WiMAX Europe 2012
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Understanding AeroMACS

(Airport Surface Communications)

Dr. Shoichi Hanatani
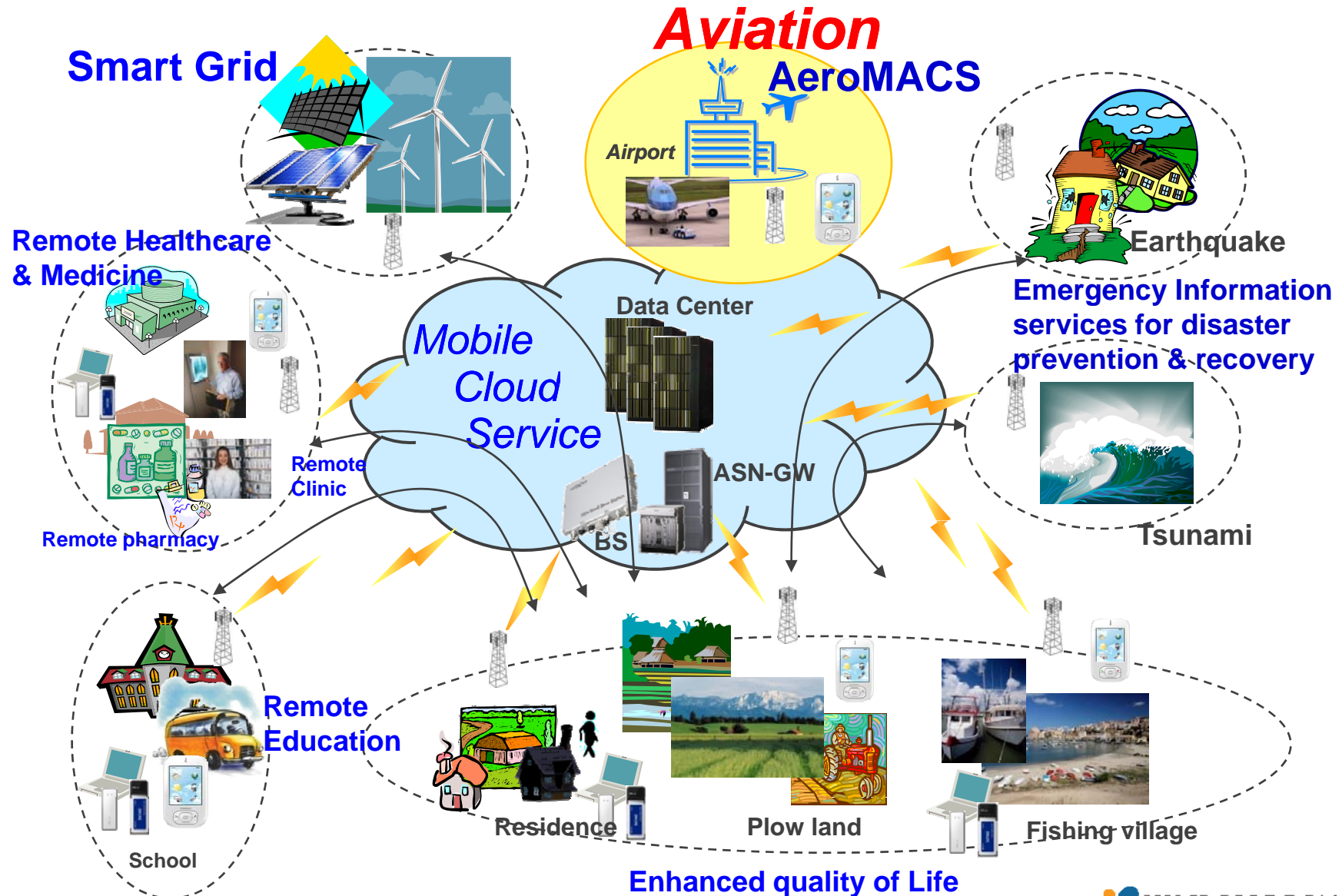**Board of Director,**
WiMAX Forum

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shoichi.hanatani.he@hitachi.com

Outline

◆ Mobile WiMAX Applications

◆ Aviation Network Systems

◆ AeroMACS : NGN Airport Communications

◆ Development and Standardization

◆ Role of WMF

◆ Road Map

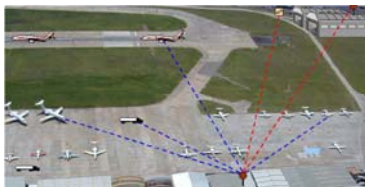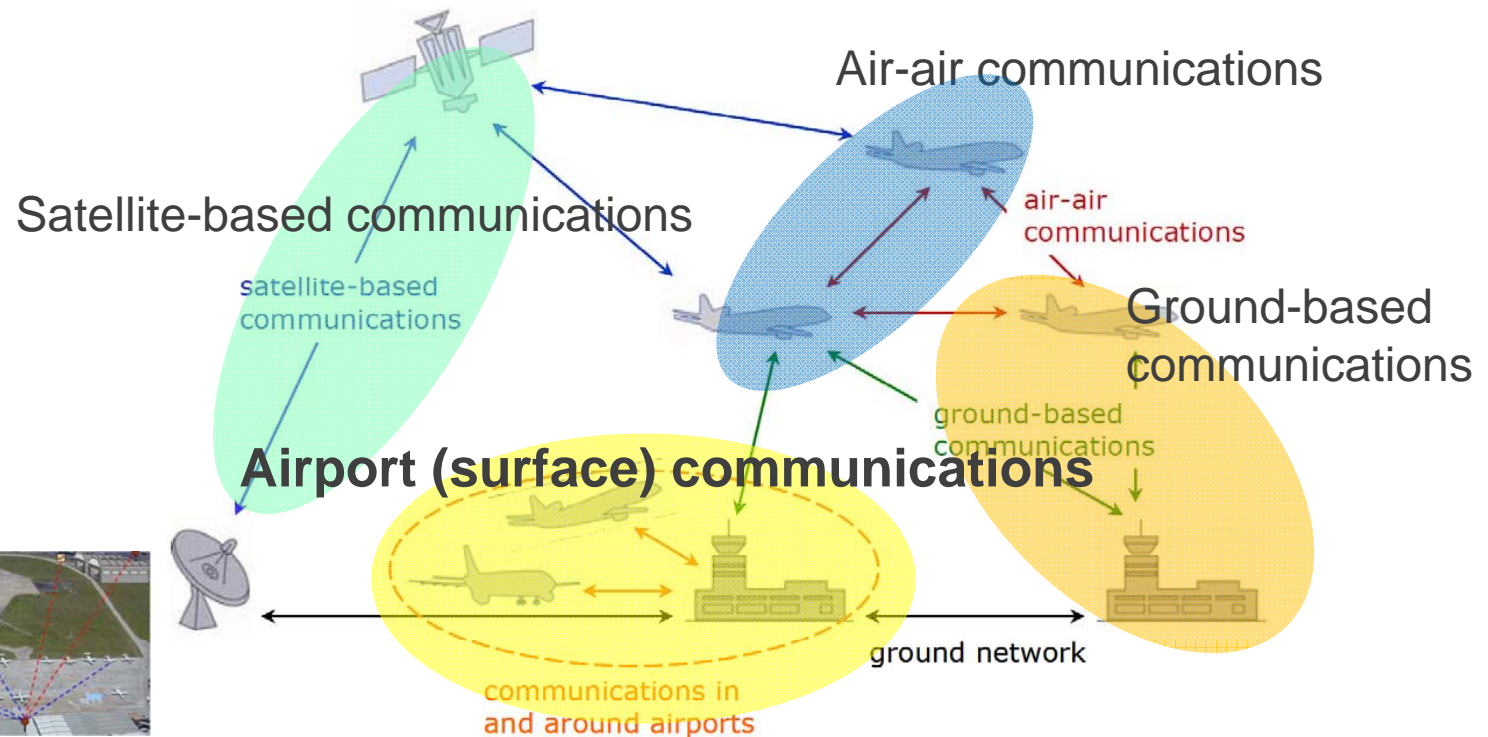WiMAX FORUM®

What Mobile WiMAX brings us

Anytime, Anywhere, Anyone & Anything being connected

Aviation

AeroMACS

Smart Grid

Airport

Remote Healthcare & Medicine

Earthquake

Emergency Information services for disaster prevention & recovery

Data Center

Mobile Cloud Service

Remote Clinic

ASN-GW

Tsunami

Remote pharmacy

BS

Remote Education

Residence

Plow land

Fishing village

School

Enhanced quality of Life

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Aviation Network System

Air-air communications

Satellite-based communications

air-air communications

Ground-based communications

satellite-based communications

ground-based communications

Airport (surface) communications

communications in and around airports

ground network

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Airport Communications
Transmission patterns & Basic design scenarios
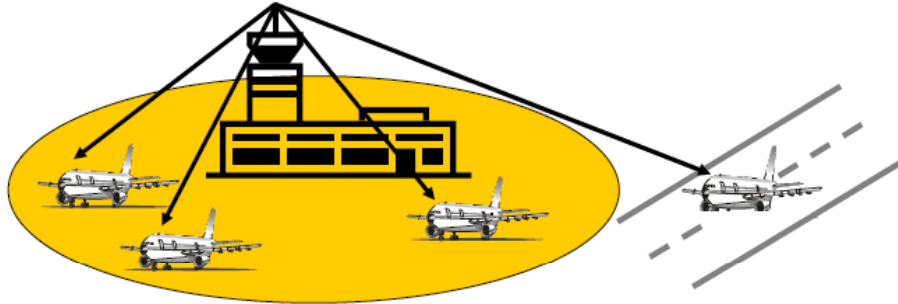
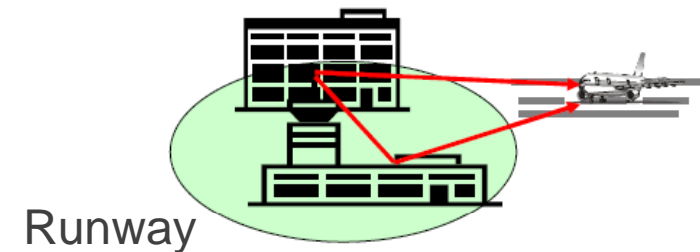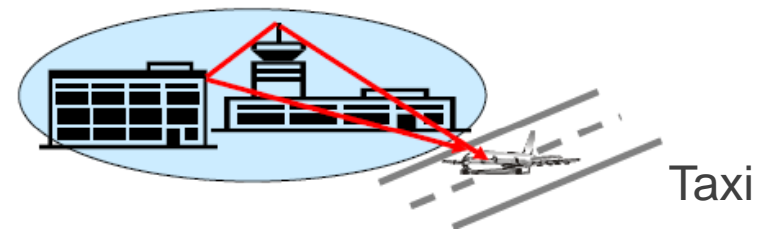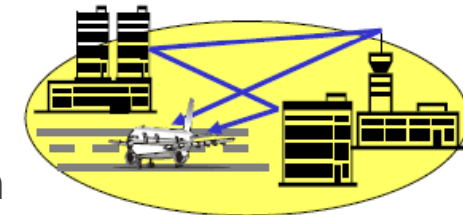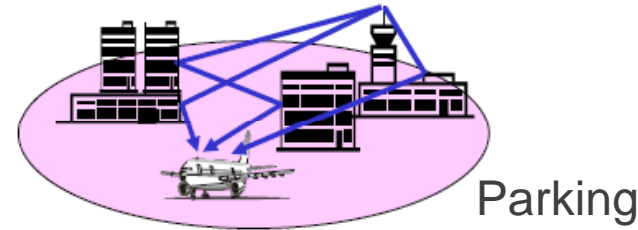**Transmission from control tower to aircrafts**
< Broadcast, multicast and unicast transmissions >
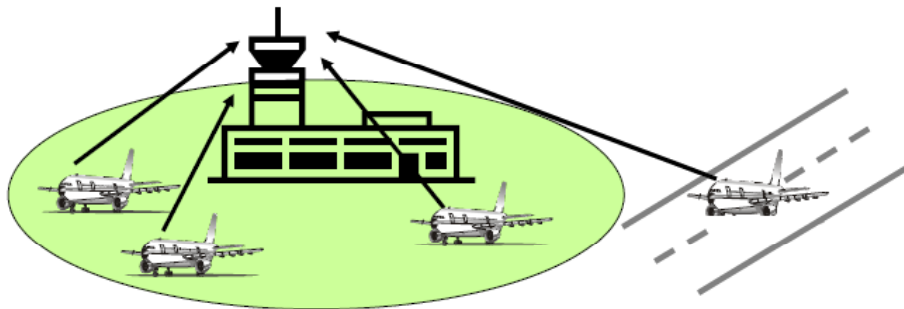
Transmission from aircrafts to control tower
< Multiple access channel >

Parking

Apron

Taxi

Runway

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Technical issues/concerns around airports

◆ No capacity left to upgrade ATC(Air Traffic Control) & ATM (Air Traffic Management)
  - ◆ Voice based on DFB-AM (Double-sideband amplitude modulation)
  - ◆ Data link based on VHF digital link (VDL mode 2)
  - ◆ And old-fashioned…

◆ Necessity of new airport communication system to enhance management and control capability and implement new functions :
  robust, efficient, secure, safe & flexible

◆ Increased traffic congestion and accident risk

◆ More delays and serious impact on airline businesses, in particular LCC

◆ Wasting energy and green concerns

What happened with my flight to Sofia on Monday is …

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Next-Gen. Airport Communication Systems

◆ **Potential Mobile Applications**

- **ATC*1 communicates with any aircraft (A/C*2-to-fixed, A/C-to-A/C) anywhere**
- **AOC*3, Advisory, and non-ATS*4 voice/data between airlines and pilot**
- **Mobile SWIM*5 and airport surface users**

◆ **Potential Fixed Applications**

- **Sensor data collection/dissemination for situational awareness**
- **Cable/Telcom replacement/augmentation**

*1 Air Traffic Control, *2 AirCraft, *3 Airline Operational Control, *4 Air Traffic Services, *5 System Wide Information Management

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Why WiMAX for NGN Airport Comm. ?

Through WiMAX 5Ss : high-Speed, Seamless, Services, Simple and Security

【 Technical values 】

- Broadband : 20Mb/s ~ 75 Mb/s at maximum
- Broad coverage : 1 ~ 3 km range
- Data Oriented / Machine to Machine communications
- Always being connected
- Low failure rate (high availability)
- Easy and fast installation
- Free from the legacy telephony system

【 Business values 】

- No management cost for telephone Number.
- Low cost for installation & maintenance
- Simple mobile station ⇒ Easy airworthiness certificate
- Easy IOT due to less proprietary specifications

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Airport Community with AeroMACS

Airport (Aerodrome)

AeroMACS Core

AeroMACS Core

Security

Legend:
- 🟩 Avionics Comm Center
- 🟣 Wireless Backhaul
- 🔴 Mobile BaseStation
- ⬛ Fixed Services
- 🟠 Mobile Station

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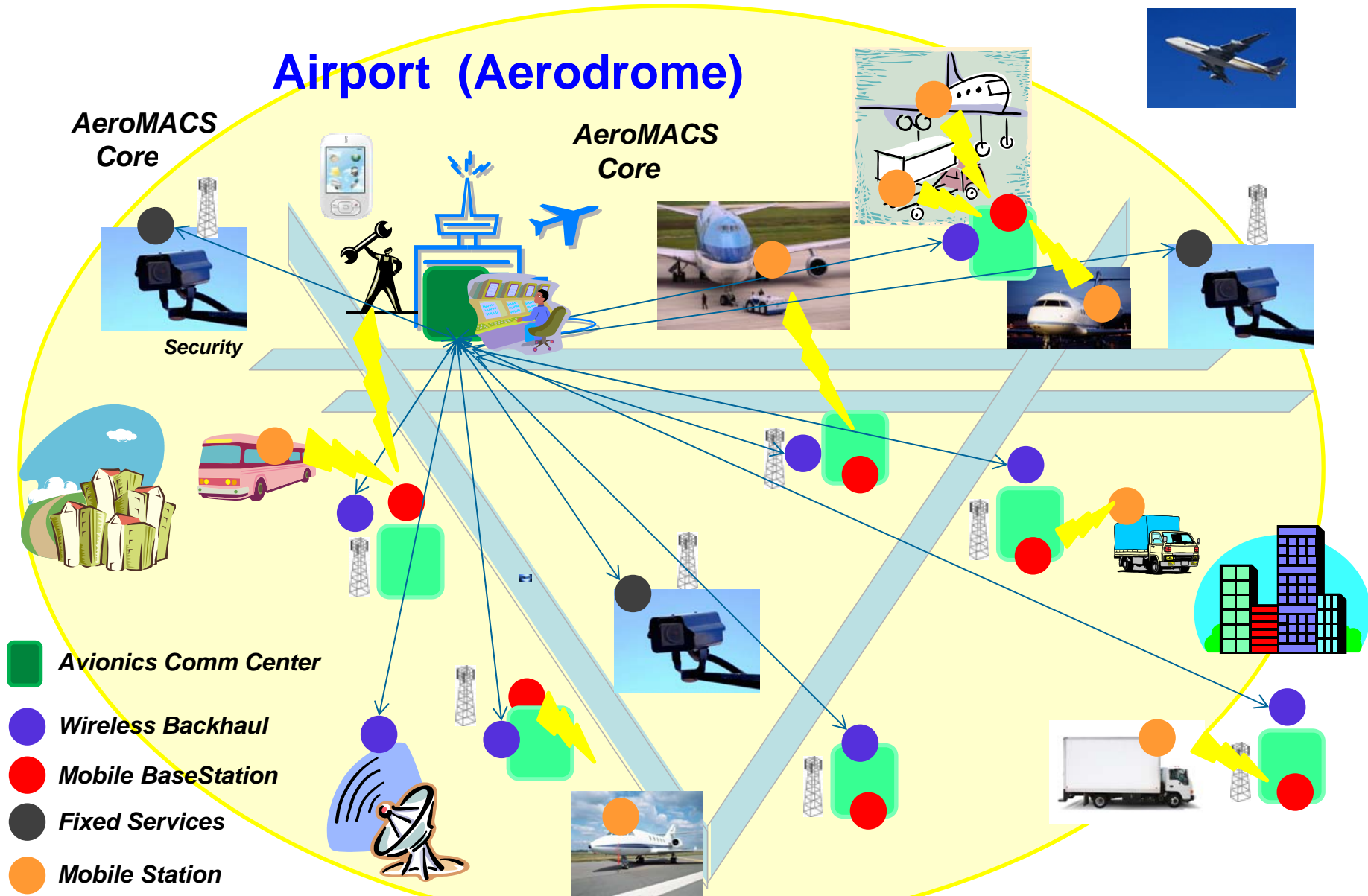
AeroMACS so far

◆ **Action Plan 17 (AP17) for future efficient ATM at UN/ICAO[1] ACP :**

  ➢ **WiMAX(IEEE802.16e -2009) was selected at ICAO 11th Air Navigation Conference(AN-Conf/11) in 2007**

◆ **International Study & Development at ICAO, U.S., EU, Japan and …**

  ➢ **ICAO ACP WG-S, JCAB[2]/ENRI[3](Japan), WiMAX Forum Aviation-WG**

  ➢ **EuroCONTROL /EuroCAE (EU Commission), JCAB/ENRI(Japan)**

  ➢ **FAA / RTCA Special Committee 223 (US), JCAB/ENRI (Japan)**

  ➢ **WiMAX Forum Aviation –WG, Technical-WG, Certification-WG**

◆ **Joint Projects at FAA/NASA and EUROCONTROL**

  ➢ **FAA/RTCA: NASA, US system venders**

  ➢ **EUROCONTROL/EuroCAE: France, Germany, Spain, Sweden, U.K. system venders**

    [1] UN/ICAO (United Nations / International Civil Aviation Organization)
    [2] JCAB (Japan Civil Aviation Bureau)
    [3] ENRI(Electronic Navigation Research Institute

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Joint project with FAA and NASA

Test Bed Project at Cleveland Airport, U.S.
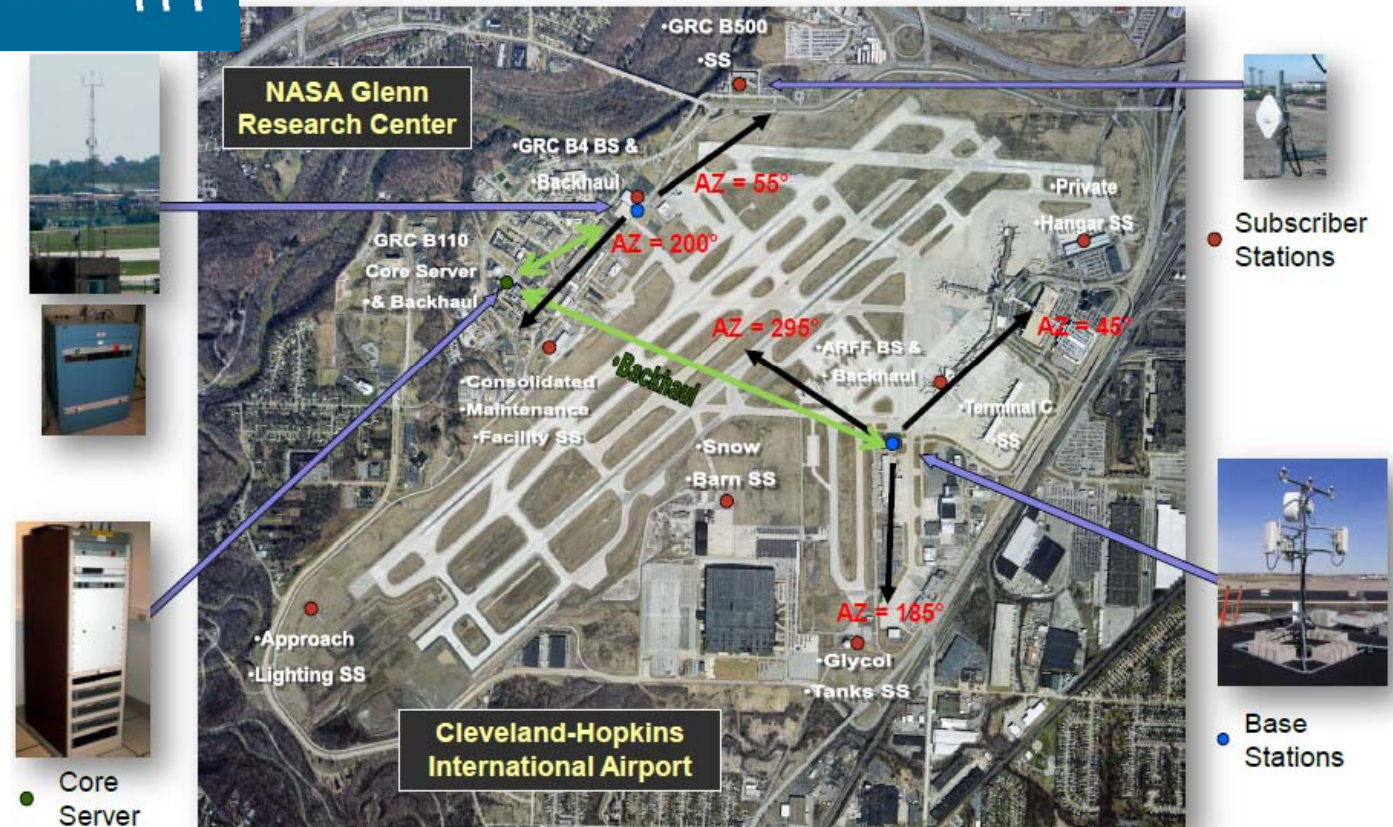
Source :
AeroMACS for Potential Aats – SWIM TIM6 03 November 2010

AeroMACS overview

1. Frequency & Bandwidth
- Frequency : C-band (5095MHz - 5150MHz / 5000MHz – 5030MHz)
- Bandwidth : 5MHxz/CH

2. Base Station signal level control & optimization
- Power control to minimize RF interferences (FAA Satellite RF interference simulation)
- RF simulation and Optimization by practical field test on Airport surface

3. MIMO function support
- Only MIMO-A support at this moment
   (MIMO-B under discussion : only one antenna system on Airborne)

4. Security function support (under discussion)
- Supporting Layer discussion through WIMAX

5. VoIP function support (under discussion)
- Requirement of Voice function from Avionics industries

6. MBS(Multicast and Broadcast Service) function (under discussion)
- Innovation of Broadcasting through Muticast-technology

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Collaborative Standardization Project

Order to AT4W

EUROCONTROL

EUROCAE

RTCA

ICAO·OACI·ИКАО

System Profile

Creation by RTCA

PICS

AeroMACS System Requirement Documents (EuroControl)

Requirements Specifications

AWG

TWG

CWG

MOPS

- **Airborne MOPS**
   Collaborations by
   EuroCAE/RTCA
- **Ground MOPS**
   by only EuroCAE

MASPS

- **Creation by EuroCAE**
   Requirements for Performance

?

SARPS

- **Create by ICAO ACP**
   Whole System
   specifications

MOPS = Minimum Operational Performance Specification
MASPS = Minimum Aviation System Performance Specification
CRSL = Certification Requirement Status List
PICS = Protocol Implementation Conformance Statement
SARPS = Standards and Recommended Practices

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WiMAX Forum's role

Feasible Specification & Certification Test Items

- Create the function list (PICS) to clarify certification test items for the function validation

- Create the certification test items (PCT, RCT, MIOT) in the AeroMACS-PICS by WiMAX Forum

- Guarantee (Certify) the Inter-Operability by WiMAX Forum Certification Working Group's Certification

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Activity within WiMAX Forum

CWG	TWG	AWG
Create Certification Test Items	System Profile	Point of Contacts Overall Management
	PICS	Deploy to TWG about Technical issue
PCT		
Validate Certification Test	RCT	Acceptance at TWG
	MIOT	Formal response as WMF (AWG)
CRSL		

Aviation Industries
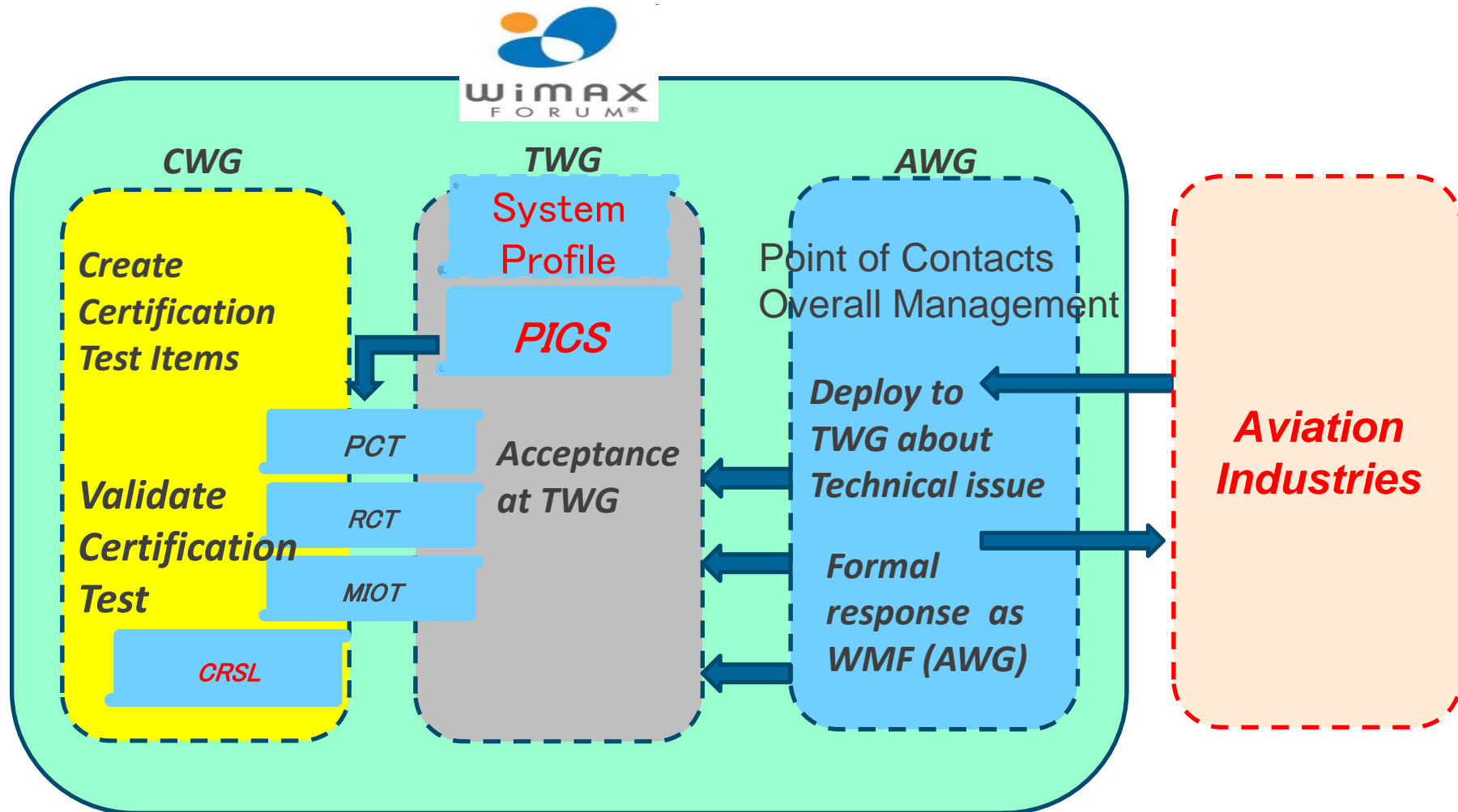
AeroMACS Roadmap

For world-wide commercial deployment

UN/ICAO ACP
Action Plan-17
Startt

UN/ICAO ACP
Action Plan-17
Fixed

AeroMACS
IEEE802.16e-2005
Profile-cC (Ref-6)

Study by
FAA/RTCA
Started

EuroCTL/EuroCAE
Jointed with RTCA

SARPS
by
UN/ICAO ACP
WG-S

2020

2015   2016

2017

2013

2014

2011

2012

2010

Worldwide
deployment

2008

Field Trial studies
by
US, Euro, Japan

2009

C-band
for
AeroMACS
by
WRC-04

Field Trial test
for limited-
commercial
services by
US/FAA

2006

AeroMACS
MOPS / MASPS
By
RTCA / EuroCAE

Commercial
service by
US/Euro/Japan
(Target Plan)

2007

2005

- Airborne-MOPS
By RTCA
- Ground-MOPS,:
By EuroCAE

2004

(subject to change)

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