Global and Regional Developments

- GAGAN

- Extension of GAGAN services to the MID States is possible, interested states need to approach CAA INDIA for further coordination.
- Provides **(RNP 0.1)** and **(APV-1)** services within Indian FIR.

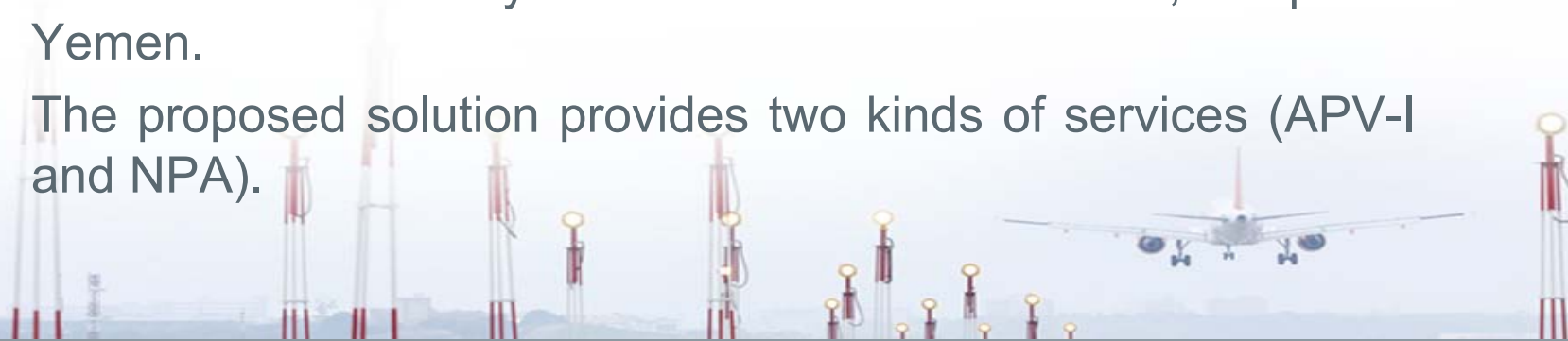






## Global and Regional Developments

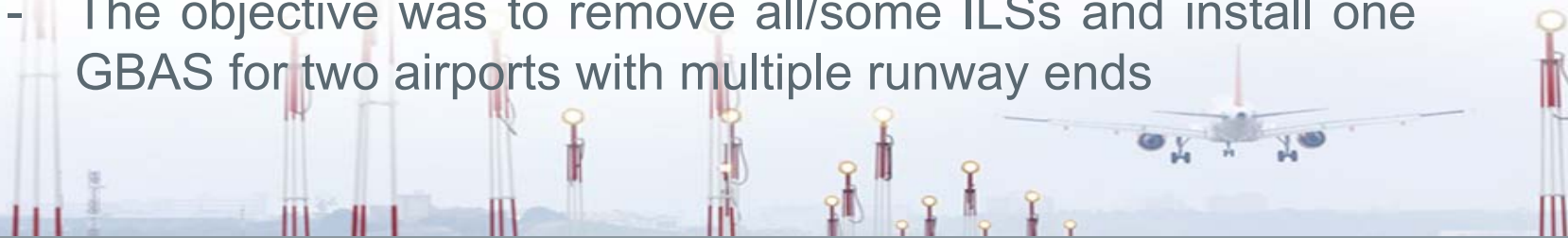
- **Autonomous SBAS for GCC, Iraq and Yemen**
  - The Workshop was apprised of the results of the study case carried out by Thales related to the implementation of an Autonomous SBAS system for the GCC States, Iraq and Yemen.
  - The proposed solution provides two kinds of services (APV-I and NPA).





## Global and Regional Developments

- **GBAS Implementation (FRANCE)**
  - The outcomes of the Paris CDG GBAS Study was not very positive in terms of replacement of the current ILSs by GBAS, due mainly to low level of fleet equipage, lack of standards (for CAT II/III) and need to modify the ATC tools.
  - The objective was to remove all/some ILSs and install one GBAS for two airports with multiple runway ends





## Global and Regional Developments

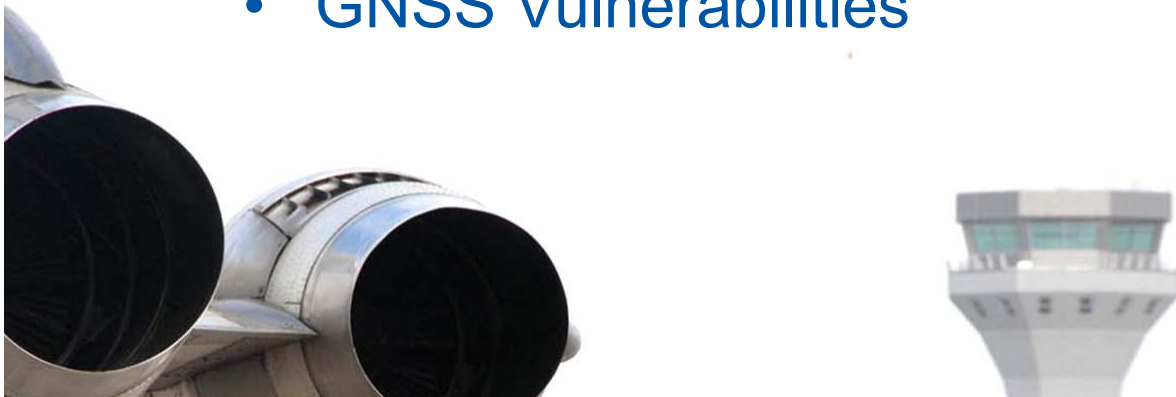
- **GBAS Implementation (FRANCE)**
  - GBAS implementation is currently not economical for small airports (1 RWY). The cost of 1 GBAS is around 1.5 to 2 M Euros per Station (# cost of 3 ILSs)
  - GBAS CAT I deployment remains limited





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## Why is GPS Vulnerable?

- Very Low signal power
- Single Civil Frequency
- Spectrum Competition
- Jamming techniques are well known





## Unintentional Interference

- Ionospheric (Solar Effect)
- Radio Frequency Interference (TV, Mobiles,..etc)
- On-board Systems



## Solar Effect

- GNSS signals are delayed by varying amounts of time depending on the density of ionized particles (ionosphere) which itself depends on the intensity of solar radiation and other solar energy bursts.
- The type and severity of ionospheric effects vary with the level of solar activity, the region of the world and other factors such as time of year and time of day.
- Rare solar storms can affect GNSS service over a wide area.
- Solar activity peaks every eleven years
- Can cause GNSS service to be degraded or temporarily lost



## Intentional Interference

- Jamming
  - Personal privacy devices (ppds)
  - Jammer to avoid vehicle tracking
- Spoofing
  - GNSS Spoofing is less likely than the spoofing of traditional aids because it is technically much more complex
  - Spoofing of GBAS virtually impossible (Authentication scheme)





## Overcome the Interference

- New Frequency (L5 signal)
- Multi-constellation/ multi-frequency GNSS
- Effective Spectrum Management
- Enforcement (Regulations/Laws)
- advanced avionics



## Mitigation strategies

Three principal methods (can be applied in combination):

- a) taking advantage of on-board equipment, such as IRS;
- b) taking advantage of conventional navigation aids and radar; and
- c) employing procedural (aircrew and/or ATC) methods



## Mitigation strategies

- Ensure the safety and regularity of air services
- Discourage intentional interference attempts by reducing the operational impact of interference



## Cyber Security

The Workshop highlighted the need of developing national Security policy against cyber threats including awareness and training programmes.



The Workshop reiterated the ANC/12 Recommendations related to GNSS Vulnerabilities:

- Recommendation 6/6 – Use of multiple constellations
- Recommendation 6/7–Assistance to States in mitigating global navigation satellite system vulnerabilities
- Recommendation 6/8–Planning for mitigation of global navigation satellite system (GNSS) vulnerabilities
- Recommendation 6/9 – Ionosphere and space weather information for future global navigation satellite system implementation



- States are encouraged to embrace early benefits from Basic GNSS (ABAS) implementation (PBN RNP APCH operations).
- States to keep pace with GNSS global and regional developments, and explore all possible solutions to achieve the required performance objectives, in accordance with the GANP and regional priorities and plans.
- The regional and national GNSS implementation plans/strategies should be linked to the regional ASBU implementation Plans approved by the relevant PIRG.
- Airspace users should be involved in the planning of any GNSS implementation, in order to take into consideration operational needs and fleet capabilities.



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THANK YOU