(사)한국항공교통관제사협회
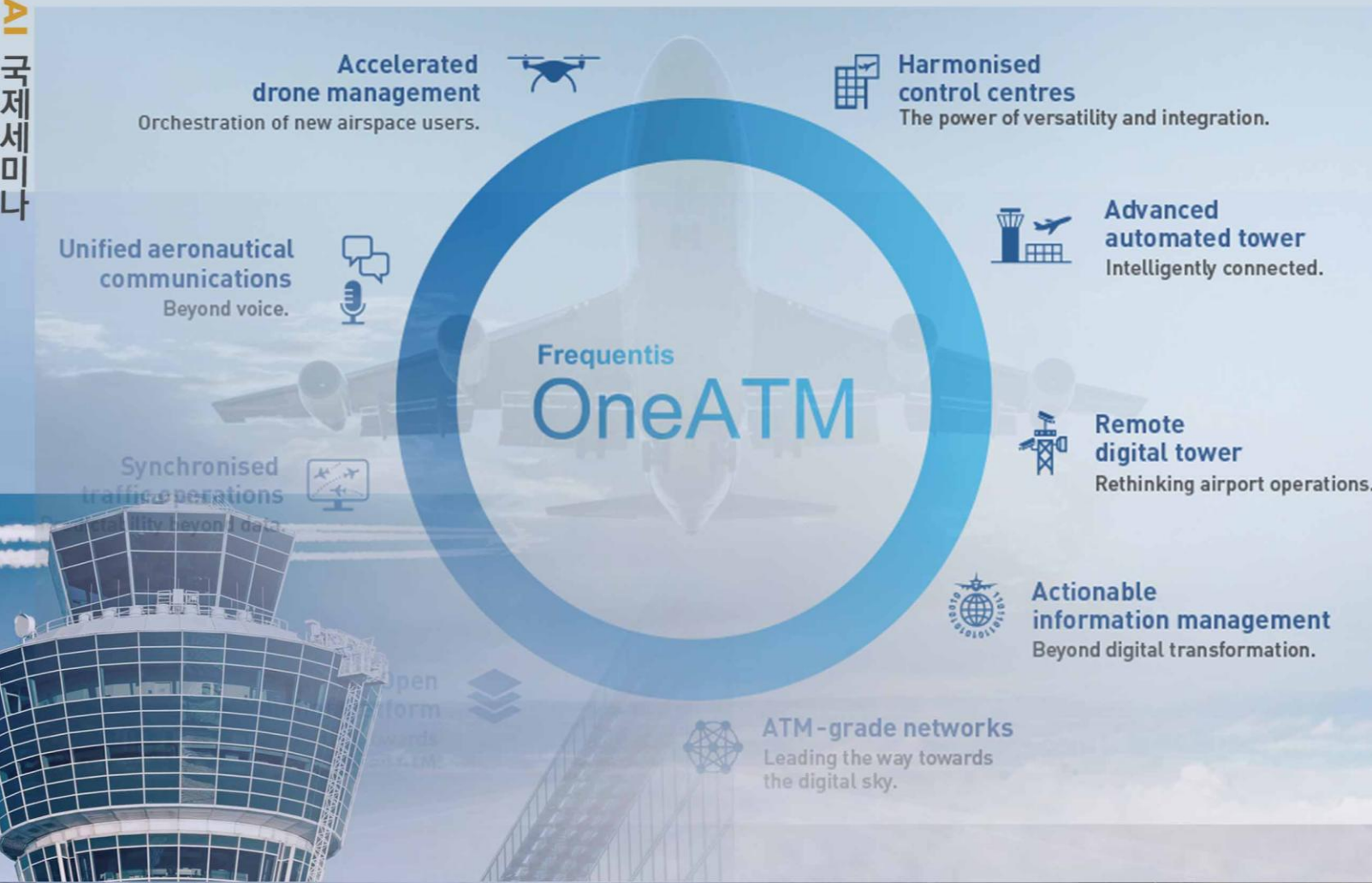Korea Air Traffic Controllers` Association

선진미래항공교통
DIGITAL + AI 국제세미나

Future Air Traffic Management DIGITAL + AI International Seminar

일시 : 2024.11.22(금) 10:00 ~ 16:00
장소 : 코트야드 메리어트 서울 보타닉파크
주최 : (사)한국항공교통관제사협회(KATCA)
주관 : **FREQUENTIS** 프리퀀티스,   **GOAMACE AVIATION** ㈜고암에이스

Memo

선진미래항공교통 DIGITAL+AI 국제세미나

Future Air Traffic Management DIGITAL + AI Int. Seminar

개 회 사

존경하는 항공교통 관계자 여러분!

 오늘 이 자리에 함께해 주신 모든 분들께 깊은 감사의 말씀을 드립니다. 특히 이 세미나를 위해 멀리 해외에서 기꺼이 시간을 내주신 프리퀀티스 여러 관계자와 전문가 여러분께도 감사드립니다.

 오늘날 항공교통은 전 세계적으로 점점 더 복잡해지고 있으며, 증가하는 항공기 운항 횟수와 급격한 기술 발전에 발맞추어 안전하고 효율적인 관제 시스템이 무엇보다 중요해졌습니다.

이에 따라 인공지능(AI), 빅데이터 분석, 자동화 시스템 등 첨단 기술의 도입은 필수적이 되었습니다. 특히 AI 시스템은 항공기 운항 최적화, 실시간 데이터 처리, 위험 예측 및 대응 등을 통해 기존 시스템의 한계를 뛰어넘어 새로운 가능성을 열고 있습니다.

 이번 세미나는 이러한 첨단 기술들이 항공교통관제에 어떻게 적용될 수 있을지, 그리고 우리가 맞이하게 될 다양한 도전과제들에 대해 국가적 플랜은 어떻게 설정하고 있는지에 대한 심도 깊은 논의를 위해 마련되었습니다.

오늘 논의될 AI 기반 관제 시스템, AR, VR등 자동화 및 예측 분석 기술들은 항공교통의 안전성과 효율성을 한층 더 높여줄 것으로 기대됩니다. 또한 이러한 기술이 미래 항공교통의 혁신을 주도할 것으로 믿습니다.

 이 자리를 통해 우리 모두가 항공교통관제의 미래를 그려보고, 각자의 경험과 전문 지식을 공유하여 더욱 발전할 수 있는 계기가 마련되길 바랍니다.

다시 한 번 참석해 주신 모든 분들께 깊은 감사를 드리며, 이번 세미나가 모두에게 의미 있고 유익한 시간이 되기를 기원합니다.

감사합니다.

한국항공교통관제사협회 회장 김필연

선진미래항공교통 DIGITAL + AI 국제세미나

Future Air Traffic Management DIGITAL + AI Int. Seminar

세부진행 순서

시간		세부 내용
09:30 ~ 10:00	30'	▪ 등록 및 환담 (VIP 안내)
10:00 ~ 10:20 개회	20'	▪ 개회식
	2'	(개회선언) 사회자
	3'	(내빈소개) 사회자
	5'	(개회사) 한국항공교통관제사협회
	5'	(환영사) 국토교통부
	5'	(축 사) 한국공항공사/인천공항공사
10:20~10:30	5'	▪ 기념촬영 (주요 내빈) 및 정리
기술 발표	90'	▪ 세션1 : FREQUENTIS Presentation
12:00 ~ 12:50	50'	오 찬
주제 발표	30'	▪ 세션2 : 국토교통부
기술 시연 1	90'	▪ 세션3 : DIGITAL TOWER Tech Demo
15:00 ~ 15:20	20'	Coffee Break Time
기술 시연 2	30'	▪ 세션4 : Tower Pad A-SMGCS Demo
	30'	▪ 세션5 : AVCS, K-UAMCS Demo
16:20 ~ 16:30	10'	▪ 폐회 (경품추첨 및 폐회 선언)

세션 소개

구분	시간			세 션 명	발표자	
개회사	10:00	10:05	5'	미래항공교통 국제 세미나 개회사	한국항공교통관제사협회 회장 김필연	
환영사	10:05	10:10	5'	미래항공교통 국제 세미나 환영사	국토교통부 항공안전정책관 유경수	
축사	10:10	10:15	5'	미래항공교통 국제 세미나 축사	한국공항공사 인천공항공사	
세션1	10:30	12:00	90'	FREQUENTIS OneATM	FREQUENTIS Martin, Peter, David	
	12:00	12:50	50'	점 심		
세션2	13:00	13:30	30'	아태지역 ATFM 발전 현황	국토교통부 항공교통조정과 김우진	
세션3	13:30	15:00	90'	DIGITAL TOWER Tech Demo	FREQUENTIS David	
	15:00	15:20	20'	Coffee Break Time		
세션4	15:20	15:50	30'	Tower Pad A-SMGCS Demo	FREQUENTIS Peter	
세션5	15:50	16:20	30'	AVCS, K-UAMCS Demo	㈜고암에이스 상무 김 회	

Memo

SESSION ❶

" FREQUENTIS OneATM "

Martin Chaloupek
Frequentis Singapore,
Managing Director, Head of Asia

Memo

Digital.
Sustainable.
Safe.

Seminar "Digital Tower + AI: The Power in the Tower"

22 November 2024, Seoul

FREQUENTIS

FOR A SAFER WORLD

We set standards in control centres worldwide

FREQUENTIS
FOR A SAFER WORLD

Enabling our global customers to make the world a safer place

… for more than 75 years!

2,300 employees

€427m revenues in 2023

Vienna headquarters

Our vision

#1 in safety-critical control centre solutions

95% of all air traffic safely managed by Frequentis technology

4,000+ LifeX workstations ensuring safety in everyday life

250 military centres and airbases worldwide use Frequentis solutions

240,000 km largest maritime coastline protected

7 of the 10 largest rail networks in Europe use Frequentis technology

Frequentis: a strong network around the world
with hubs for added customer proximity

500+
customers

150
countries

150+
Active channel
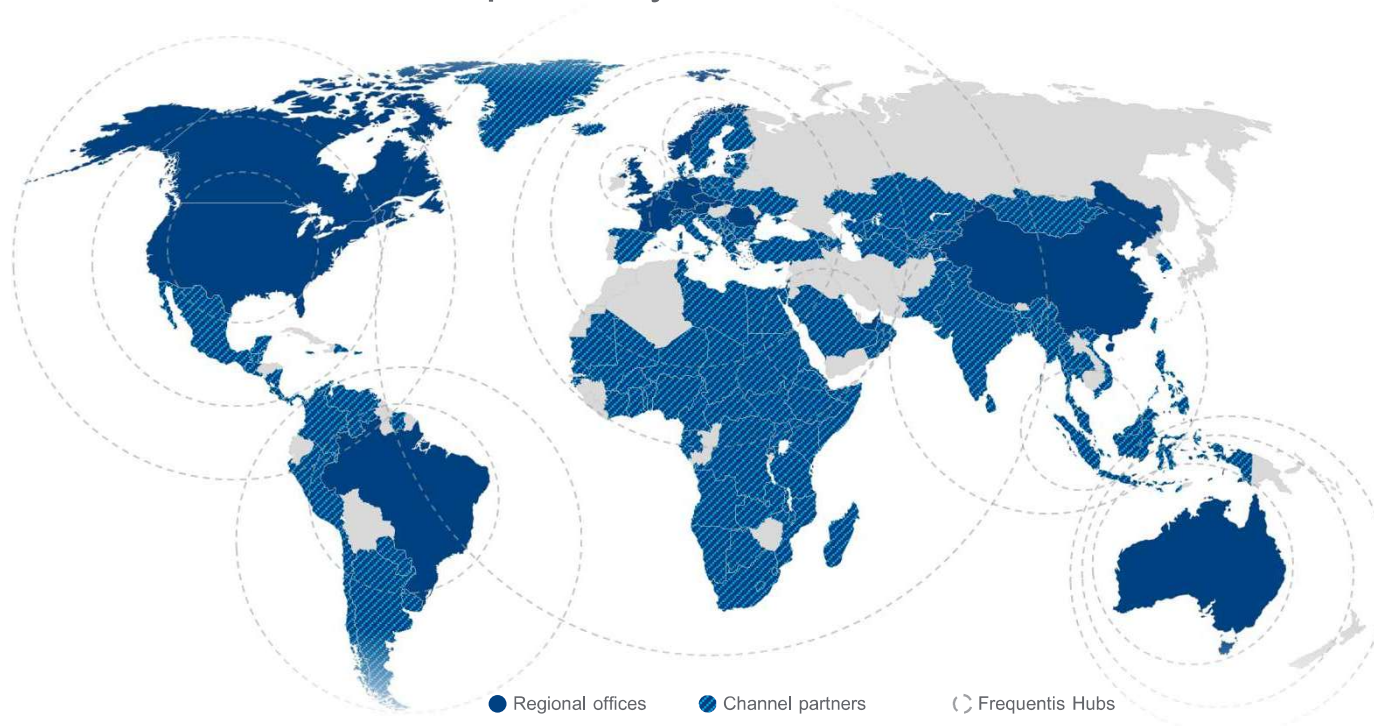partners for 125 countries

Regional offices ● Channel partners ● () Frequentis Hubs

1947	1955	1983	1990 - 1999	2000 - 2009	2010 - 2019

Frequentis
Vienna, Austria

SVK UK   GER   CAN USA   SG   AUS   ROU   BRA CHI   NOR FRA   UAE

Subsidiaries

→ overview
Frequentis
Group

FREQUENTIS
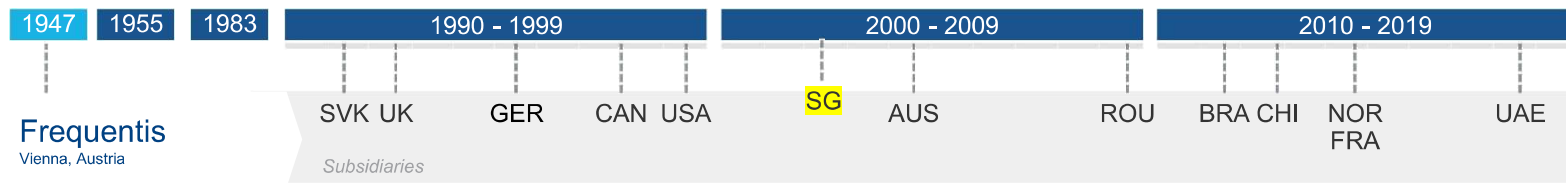
OneATM

Digital. Sustainable. Safe.

30.000+
Working positions worldwide

370+
customers

95%
of all air traffic is safely managed by our technology

75+ years
of experience in critical communications

140+
#1 Countries
"Overall excellence" in Air traffic mgmt. by CANSO

#1
in sustainability*

*) in 2021, the Frequentis AMAN received the Maverick sustainability award for having saved more than one million tons of CO_2 emissions globally within its 20 years of operations.

Air navigation service providers

Unmanned traffic service providers

Aeronautical data service providers

Airports

Flight information service providers

Space agencies

FREQUENTIS

Leveraging the power of integration.
Focus areas

Accelerated drone management
Orchestration of new airspace users.

Harmonised control centres
The power of versatility and integration.

Unified aeronautical communications
Beyond voice.

Advanced automated tower
Intelligently connected.

Frequentis
OneATM

Synchronised traffic operations
Predictability beyond data.

Remote digital tower
Rethinking airport operations.

Actionable information management
Beyond digital transformation.

Open digital platform
Transformation towards service-based ATM.

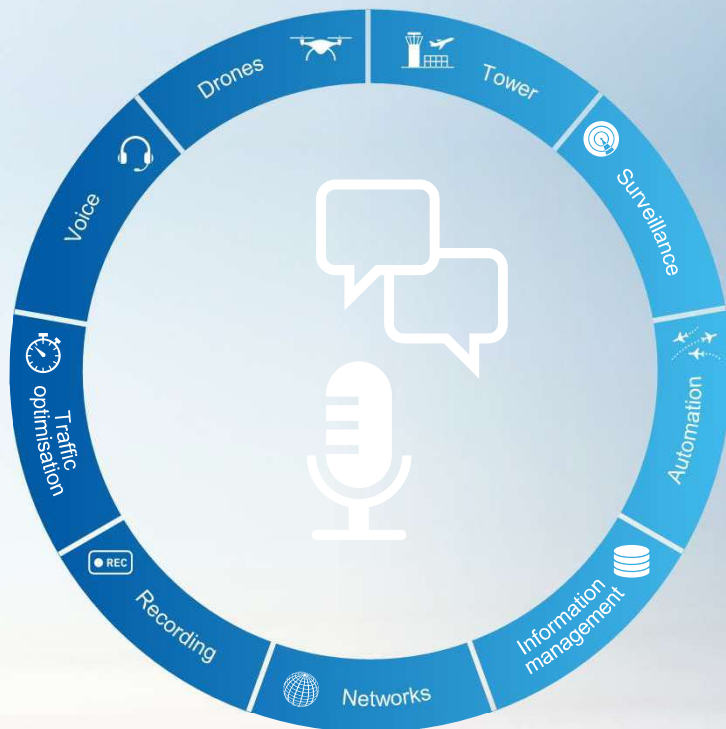**ATM-grade networks**
Leading the way towards the digital sky.

FREQUENTIS

Unified aeronautical communications
Beyond voice

Circular diagram with segments (clockwise from top): Tower, Surveillance, Automation, Information management, Networks, Recording, Traffic optimisation, Voice, Drones

Increased usability and **workflow efficiency** for ATCOs

Seamless integration
of new transport technologies

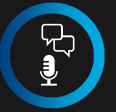**New operational concepts** through functional integration into ATM systems

Increased safety through reduced system and media breaks
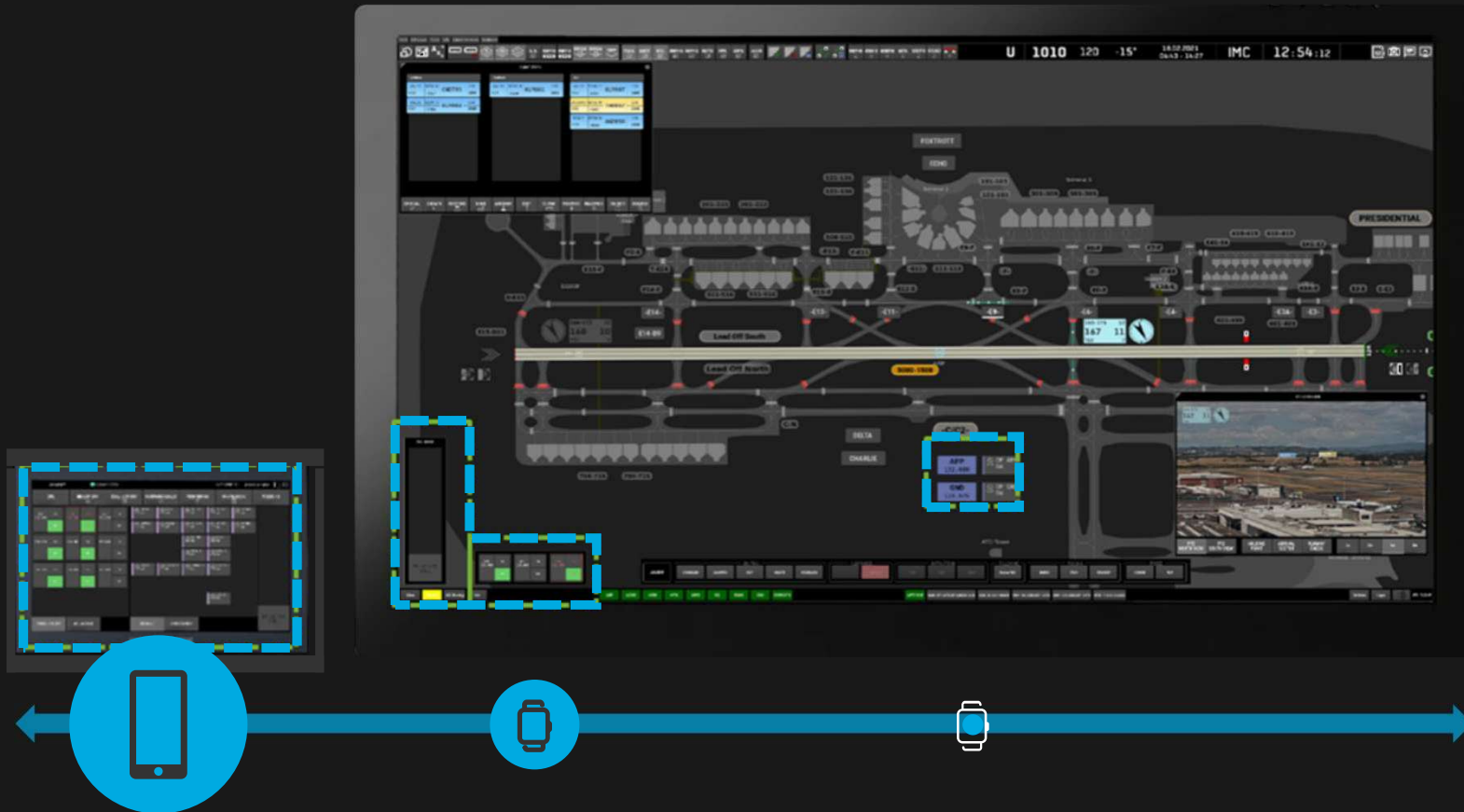
F.A. overview

FREQUENTIS

Unified aeronautical communications
Beyond voice

GUI integration in the main operational screen

Augmented and **geo-spatial** communication (e.g. Flight number, pilot name…)

Interoperable with open interfaces and mindset

SWIM-ready, future-ready and compliant with digital data services

Complete data chain, end-to-end from service provider to service consumer

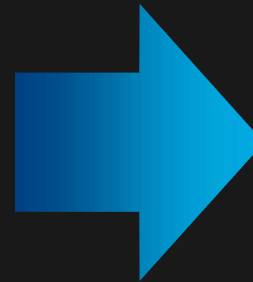**Artificial intelligence** gain advantage through actionable information management
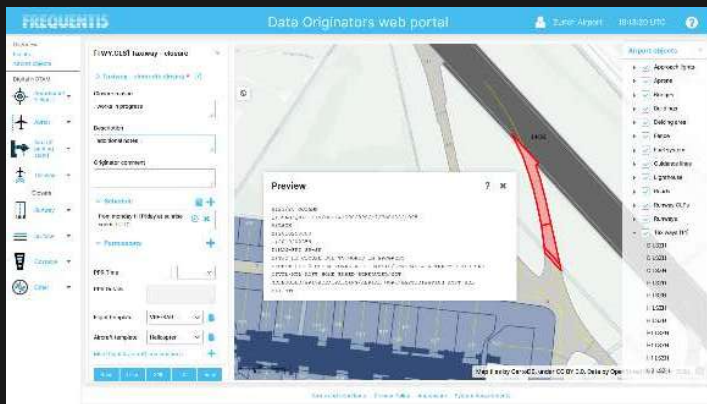
AI

Frequentis
OneATM

Actionable information management
Beyond digital transformation

Digital NOTAM platform

Digital NOTAM

Airport operator	ANSP	Airport
Proposal creation based on digital aerodrome chart	Approval workflow	Publication, Dissemination

SWIM

Synchronised traffic operations
Predictability beyond data

Performance-driven optimisation

Enhanced productivity, sequence efficiency, and the ability to predict future traffic load

Heightened **situational awareness** and reduced controller workload

Improved decision-making process especially for mixed-mode runways

Reduced ground holding contributes to a reduction in fuel burn for airlines

World's first integrated
AMAN/DMAN
ICAO ASBU B2-RSEQ

2022 – Merit Award:
Value For Money
Singapore Minister's VFM Award

F.A. overview

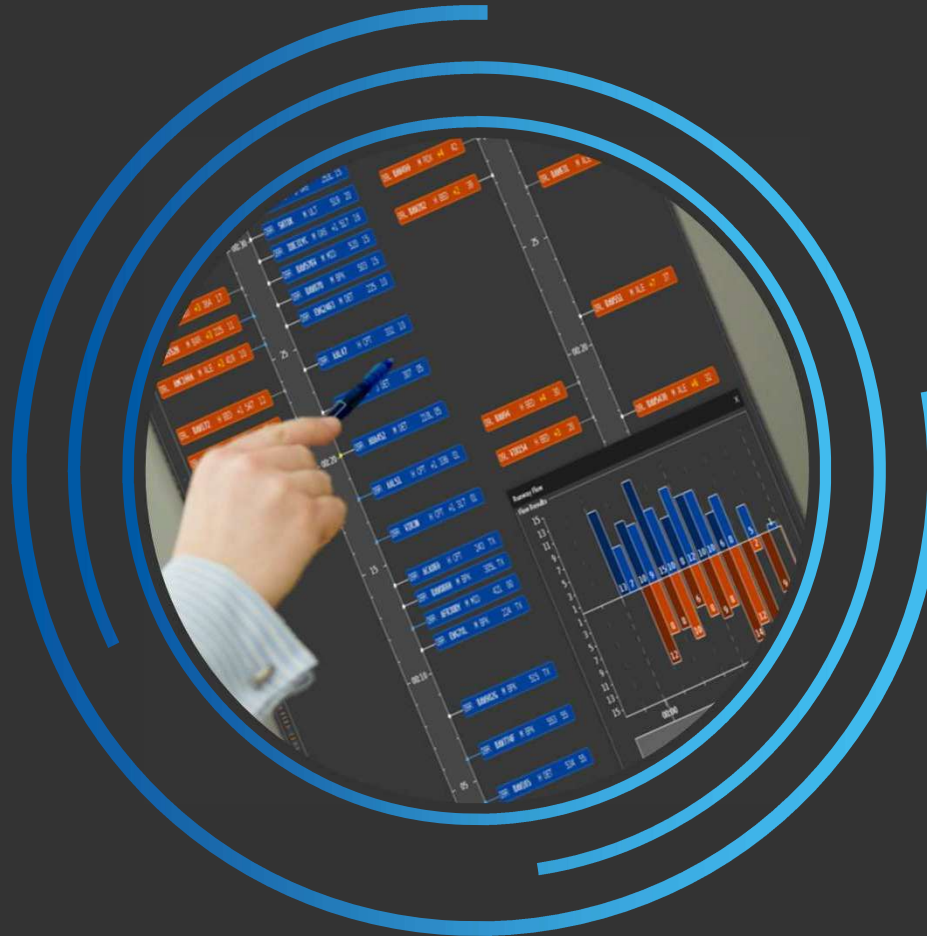FREQUENTIS

Predictability beyond data

Improved **decision-making** especially for mixed-mode runways

Improved handling of flow **constraints** and adverse conditions

Joint planning of tower and approach

Dynamic scheduling for maximised runway utilisation

Performance-driven optimisation with predictive and post-ops KPIs

Green and **efficient** operations with reduced holding
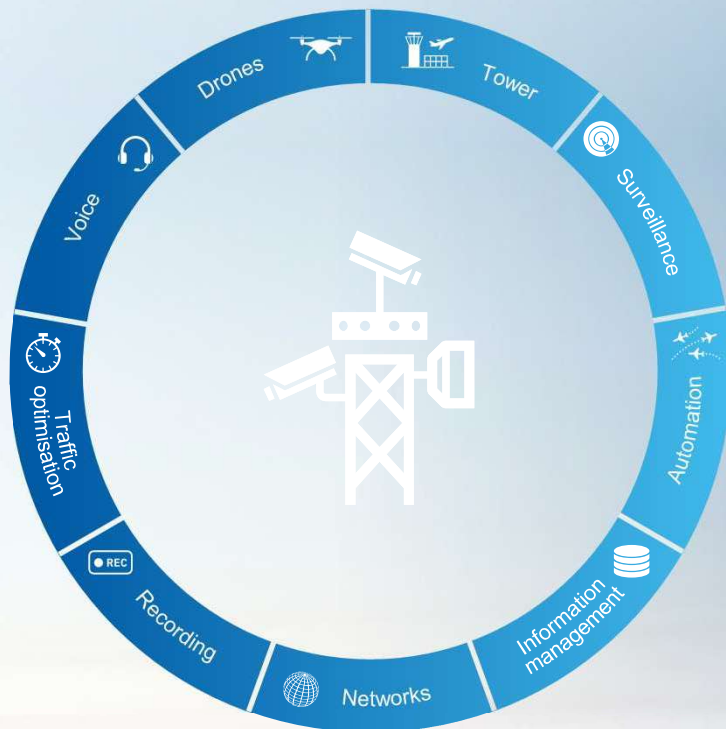
Enhanced **productivity** and sequence efficiency

Reduced controller workload through silent coordination

Heightened **situational awareness**

Performance

Remote digital tower
Rethinking airport operations

63% of the **countries** relying on remote tower technology use Frequentis solutions

80% **CAPEX savings** through reduction of construction & maintenance costs of classical towers

18% **OPEX savings** through increased operational efficiency

F.A. overview

FREQUENTIS

Remote digital tower
Rethinking airport operations

Enhanced view for improved situational awareness

Increased safety through information correlation

Operational efficiency through centre operations

Ready for multi-remote tower upgrade

Detailed view through unique PTZ camera concept

Geo-resilient multi-tower operation

Multi-remote digital tower

FREQUENTIS

Advanced automated tower
Intelligently connected

AI **Intelligent automation support**

Raising awareness for
enhanced safety and capacity

Scalable solution architecture

Expanding to hybrid digital towers seamlessly

End-to-end tower solution

Turnkey delivery, from surveillance to automation

Your operations in mind

Providing ICWP designs focused on the user

Frequentis General | © Frequentis AG 2024

F.A. overview

FREQUENTIS

Advanced automated tower
Intelligently connected

Flight-plan-based operational concept

Optimal for small or mid-sized airport without ground surveillance

Planning based on flight strips and meteorological data

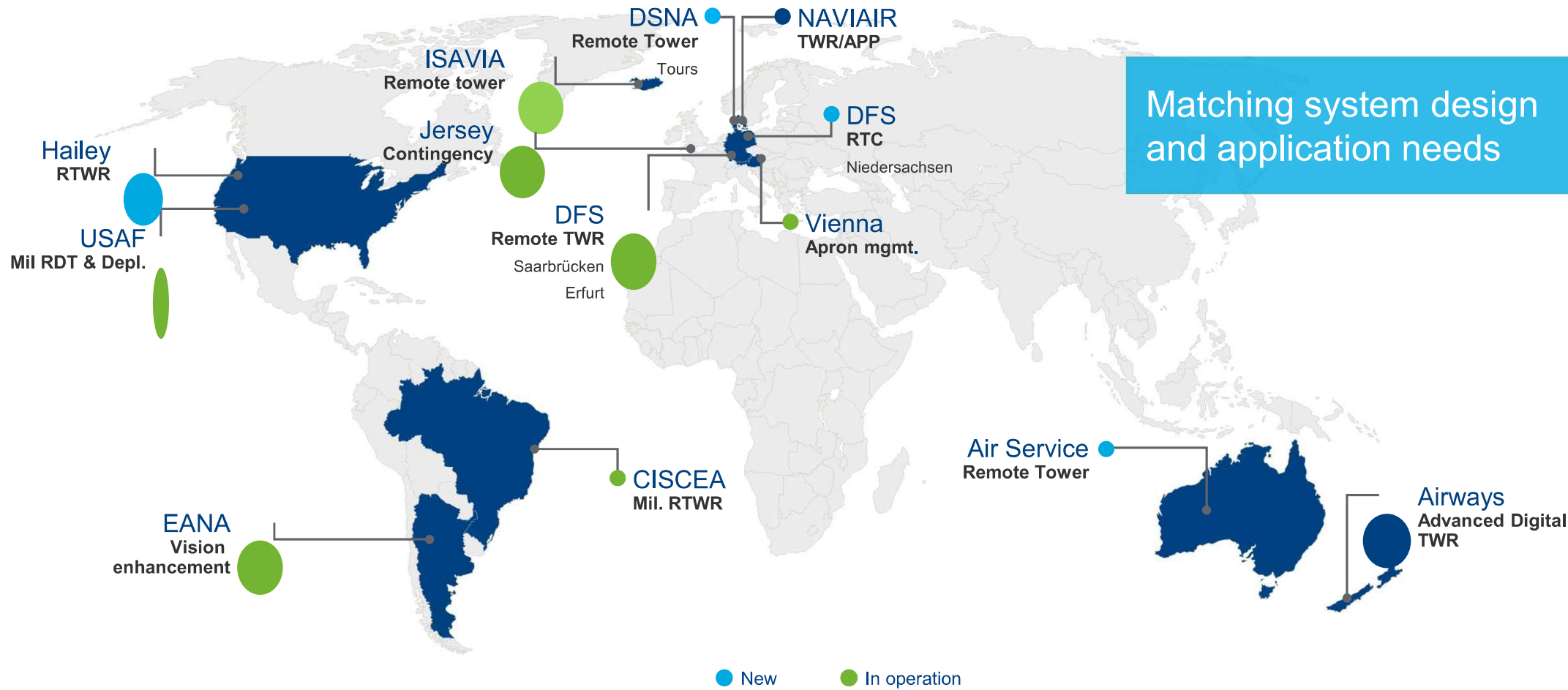Common data basis between all solution components (EFS, A-SMGCS, etc)

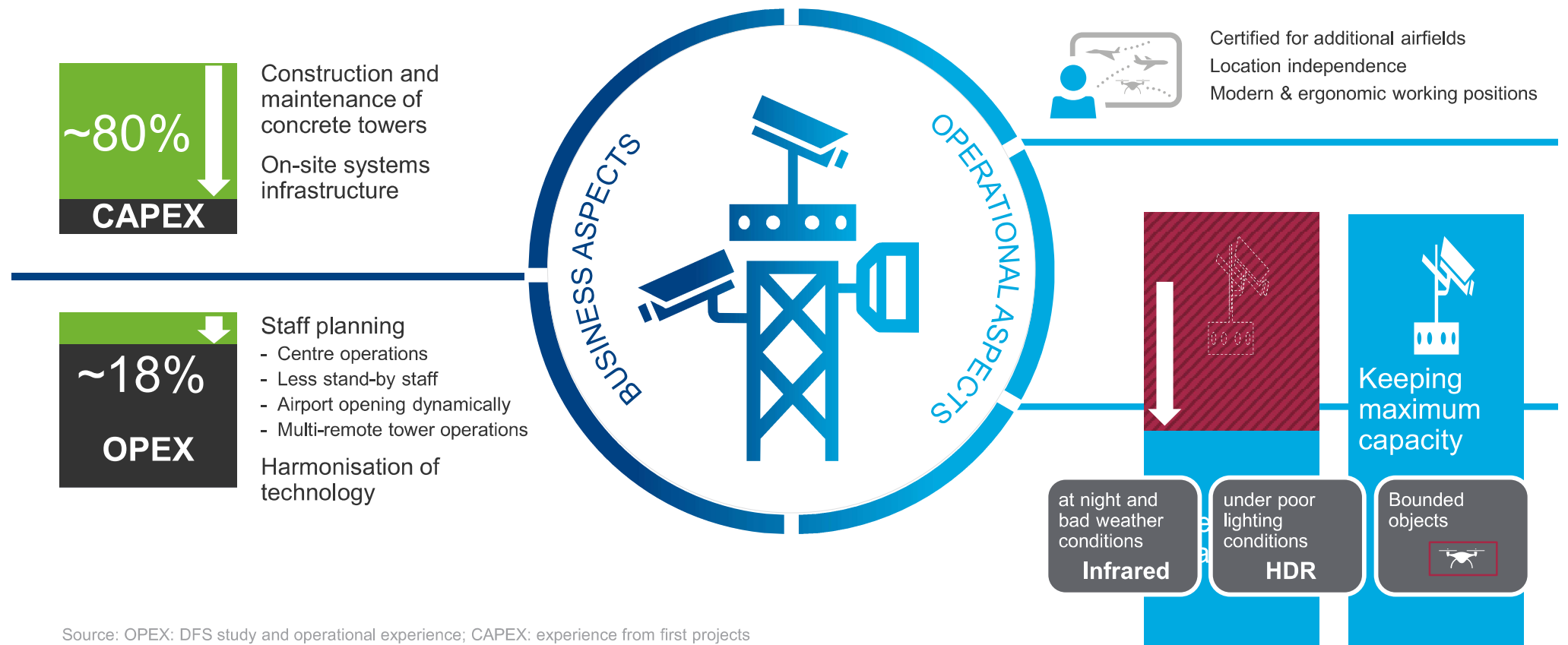End-to-end tower solution – from automation to surveillance

FREQUENTIS

Digital Tower evolution

Deployed solutions in operation around the world
Our experience

DSNA
Remote Tower
Tours

NAVIAIR
TWR/APP

ISAVIA
Remote tower

DFS
RTC
Niedersachsen

Jersey
Contingency

Hailey
RTWR

USAF
Mil RDT & Depl.

DFS
Remote TWR
Saarbrücken
Erfurt

Vienna
Apron mgmt.

Matching system design and application needs

Air Service
Remote Tower

Airways
Advanced Digital TWR

CISCEA
Mil. RTWR

EANA
Vision enhancement

● New   ● In operation

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Advancements in digitalization, safety and resilience with remote tower technology

~80% CAPEX

- Construction and maintenance of concrete towers
- On-site systems infrastructure

~18% OPEX

Staff planning
- Centre operations
- Less stand-by staff
- Airport opening dynamically
- Multi-remote tower operations

Harmonisation of technology

BUSINESS ASPECTS

OPERATIONAL ASPECTS

Certified for additional airfields
Location independence
Modern & ergonomic working positions

Keeping maximum capacity

at night and bad weather conditions **Infrared**	under poor lighting conditions **HDR**	Bounded objects

Source: OPEX: DFS study and operational experience; CAPEX: experience from first projects

FREQUENTIS

Opportunities of Remote Digital Tower solutions

End of life of an existing tower

Greenfield airport: save on construction budget

Impaired out of the window view

Business continuity
during disruptions of tower operations

Ensure highest efficiency

Bridging staff shortages
Flexible distribution of workloads
Job enrichment
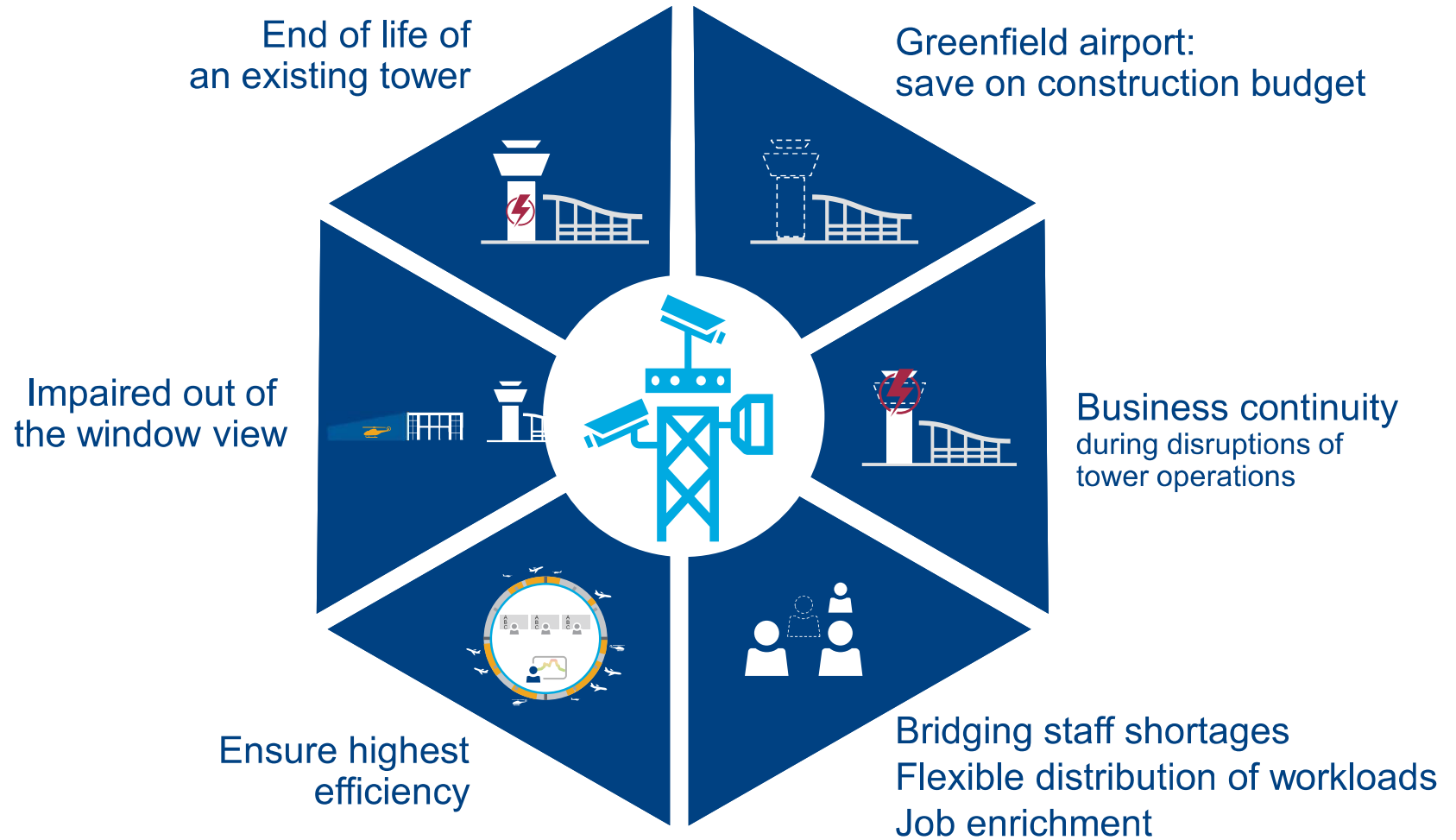
Single Remote Tower

- Single Remote Tower
- Multi-Remote Tower
- Simplified Remote
- Visual enhancement
- Contingency

Examples

- Saarbrücken (DE)
- Erfurt (DE)
- Santa Cruz (BR)

Air traffic control is carried out completely from a remote location

Sites

- Airport (Cameras + related infrastructure)
- Remote Tower Center (Controller working positions)

Remote Tower Centre

can contain multiple CWPs to control multiple airports

CWP

only one airport per CWP

FREQUENTIS

Multi-remote

Single Remote Tower

Multi-Remote Tower

Simplified Remote

Visual enhancement

Contingency

Examples

SESAR Validations
- Braunschweig
- Budapest

Multiple airports are controlled remotely from a single CWP in the RTC

Panorama layer

each airport is represented by a dedicated row of panorama screens

Control layer

planning view to indicate timely separation of flights at all controlled airports

Sqelch indication

for each airport incoming squelch indication is displayed on the control layer and panorama layer in a dedicated colour (specific to the airport)

FREQUENTIS

Simplified Remote Tower concept

- Single Remote Tower
- Multi-Remote Tower
- **Simplified Remote**
- Visual enhancement
- Contingency
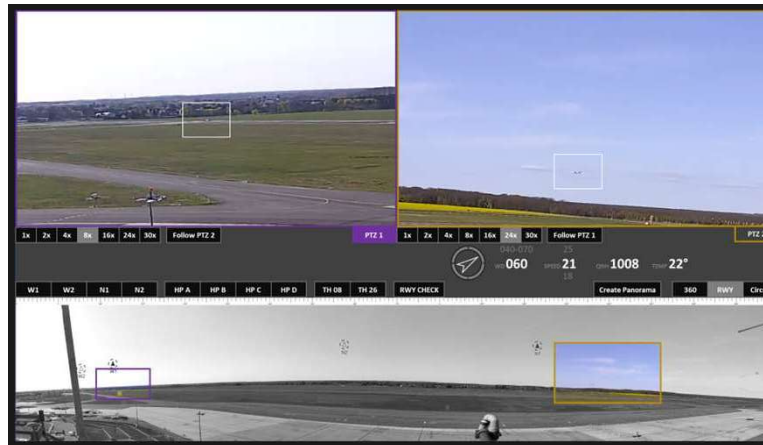
Focusing on the essentials controllers need to manage low traffic airports

Cost efficient set up with very low bandwidth demand

Simplified solution supporting small airports

WHY

Many countries do not benefit from remote tower technology so far, because of:

- Lack of internet connectivity infrastructure
- Too high investment costs
- Cost savings are not high enough to achieve a positive business case

Solution

Simplified remote tower solution with focus on:

- Controller's real needs to control small low traffic airports
- Low network bandwidth demand
- Cost efficiency
- Multi Remote Tower Capability

FREQUENTIS

Vision Enhancement

- Single Remote Tower
- Multi-Remote Tower
- Simplified Remote
- **Visual enhancement**
- Contingency

Examples

- Buenos Aires Ezeiza (AR),
- Vienna (AT)

Ensure full vision also in blind spots from the tower window

WHY

Air traffic controller's out of the window view is regularly impaired, e.g. due to:

- o Buildings obstructing the view
- o Construction work
- o Low visibility (fog, sand storms, darkness)
- o Long distances between the viewer and the objects

Solution

Overcome these issues with vision enhancement features set up in brick and mortar towers.

FREQUENTIS

Contingency

Examples

- Auckland (NZ),
- Jersey (JY)

Ensuring business continuity

Regular operations

air traffic control is still carried out from the brick and mortar tower

Contingency CWPs

deployed to a dedicated contingency centre – a certain distance away from the tower

In case the tower becomes unusable, air traffic control is moved within 30 minutes to the contingency centre at 100% capacity

FREQUENTIS

A-SMGCS introduction

A-SMGCS

A-SMGCS function blocks

Guidance service **"L4.5"**
Harmonised situational awareness

Guidance service **"L4"**
Harmonised situational awareness

Routing service **"L3"**
Control

Safety service **"L2"**
Alerting

Surveillance service **"L1"**
Harmonised traffic picture

Airfield Lighting Control & Monitoring System (ALCMS)

Electronic Clearance Input

TowerPad

Onboard moving map

Follow the greens | Onboard moving map

Manual / automatic | Pre-defined / Adaptable

RMCA
Runway monitoring and conflict alerting

CATC
Conflicting ATC clearances

CMAC
Conformance monitoring alerts for controllers

MSDF Multi-sensor data fusion and tracking

Radar | ADS-B | MLAT | Video | ….

FREQUENTIS
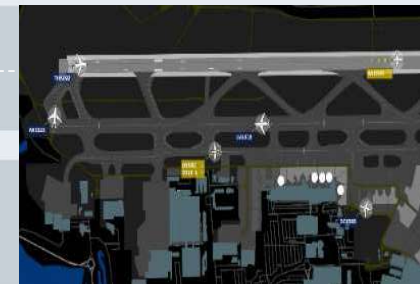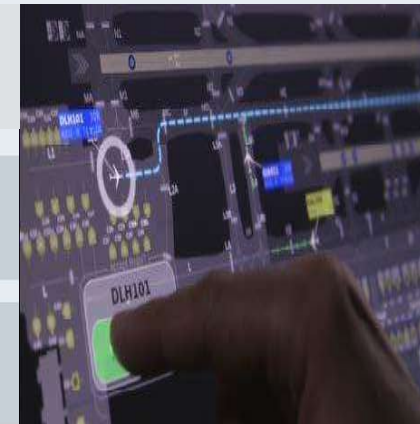
TowerPad: rethinking A-SMGCS
Example: improvements with "Follow the greens"

	CAVOK	LVC
Safety	⬆	⬆
Predictability	⬆	⬆
Communication Time	- 48%	
Taxi Time	- 17%	- 38%
Taxi Interruptions	- 41%	- 66%
Fuel Burn & CO_2	- 19%	- 41%

EXE VP-649
Follow-the-greens

"Based on more than 650 movements, one of the airports at which the solution was validated recorded a 25 % reduction in taxi time, while radio transmissions fell by the same amount. Clearance delays (the time between the pilot's push back request and actual clearance) fell by two thirds."

(Source SESAR SOLUTIONS CATALOGUE 2019 third edition p.31 SJU references: #47/ release 5)

✓ Higher safety

✓ Reduced workload

✓ Continuous taxiing

✓ Less delays

✓ Less emissions

✓ More throughput

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Multi Sensor Data Fusion & Tracking

MSDF
Multi-sensor data fusion & tracking

Surveillance engine for centre and tower

Enabling reliable and accurate situational awareness

Processing

More than 20 years of experience

traffic situation for centre and tower solutions

highly adaptable, ready for heterogenous environments

Versatile	**Scalable**	**Sensors**	**Core engine**	**Compliant**
Surveillance for ACC, APP, TWR, RDT, C-UAS	Number & kind of sensors, targets, DOI, service outputs, units	SMR, PSR, SSR, ASR, Mode-S, MLAT, ADS-B, ext. tracker, EO/IR, ..	upgrading sensor data to traffic situation for air & ground	Standard compliant traffic situation picture, ESSASP, ED87D, ..

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Surveillance engine of Frequentis centre and tower solutions
MSDF: diverse fields of application

Sensors

Radars
PSR, SMR, SSR,
Mode-S, ASR, CMB

ADS-B
ground &
space-based

Multilateration
local & wide area

External tracker
sources

INCS
electro-optical
sensors

UAS sources
cooperative/
non-cooperative

New sensor
technologies

Measurements &
target reports
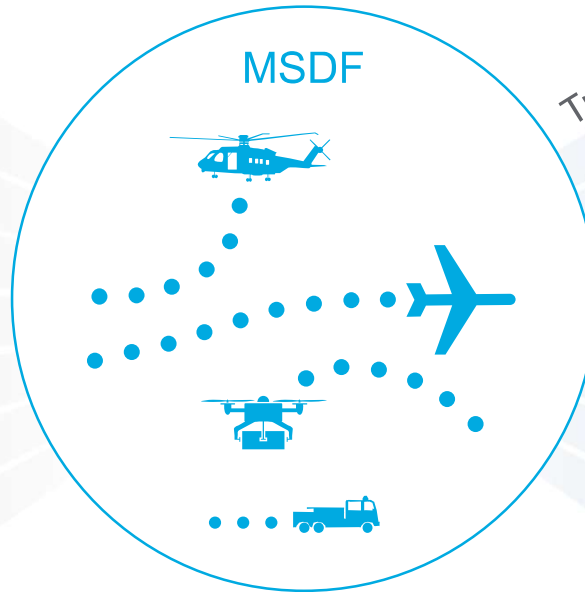
MSDF

Traffic situation picture

Surveillance service

Tracking service

EO/IR tracking service

Main/backup tracker

PSF service

ASA service

Additional service

App use cases

A-SMGCS

Counter UAS / UTM

Remote digital tower

ATM

Primary sensor fusion

ADS-B spoofing agent

Future use cases

FREQUENTIS

Demonstration
TowerPad

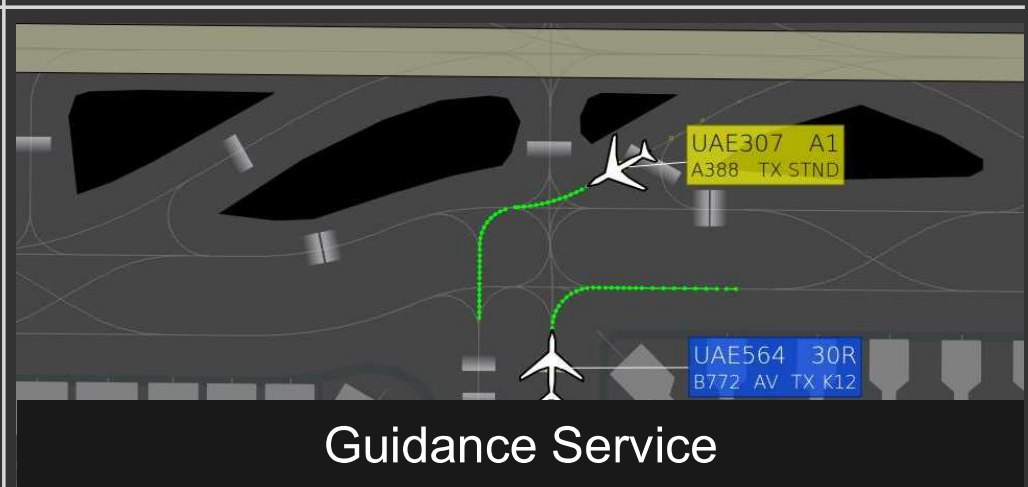# Ground traffic optimisation with extendable services and flexible iCWP display
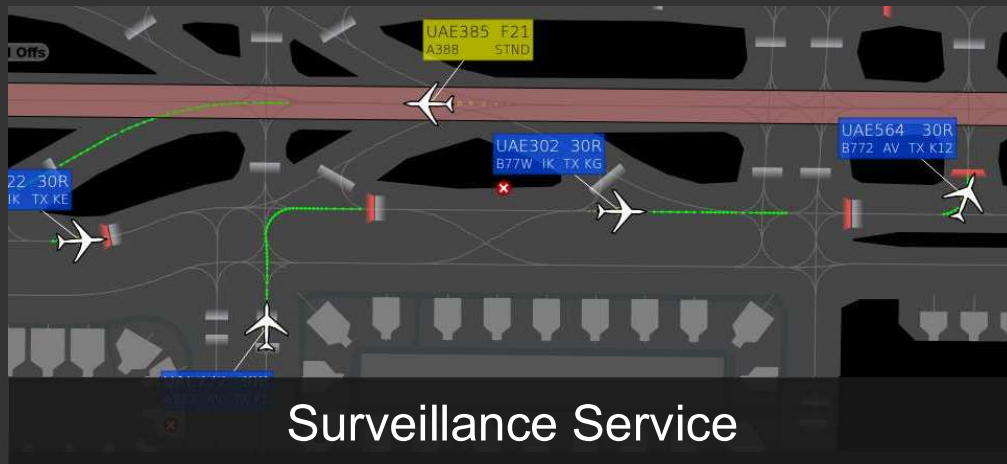
Surveillance Service
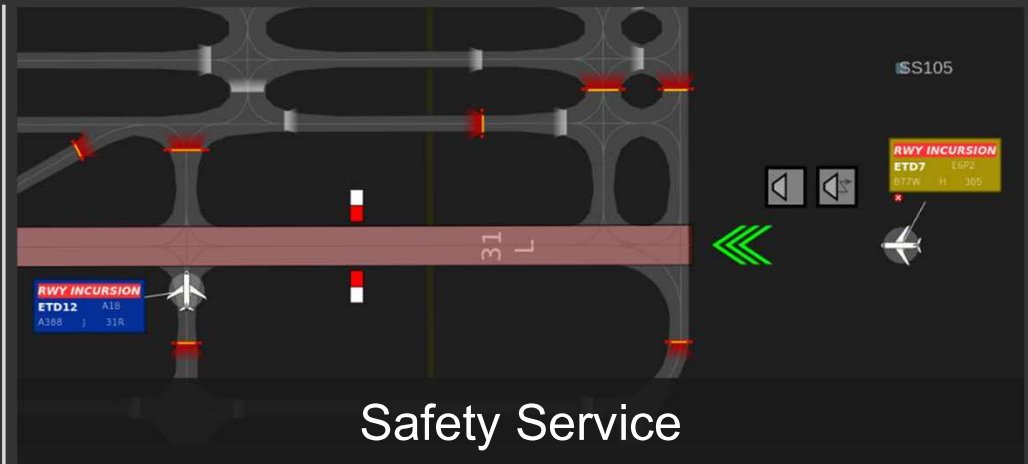
Safety Service
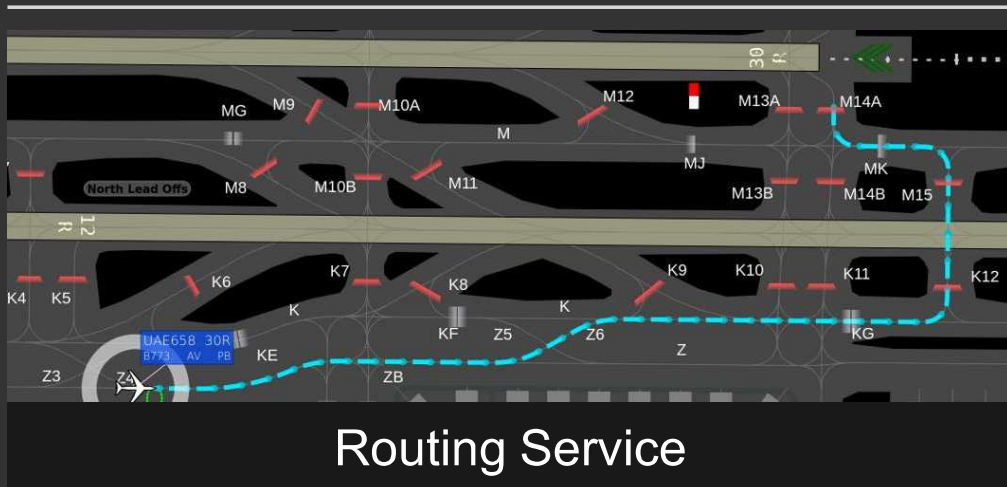
Routing Service

Guidance Service

Air Traffic Controllers' Feedback

Enhanced levels of safety and predictability leading to a better service to the airlines

Certified
ICWP Operator

Andrew Edwards
Training Specialist

Certified
ICWP Operator

Donovan Hoey
Operations Specialist

It allows me to go non-standard at a higher level of safety

I can see upfront if a situation has been deconflicted

Even in a very busy situation I can see what's happening everywhere

I have much more time to plan further ahead at pre-tactical level

I have maximum time for scanning the entire situation

It supports my workflow and I can keep the traffic moving at a higher rate

FREQUENTIS

Human factors benefits

Improved situational awareness

TWR in VMC

+44%

3,50 → 5,04

TWR in LVO

+80.2%

2,83 → 5,10

Reduced workload

GND in VMC

3,59

-53%

1,70

GND in LVO

2 operators
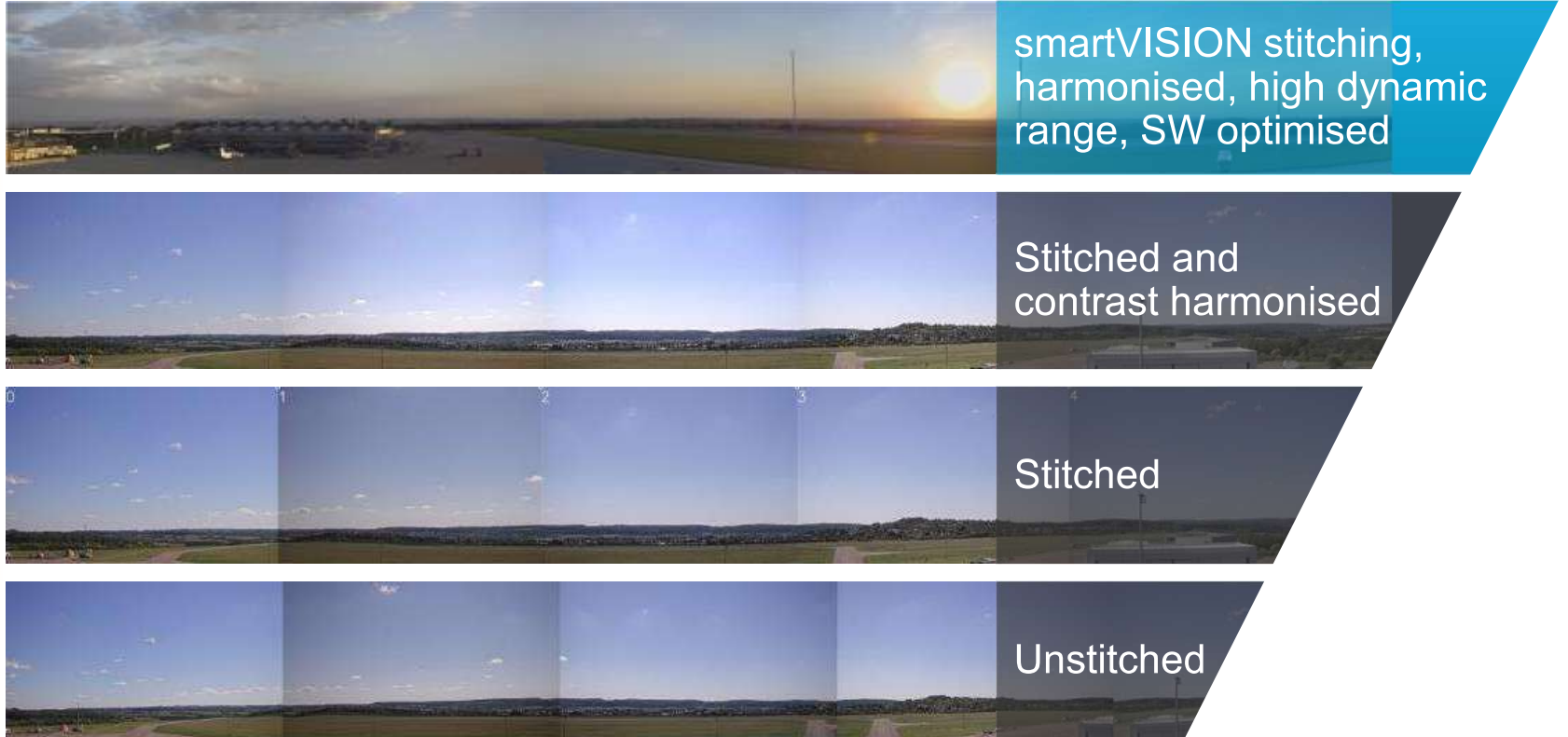4,74

-70.4%

1 operator
1,42
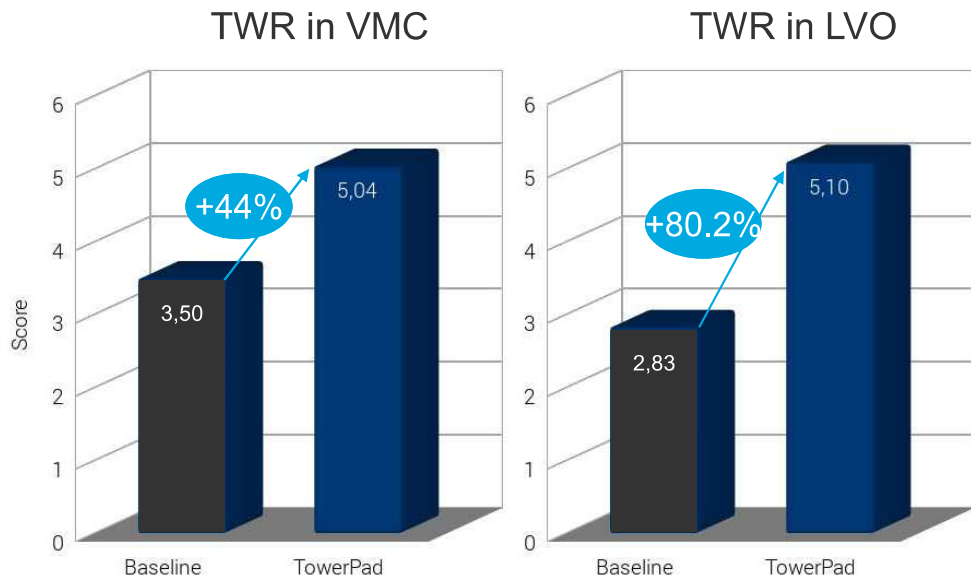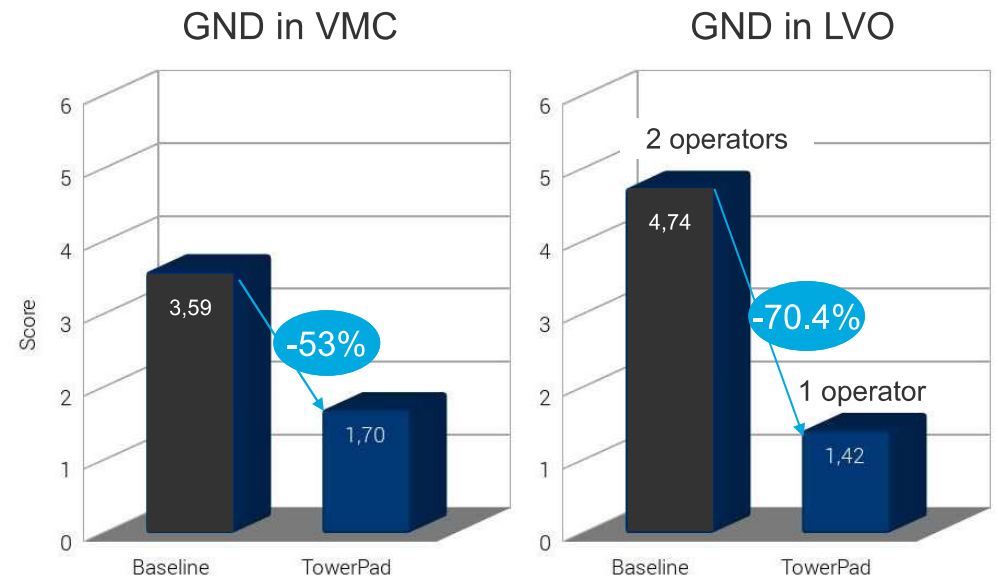
Results measured in SESAR VP-759 Validation Programme - Frankfurt Airport

FREQUENTIS

Digital Tower features shown in demonstrations

Harmonized panorama view

Avoids ATCO fatigue and mistakes because of doubled objects

smartVISION stitching, harmonised, high dynamic range, SW optimised

Stitched and contrast harmonised

Stitched

Unstitched

FREQUENTIS

High Dynamic Range (HDR)

Representing a greater range of luminance levels – close to human eye

Capturing and combining multiple different narrower range exposures of the same subject matter

FREQUENTIS

Advanced PTZ Camera designed for ATC digital tower applications

One modular PTZ system supporting

- visual
- advanced IR
- light gun

Infrared camera

Visual camera &
Light gun

EUROCAE ED 240 & ICAO (Light Gun) compliant

Detect aircraft
in far distance

in traffic pattern & final APP; detailed view of AC config.; early indication of change of course

Improved situation awareness
IR during night or low light conditions

Emergency signalling
tracking function in combination with light gun

Fast and accurate positioning

High range visual zoom sensor (30x)
Full HD 1920 x 1080 / 30 fps

Integrated light gun
ICAO certified

IR module
(uncooled – low maintenance, high sensitivity)

Dual fov – 4,6° and 14,3°

Automatic tracking
based on surv. and bounding

FREQUENTIS

Enhancing the tower view with thermal IR

Use of thermal IR technology, object tracking & augmentation
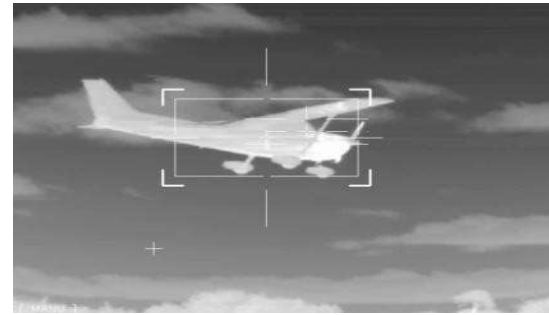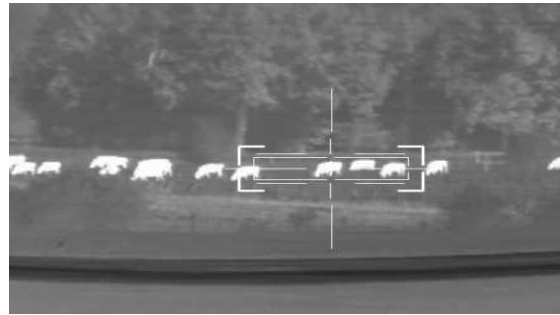
Full day and night visibility	Better visibility in sand / dust / fog	Better ground / sky contrast

No sunlight reflections	Better identification of aircrafts, cars, people, wildlife

FREQUENTIS

Augmented reality

- Harmonized panorama view
- HDR
- PTZ
- Thermal IR
- AR

C Q1031 04/M01 22509KT VMC

340 350 N 004 020 030

OS221

260-290 22
280 **15**
T3 X6 13

260-290 22
280 **15**
T3 X6 13

B

U2556

OS941

D-EBCW

A

Reduced head down times

Higher situational awareness

FREQUENTIS

Advanced augmentation - surveillance label

Support CAT 62, CAT 20, CAT 21, CAT 48

Configurable design

Interpolation & prediction
(compensate timing & update rate)

Support of multiple layers
(change between different designs)

Transparency to avoid overlaps

Filtering based on time & distance

FREQUENTIS

Bounding based on object detection & tracking

Full panorama resolution and **up to 30 fps** for smooth tracking

Latest Image Processing Technology for detection of small targets (based on motion)

Customizable for specific detection use cases by support of masks and multiple profiles

Support of **visual and IR** image sources

Output of surveillance feed (CAT 15) for data fusion

AI-based cloud filter

Support separation of aircraft in traffic pattern and final approach

Detect aircraft or vehicle on runway

FREQUENTIS

Multi-Remote Tower features

Holistic overview of all airports

Enhanced situational awareness

Multi-airport flight planner
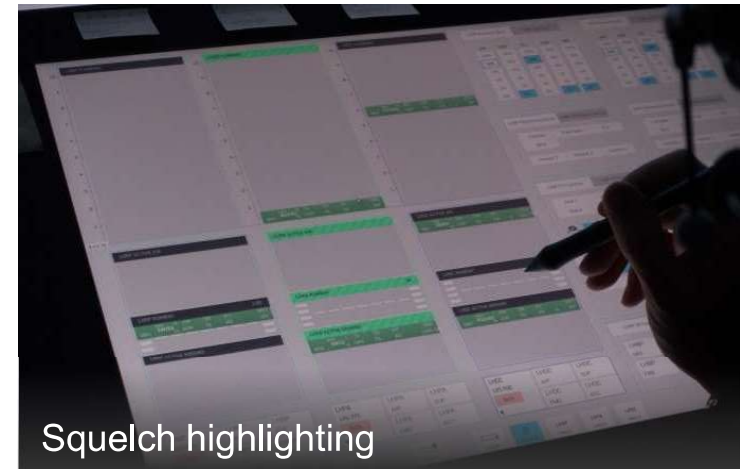
Squelch highlighting

FREQUENTIS

Frequentis OneATM

Digital.
Sustainable.
Safe.

FREQUENTIS

SESSION❷

"아태지역 ATFM 발전 현황"

김 우진

주무관

국토교통부
항공교통본부
항공교통조정과

Memo
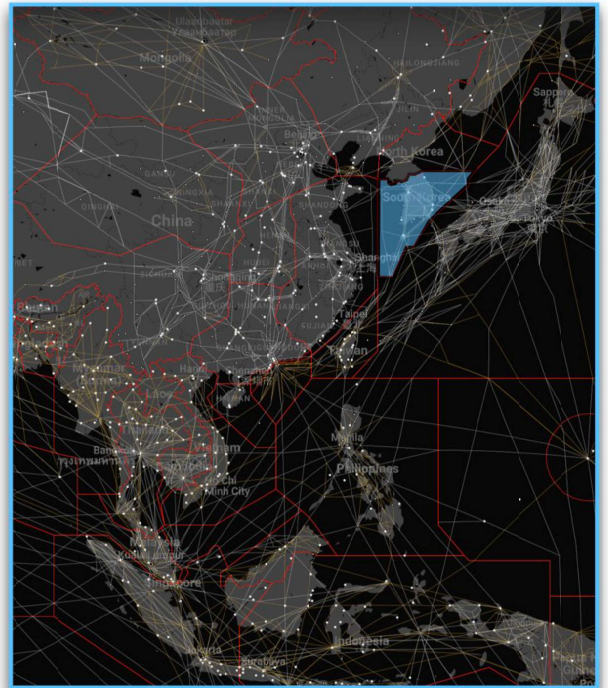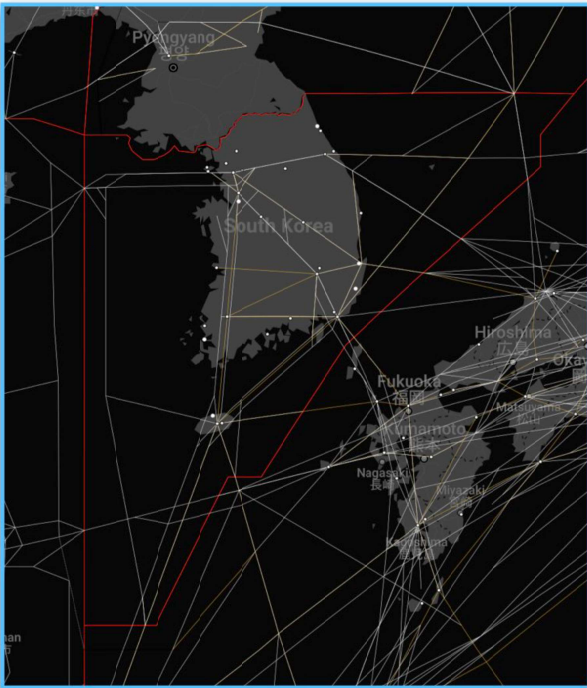
아태지역 ATFM
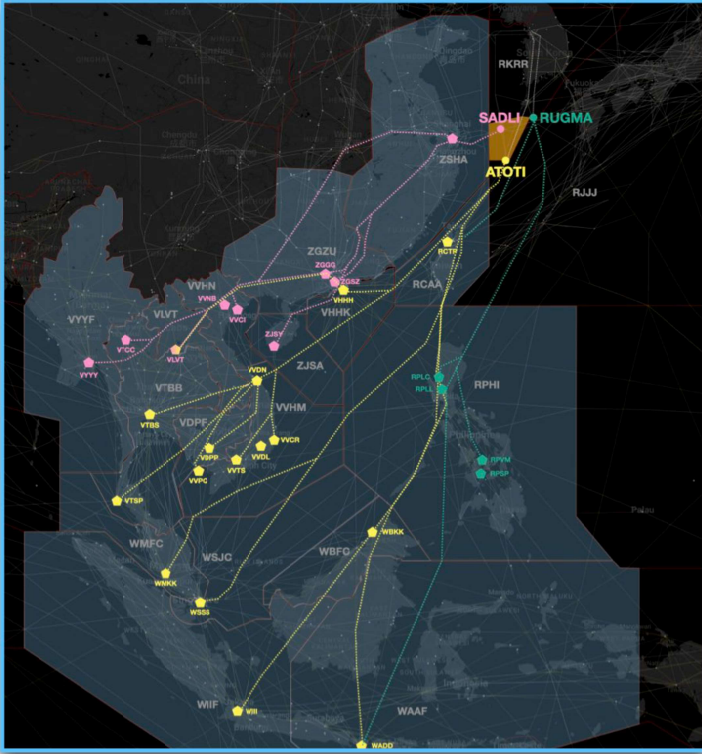# 발전 현황

선진미래항공교통 Digital AI 국제 세미나
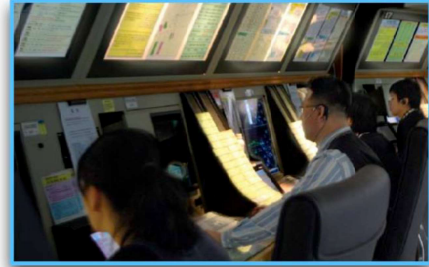'24.11.22 / 코트야드 메리어트 서울

국토교통부
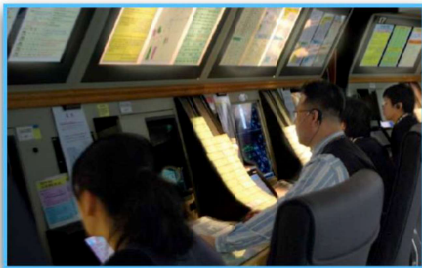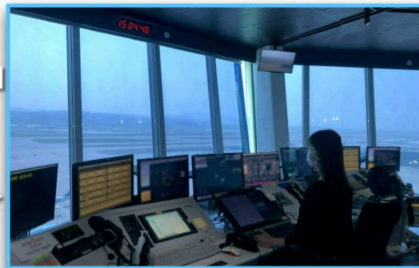항공교통본부
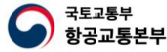
시야의 확대
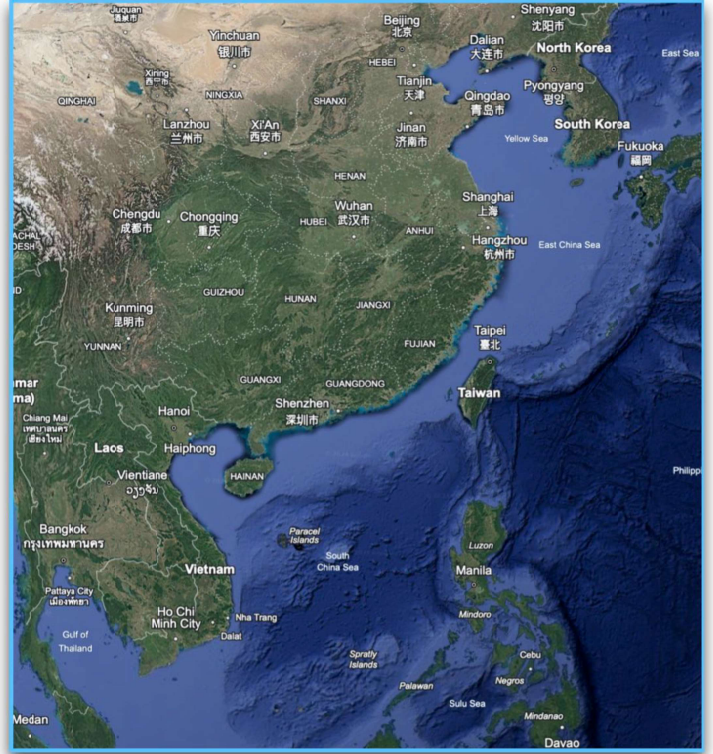
ATFM 이란 무엇인가?

Area Control Center(ACC)

- **지역관제센터(ACC) 간** 양자 합의서·양해각서에 따라, 관제이양 FIX 기준 **Restriction(제한사항)** 유선 상호 발부
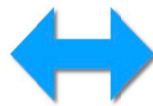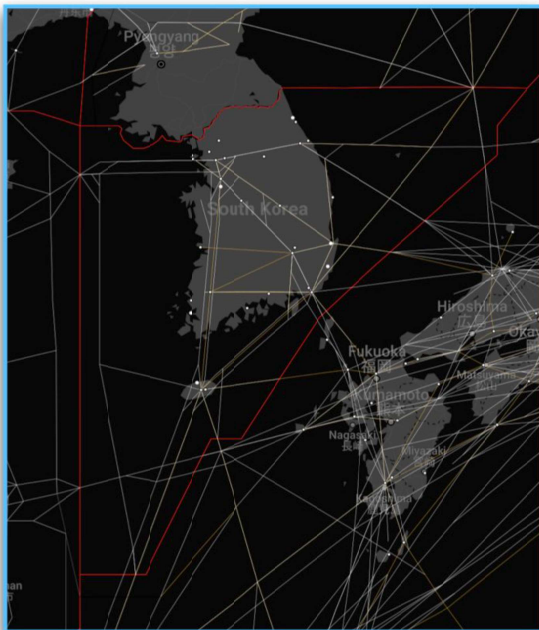- ACC 관제시스템은 출발예정시간(EOBT) 30분 전, 비행진행기록지 출력 → **ACC의 Release Time 수동 계산**

ACC   TWR   항공기

- (항공기→TWR) Push Back 요청, (TWR→ACC) Release Time 요청
- (ACC→TWR) Release Time 발부, (TWR) Release Time을 준수하여 항공기 이륙
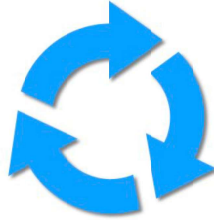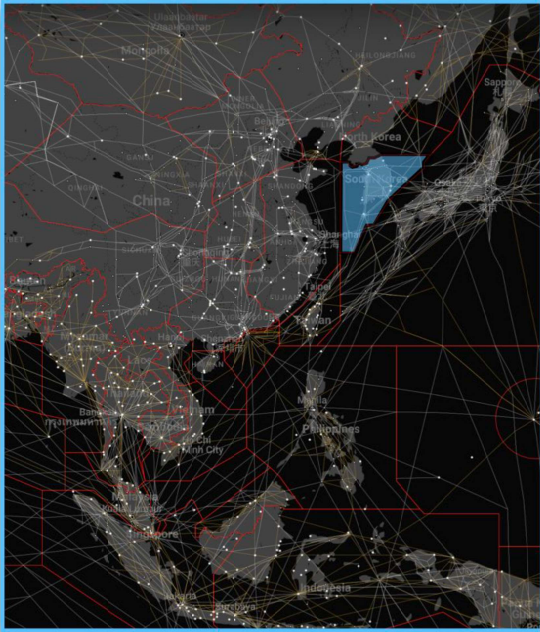
ATFM System, A-CDM System을 통한, (EOBT 120분 전) CTOT(Calculated Take Off Time) 발부

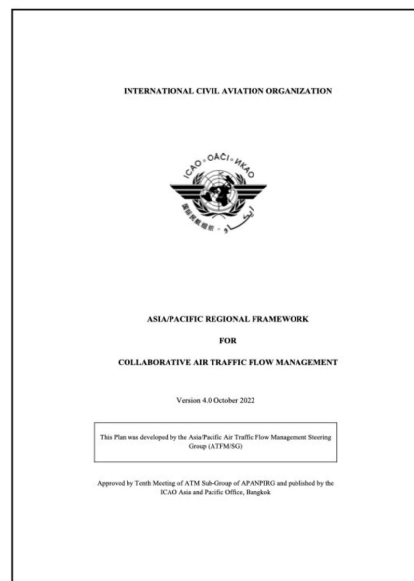**ATFM의 역할 - 1 : 인접국 간 협력**

ATFM

ATFM의 역할 - 2 : 지역 내 협력

ATFM

ATFM의 교과서

ICAO Doc 9971 : Manual on Collaborative ATFM
First Edition 2012, Second Edition 2014, Third Edition 2018

ICAO Asia/Pacific Regional Framework for Collaborative ATFM
(Version 1.0 2015 ~ Version 4.0 Oct 2022)

ICAO Doc 9971

Doc 9971

Manual on Collaborative
Air Traffic Flow Management (ATFM)

Third Edition, 2018

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO Doc 9971 : Manual on Collaborative ATFM
First Edition 2012, Second Edition 2014, Third Edition 2018

8.5.3.9   In an ideal scenario the ATFM service for a given region would be provided by a centralized ATFM organization supported by local FMUs. In many regions of the world, however, a single ATFM organization may not be feasible due to political and institutional considerations. In these instances, emphasis is placed on collaboration and on projects such as the multi-nodal cross-border ATFM.

8.5.3.10   Confronted with the hurdles associated with the establishment of a central ATFM unit, some States have decided to implement international cross-border ATFM relying on national resources and international cooperation. In this case, multiple States/ANSPs in a region implement and operate ATFM systems, which impact multiple FIRs/sectors of arspace/aerodromes (possibly in more than one State) as is illustrated in Figure II-8-2.

8.5.3.11   In this concept, each ANSP operates an independent, virtual ATFM/CDM node supported by an interconnected information-sharing framework. The flows of air traffic are then being effectively managed based on a common set of agreed principles among the participating ANSPs and airports. A node comprised of the ANSP and associated aerodromes is able to manage the demand and capacity through adjustments in aircraft calculated landing times (CLDTs), which generate calculated take-off times (CTOTs) for particular aircraft at the departure airport.

8.5.3.12   Each ANSP performs demand and capacity balancing within its own area of authority. Where ATFM measures require participation of regional and international flights, the flows will be managed by the agreed coordination procedures.

이상적인 시나리오에서는 특정 지역에 대한 ATFM 서비스가 지역 FMU의 지원을 받는 중앙 집중식 ATFM 조직에 의해 제공됩니다.
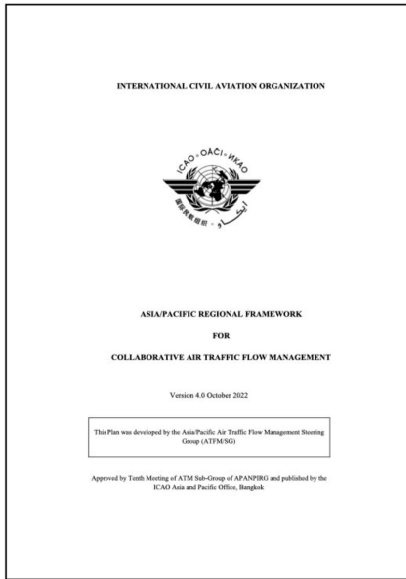그러나 전 세계 많은 지역에서는 정치적, 제도적 고려 사항으로 인해 단일 ATFM 조직이 불가능할 수 있습니다.
이러한 경우에는 협업과 멀티-노달 ATFM과 같은 프로젝트에 중점을 둡니다.

중앙 ATFM 기구 설립과 관련된 장애물에 직면한 일부 국가는 국가 자원과 국제 협력에 의존하여 국제적인 국경 간 ATFM을 구현하기로 결정했습니다.

아태지역 → 멀티-노달 → 국제 협력

ICAO Asia/Pacific Regional Framework for Collaborative ATFM
(Version 1.0 2015 ~ Version 4.0 Oct 2022)

Distributed Multi-Nodal Network ATFM Concept

3.13 The ATFM/SG/11 meeting also stressed that amendments to the Framework must remain aligned with the APANPIRG-approved Asia/Pacific ATFM Concept of Operations.

3.14 The core concept of the Framework is the Distributed Multi-Nodal ATFM Network, i.e., a network of Air Navigation Service Providers (ANSPs) and/or Sub-Regional Groups leading independent ATFM operation within their area of responsibility and connecting to each other through information sharing framework. The ATFM operations in each node will be based on regionally agreed principles and high-level operating procedures.

3.15 The concept has been accepted into the Asia/Pacific Regional Framework for Collaborative ATFM as a viable solution for the region.

3.14 프레임워크의 핵심 개념은 분산형 멀티-노달 ATFM 네트워크, 즉 각자의 책임 영역 내에서 독립적인 ATFM 운영을 주도하고 정보 공유 프레임워크를 통해 서로 연결되는 항공 항행 업무 기관(ANSP) 및 하위 지역 그룹으로 구성된 네트워크입니다. 각 노드의 ATFM 운영은 지역적으로 합의된 원칙과 높은 수준의 운영 절차를 기반으로 합니다.

ICAO Asia/Pacific Regional Framework for Collaborative ATFM
(Version 1.0 2015 ~ Version 4.0 Oct 2022)

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분산형 멀티-노달 ATFM 네트워크

하위-지역 그룹 : ATFM/SG, AMNAC, NARAHG

지역적으로 합의된 원칙과 높은 수준의 운영절차
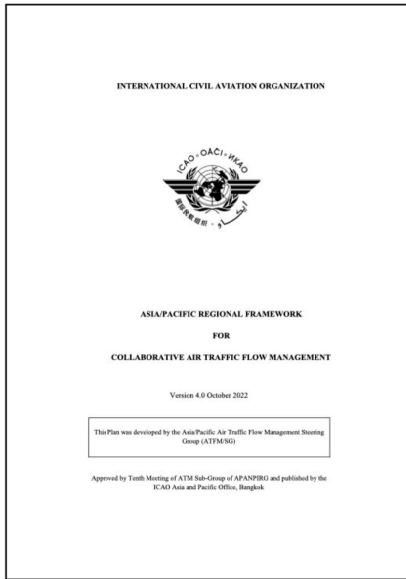
ATFM Communications by AFS

5.75   Recognizing that States' needs for ATFM may vary, where necessary ATSUs may participate in collaborative ATFM without having the need for dedicated ATFM systems or terminals. The Aeronautical Fixed Service (AFS) may provide a suitable method for distribution of ATFM measure information to such ATSUs.

5.76   Given that the main ATFM measure used in Asia/Pacific under the Distributed Multi-Nodal ATFM Network concept is the Ground Delay Program (GDP), the ability to exchange Calculated Take-Off Times (CTOTs) and other associated data elements in machine-readable formats over AFS (AFTN/AMHS) between not only ATFM systems but also ATM automation is critical. The ATFM/SG therefore studied the best practices from other regions on the topic, with particular attention paid to the EUROCONTROL Specification for ATS Data Exchange Presentation (ADEXP) which governs the AFS-based exchanges of ATFM slot-related messages within the European ATFM network.

ICAO Asia/Pacific Regional Framework for Collaborative ATFM
(Version 1.0 2015 ~ Version 4.0 Oct 2022)

분산형 멀티-노달 ATFM 네트워크 개념에 따라 아태 지역에서 사용되는 주요 ATFM 조치가 지상 지연 프로그램(GDP)이라는 점을 고려할 때, ATFM 시스템 뿐만 아니라 ATM 자동화 간에 AFS(AFTN/AMHS)를 통해 계산된 이륙 시간(CTOT) 및 기타 관련 데이터 요소를 기계 판독 가능한 형식으로 교환하는 능력은 매우 중요합니다. 따라서 ATFM/S는 이 주제에 대한 다른 지역의 모범 사례를 연구했으며, 특히 유럽 ATFM 네트워크 내에서 ATFM 슬롯 관련 메시지의 AFS 기반 교환을 관장하는 EUROCONTROL ATS 데이터 교환 프레젠테이션 사양(ADEXP)에 주의를 기울였습니다.

국가 간 시스템을 통한 CTOT 교환

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC REGION
AFTN/AMHS-BASED INTERFACE CONTROL DOCUMENT
FOR
AIR TRAFFIC FLOW MANAGEMENT

Version 2.0

Approved by the Communications, Navigation and Surveillance
Sub-Group of APANPIRG (CNS SG)
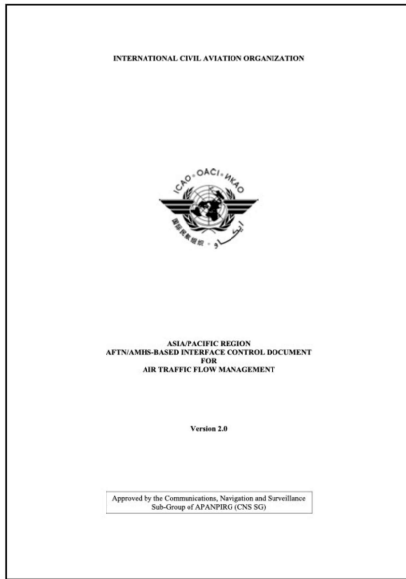
ICAO Asia/Pacific AFTN/AMHS ICD for ATFM
(Version 1.0 2019 ~ Version 2.0 2020)

Figure 5 is an example of a SAM message that follows the ADEXP structure:

—TITLE SAM
—ARCID SAA123
—ADEP FAJS
—ADES FADN
—EOBD 100303
—EOBT 1020
—CTOT 1035
—REGUL FAJS
—TAXITIME 0015
—REGCAUSE WA 84

Figure 5: SAM message using ADEXP structure

ATFM을 위한 기본 요소

아태지역 → 멀티-노달 → 국제 협력

분산형 멀티-노달 ATFM 네트워크

하위 지역 그룹 : ATFM/SG, AMNAC, NARAHG

지역적으로 합의된 원칙과 높은 수준의 운영절차

국가 간 시스템을 통한 CTOT 교환

중앙화된 ATFM
(Centralized ATFM)

Departure ✈ Overfly ✈ Arrival

Centralized ATFMU

분산형 ATFM
(Distributed Multi-Nodal ATFM)

Departure ✈ Overfly ✈ Arrival

ATFMU ↔ **ATFMUs** ↔ **ATFMU**
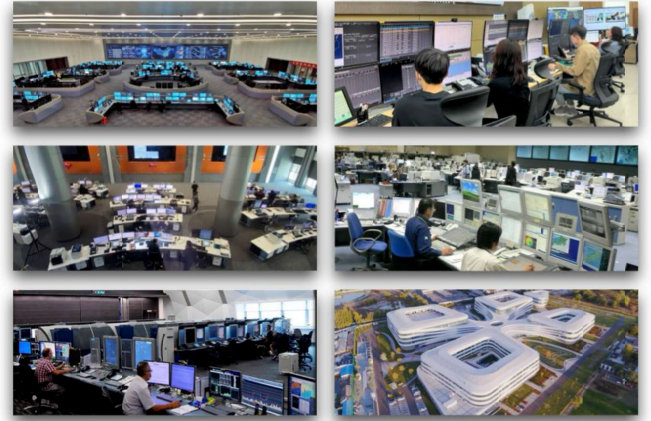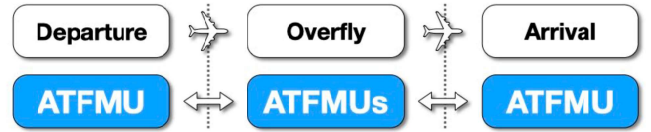
중앙화된 ATFM
(Centralized ATFM)

Centralized ATFMU
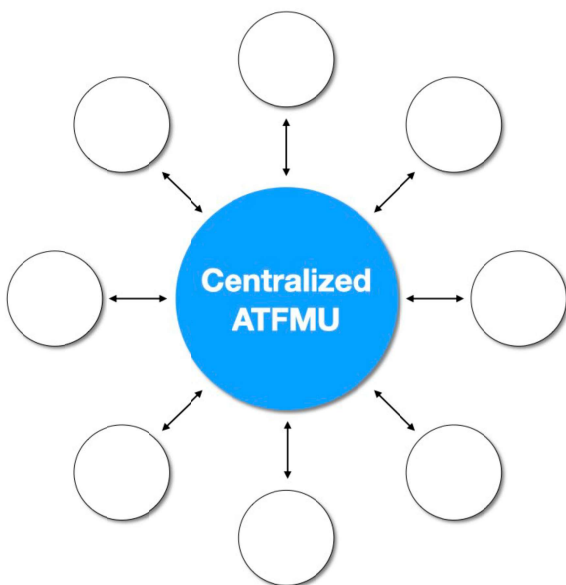
분산형 ATFM
(Distributed Multi-Nodal ATFM)

ATFMU
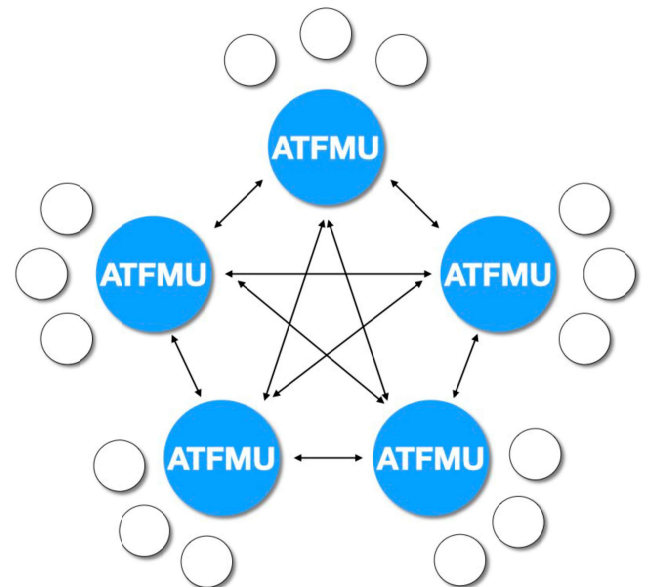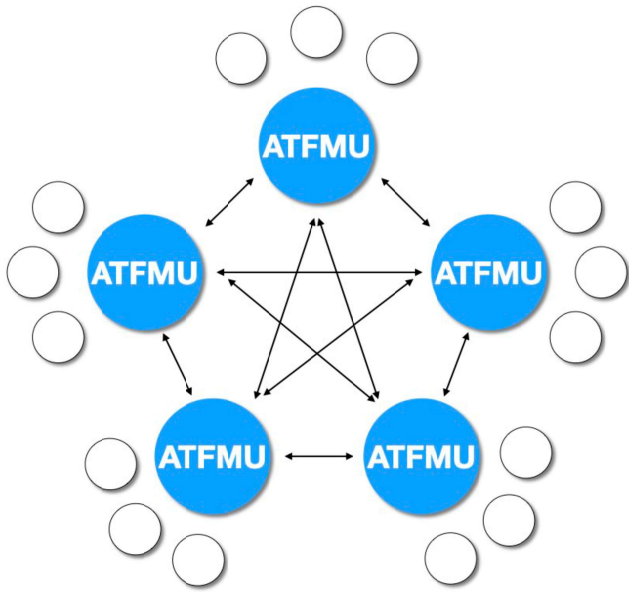
ATFM/SG
ICAO Asia-Pacific ATFM Steering Group

AMNAC
Asia-Pacific Cross-Border Multi-Nodal ATFM Collaboration

NARAHG
Northeast Asia Regional ATFM Harmonization Group

EATMCG
East Asia ATM Coordination Group

아태지역 ATFM 발전 현황

Evolution of Asia-Pacific ATFM

Research Collaboration on Regional ATFM Concept 2013

AIRBUS CAAS

Distributed Multi Nodal Regional ATFM Concept 2014 - ….

CDM

CANSO Whole-of-Flight CDM Pilot Project between BKK-SIN 2011-2012

CAAS canso

Supported by
CHANGI DCA THAI AOT

Tripartite CDM Project between BKK-HKG-SIN 2012-2013

VIRTUAL ATFM

DISTRIBUTED MULTI-NODAL ATFM NETWORK

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC REGION
AFTN/AMHS-BASED INTERFACE CONTROL DOCUMENT
FOR
AIR TRAFFIC FLOW MANAGEMENT

Version 2.0

Approved by the Communications, Navigation and Surveillance
Sub-Group of APANPIRG (CNS SG)

ICAO Asia/Pacific AFTN/AMHS ICD for ATFM
(Version 1.0 2019 ~ Version 2.0 2020)

Technical Development

2020: SWIM

Exchange ATFM data elements with SWIM-based technologies
➢ Draft ICD developed
➢ Some tests done

Exchange ATFM data elements via AFTN / AMHS
➢ ICD developed

2019: AFTN

DISTRIBUTED MULTI-NODAL ATFM NETWORK

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |

FIRST MEETING OF NORTH ASIA REGIONAL ATFM HARMONISATION GROUP (NARAHG/1)
ICAO Asia and Pacific Regional Sub-Office, Beijing China
21-22 August 2014

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

CRACP ➡ Cross Region ATFM Collaborative Platform

First mentioned on NARAHG/3 in 2015 by China

2014 **2015** 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

CRACP HITL TEST in 2017

China Japan and ROK joint made human in the loop test for cross region operation during NARAHG/5

2014 2015 2016 **2017** 2018 2019 2020 2021 2022 2023 2024 2025 2026

The 5th meeting of Northeast Asia Region ATFM Harmonization Group

2017/01/18 SHANGHAI, CHINA

CRACP project approved by China Japan and ROK after NARAHG/5

2014 2015 2016 **2017** 2018 2019 2020 2021 2022 2023 2024 2025 2026

Shanghai ATCC and Fukuoka ATMC CRACP test

China and Japan start CRACP stage 1 via internet in 7th February 2018

| 2014 | 2015 | 2016 | 2017 | **2018** | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |

NARAHG/6 MEETING

ROK setup CRACP clients in Daegu ATCC after NARAHG/6 meeting in April 2018

| 2014 | 2015 | 2016 | 2017 | **2018** | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
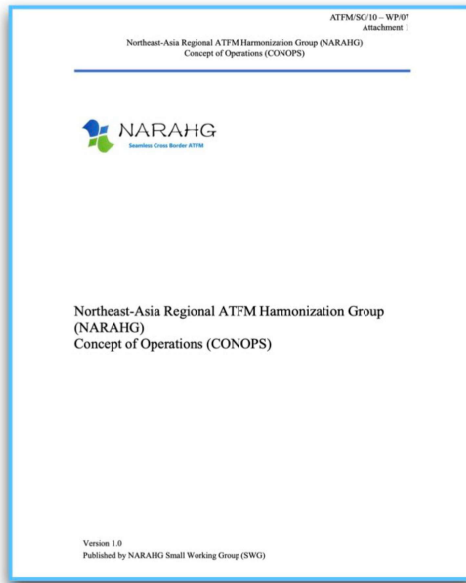
ATFM/SC/10 – WP/0?
Attachment :

Northeast-Asia Regional ATFM Harmonizaion Group (NARAHG)
Concept of Operations (CONOPS)

NARAHG
Seamless Cross-Border ATFM

Northeast-Asia Regional ATFM Harmonization Group
(NARAHG)
Concept of Operations (CONOPS)

Version 1.0
Published by NARAHG Small Working Group (SWG)

2014 2015 2016 2017 2018 2019 **2020** 2021 2022 2023 2024 2025 2026

Figure 5 Process of Cross-Border ATFM
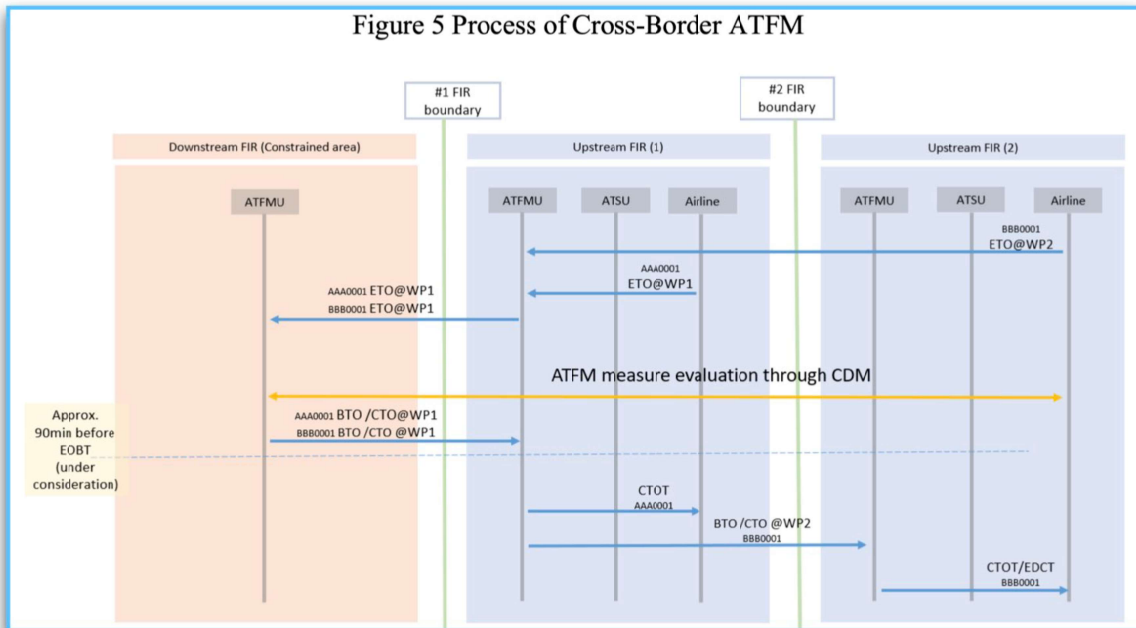
2014 2015 2016 2017 2018 2019 **2020** 2021 2022 2023 2024 2025 2026

우리나라 ATFM 발전 현황

EATMCG/15

East Asia ATM Coordination Group
('23.3월)

13 MINIT
10 MINIT
5 MINIT
5 MINIT
20 MIT at FL260
VVDN
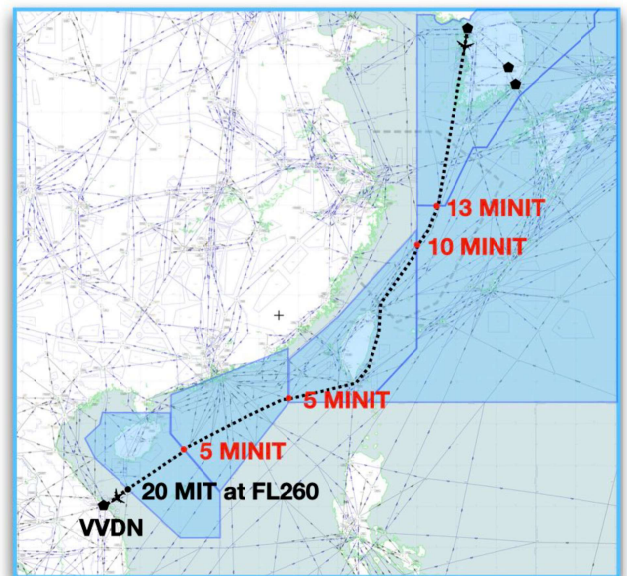
2014   2015   2016   2017   2018   2019   2020   2021   2022   **2023**   2024   2025   2026

ATFM/SG/13

ICAO Asia-Pacific ATFM Steering Group
('23.4월)

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

아국 입항 흐름관리 개선

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

'24.2.22, 04~14시/KST 국가간 제한사항 발부 현황

1. 평소 ATOTI 교통량의 50%를 차지하는 호치민FIR
2. 제한사항이 여러 FIR을 거치며 수용량이 분배되어, 호치민FIR은 10%의 수용량을 배정받음
3. 이로 인한 지연 집중 발생한 것으로 추정

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

'24.02.22 인천공항 강설·저시정 관련 Initiating

평균 1시간 40분
최대 6시간 29분
지연 발생

[24.02.22/인천착륙/ATOTI 통과 교통량 및 지연시간]

[24.02.22/인천착륙/ATOTI 통과/출발공항별 교통량 및 지연시간]

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

아국 입항 흐름관리 개선

('24.2월 기준)

평상시 ATOTI 입항 교통량 비율(04~10시/KST)

(UTC)	1800 11대	1900 15대	2000 19대	2100 22대	2200 22대	2300 9대	0000 7대
	55%	67%	74%	59%	77%	100%	43%

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

아국 입항 흐름관리 개선

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

AMNAC/21

Asia-Pacific Cross-Border Multi-Nodal ATFM Collaboration
('24.3월)

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

---

1. Possible solutions

Prevention

Understanding each other's needs, identifying unnecessary conflicts, and Prevent Conflicting CTOTs in advance

MPR

Most Penalizing Regulation

1. Proactively identify conflicting CTOTs : identify overlapping flights
2. Assess together whose separation(restriction size) is greater
3. ATFMU requiring the greater separation issues the CTOTs

Latest CTOT

If the facilitating ATFMU receives multiple CTOTs,
it adopts the CTOT with the latest one(largest delay)

One CTOT

The most upstream of multiple ATFMUs issues CTOTs
that includes the requirements of downstream ATFMUs

(AMNAC/21) Conflicting ATFM Measures Resolution Concept paper

Air Traffic Management Office
MOLIT, Republic of Korea

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

2.2   Following the discussion at AMNAC/20, ATMO and ATMB had developed further thinking around the issue and presented to the AMNAC Core Team during the Core Team session of AMNAC/21. Based on the discussion, the AMNAC Core Team identified **3 strategies to address the conflicting ATFM measures issue:**

(1) *Prevention* – The first strategy aims to prevent the occurrences of multiple ATFM measures by increasing capacity and enhancing coordination among different stakeholders.

(2) *Identifying Hotspots* – The second strategy involved identifying hotspots in the region, such as specific routes and waypoints, that are frequently subjected to multiple ATFM requirements or constraints. ANSPs/ATFM units involved in the hotspots could use the information to collaboratively improve the management of traffic in the area and reduce the need for multiple ATFM measures.

(3) *One CTOT Solution* – The third strategy proposes to consolidate all ATFM measures along the same flow into a single CTOT by the most upstream ATFMU, which would help to reduce the risk of a flight being subjected to multiple CTOTs but would require very effective CDM among ATFMUs involved in the traffic flow.

2.3   Based on the strategies above and recognizing that the Southeast Asia – Northeast Asia is one of the main traffic flows in the region often faced with multiple ATFM measures, **the AMNAC Core Team agreed to have ATMB (China), HKCAD (Hong Kong China), and ATMO (Republic of Korea) conduct operational trials based on the One CTOT Solution concept and bring the results for further discussion by the AMNAC group at the next meeting.** It was expected that this operational trial would potentially pave the way for effective resolution of conflicting ATFM measures in the region.

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

ATFM/SG/14
ICAO Asia-Pacific ATFM Steering Group
('24.4월)

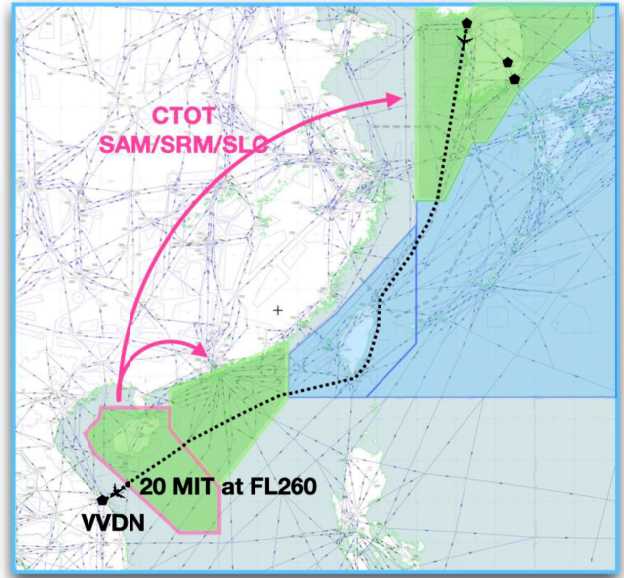

INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE METEOROLOGY/AIR TRAFFIC MANAGEMENT (MET/ATM) SEMINAR AND FOURTEENTH MEETING OF THE ASIA/PACIFIC AIR TRAFFIC FLOW MANAGEMENT STEERING GROUP (ATFM/SG/14)

Bangkok, Thailand, 22 – 26 April 2024

The views expressed in this Report should be taken as those of the Meeting and not the Organization

Approved by the Meeting and published by the ICAO Asia and Pacific Office, Bangkok
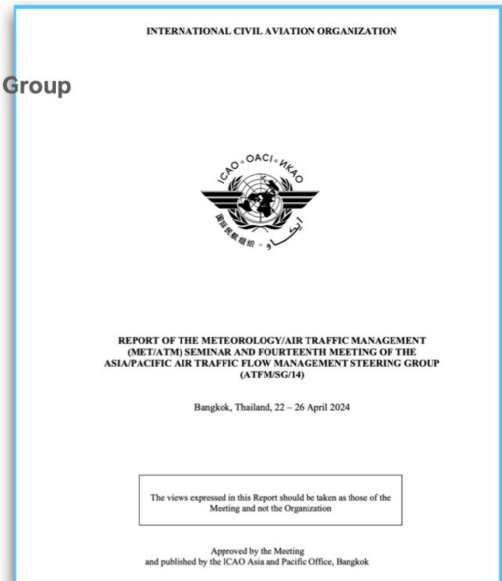
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

ATFM/SG/14

ICAO Asia-Pacific ATFM Steering Group
(’24.4월)

4.57   The AMNAC Team identified three (3) strategies to address the issue of conflicting CTOTs including:

     a)   *Prevention* – The first strategy aims to prevent the occurrences of multiple ATFM measures by increasing capacity and enhancing coordination among different stakeholders.

     b)   *Identifying Hotspots* – The second strategy involved identifying hotspots in the region, such as specific routes and waypoints, that are frequently subjected to multiple ATFM requirements or constraints. ANSPs/ATFM units involved in the hotspots could use the information to collaboratively improve the management of traffic in the area and reduce the need for multiple ATFM measures.

     c)   *One CTOT Solution* – The third strategy proposes to *consolidate* all ATFM measures along the same flow into a single CTOT by the most upstream ATFMU, which would help to reduce the risk of a flight being subjected to multiple CTOTs but would require very effective CDM among ATFMUs involved in the traffic flow.

4.58   The meeting was informed of the operational trial between China, Hong Kong China and the Republic of Korea would be conducted based on the One CTOT Solution to tackle the issue of conflicting ATFM measures along the Southeast Asia - Northeast Asia traffic flow.
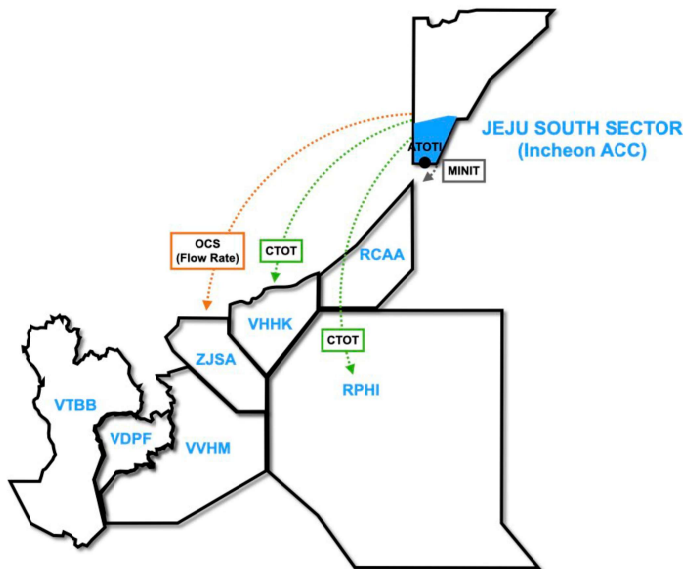
| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | **2024** | 2025 | 2026 |

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | **2024** | 2025 | 2026 |

AMNAC/22

Asia-Pacific Cross-Border Multi-Nodal ATFM Collaboration
('24.10월)

Sample: One CTOT Solution (OCS)

Description

The One CTOT Solution (OCS) operational concept aims to enhance Air Traffic Flow Management (ATFM) by consolidating all ATFM measures along the same flow into a single Calculated Take-Off Time (CTOT). This approach streamlines operations, minimizes delays, and improves overall efficiency by reducing the likelihood of a flight being subjected to conflicting ATFM measures.

The primary objective of OCS is to integrate ATFM measures from various initiating ATFMUs, acting as the ATFM Requirement Units (ARUs), and consolidate them through a single CTOT determined by the ATFM Harmony Unit (AHU). This ensures that flights comply with all constraints and ATFM requirements while maintaining optimal flow, reducing the operational burden on all stakeholders.

Description	Essential Vocabulary	Recommended Phraseology Example	Case Study

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**2024**	2025	2026

NARAHG/10

Northeast Asia Regional ATFM Harmonization Group
('24.6월)

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**2024**	2025	2026

NARAHG/10

Northeast Asia Regional ATFM Harmonization Group
('24.6월)

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 **2024** 2025 2026

ATFM의 미래는?

Workshop on FF-ICE
(Flight & Flow Information for a Collaborative Environment)
协同环境下的飞行和流量信息研讨会
2024 / 10 / 21-22
Beijing, China 中国·北京

Workshop on Cross Border ATFM Development
跨境流量管理发展研讨会
2024 / 10 / 23-24
Beijing, China 中国·北京
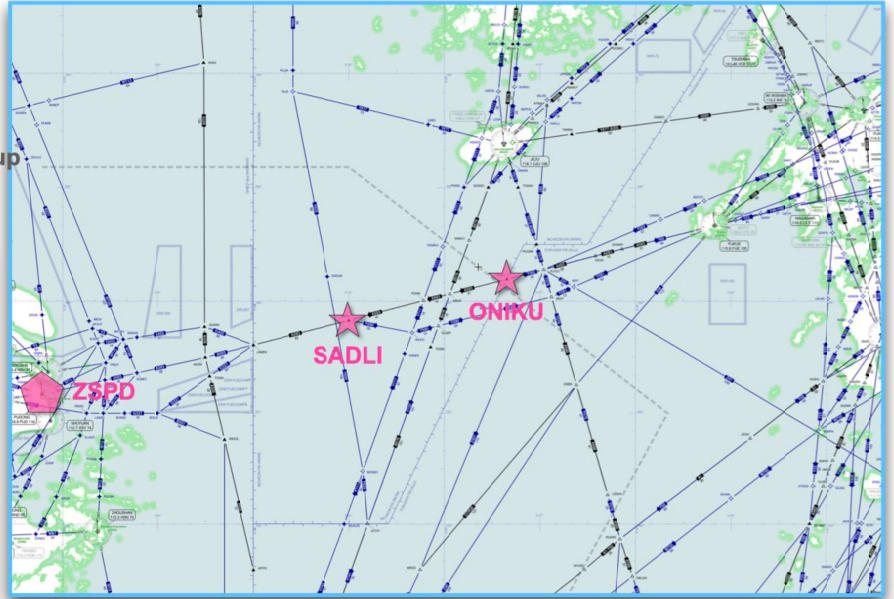
CANSO

SUBSCRIBE   JOIN CAN

CANSO website > News & views > Blog > Regional Cross-Border ATFM Virtually! Really?

Regional Cross-Border ATFM Virtually! Really?

🕐 18/10/2024

"In computing, the term virtual refers to a digitally replicated version of something real, whether it's a machine, a switch, memory or even reality. It is distinguished from the real by the fact that it lacks an absolute, physical form. However, functionally it is no less real." Tech Target

ATFM in the Asia Pacific is approaching an inflection point.

At the Asia Pacific Cross-Border Multi-Nodal ATFM Collaboration (AMNAC) meeting held from 14 to 18 October, CANSO introduced the idea of the Next Generation ATFM for the region which the group agreed to further evolve. To understand where we can go next, we need to first understand where we came from.

The original concept of ATFM can be traced back to the ICAO European Air Navigation Conference in 1971 which established the term "flow control" to balance rising traffic demand with ATS capacity. Despite the idea of a European Flow Control Centre being surfaced in 1972, 12 European ATFM units were subsequently established at the national level. Cross-border coordination was limited as the approach was not whole-of-region. It soon became obvious that this arrangement was not good enough. No real change happened until air traffic delays became headline stories. This triggered the European Transport Ministers' decision in 1988 that led to the formation of the Centralised Flow Management Unit.

The situation in the Asia Pacific today bears some similarities to Europe before 1988, albeit with more cross-border awareness. Asia Pacific States with large domestic traffic perform ATFM mainly within their national borders. Initial but limited cross-

About the Author

Poh Theen Soh, Director Asia Pacific Affairs, CANSO, looks at how ATFM in the Asia Pacific is approaching an inflection point

Similar Posts

Learning lessons to build resilience ⊙

CANSO drones exhibition wins over European Parliament ⊙

CANSO

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CANSO website > News & views > Blog > Regional Cross-Border ATFM Virtually! Really?

Regional Cross-Border ATFM Virtually! Really?

🕐 18/10/2024

ATFM의 원래 개념은 1971년 ICAO 유럽 항공항법 회의에서 증가하는 교통 수요와

ATS 수용 능력의 균형을 맞추기 위해 "흐름관리"라는 용어를 확립한 것으로 거슬러 올라갈 수 있습니다.

1972년 유럽 흐름관리 센터에 대한 아이디어가 수면 위로 떠올랐음에도 불구하고

이후 12개의 유럽 ATFM 기관이 국가 차원에서 설립되었습니다.

접근 방식이 지역 전체가 아니기 때문에 국경 간 조정이 제한되었습니다.

곧 이러한 체계가 충분하지 않다는 것이 분명해졌습니다.

항공 교통 지연이 헤드라인을 장식할 때까지 실질적인 변화는 일어나지 않았습니다.

이로 인해 1988년 유럽 교통부 장관들의 결정이 촉발되어 중앙 집중식 흐름관리 기관이 구성되었습니다.

당연히 전환에 대한 우려가 있을 것입니다. ANSP는 통제권을 잃거나 기존 ATFM 사업부를 해체해야 할까 봐 두려워할 수 있습니다. ATFM 계산 도구는 가상이지만, 루프에는 인간이 존재하며 기존 ATFM 사업부의 역할은 진화할 것입니다. 참가자들이 궁극적으로 통제할 수 있는 것은 계약이 자발적이며 상호 이익이 되는 경우에만 계속된다는 것입니다.

이러한 미래 지역 ATFM의 가장 큰 장애물은 신뢰입니다. 형평성을 위한 관련 기본 규칙을 확립하고 투명성을 보장하기 위해서는 프레임워크 또는 지역 감독 기관이 필요합니다. 국경을 넘는 의사 결정은 복잡한 조직 행동을 수반하는 춤입니다. 진전은 새로운 정책으로 이어지는 사고방식의 변화에 따라 달라질 것입니다. AMNAC 회의에서 CANSO가 제안한 것처럼, 새로운 아이디어에 대한 신뢰를 구축하는 한 가지 방법은 시험을 실시하고 스트레스 테스트를 하는 것입니다. AMNAC 2.0의 시간이 가까워졌습니다.

감사합니다

항공교통본부 항공교통조정과
김우진 주무관
053-668-0494
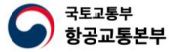
국토교통부
항공교통본부

SESSION❸

" FREQUENTIS DIGITAL TOWER Tech Demo "

BAUMHOLZER David
Frequentis Australasia Pty Ltd
Senior Solution Consultant,
Technical Solution Manager

" FREQUENTIS DIGITAL TOWER Tech Demo "

" FREQUENTIS DIGITAL TOWER Tech Demo "

SESSION ❹

"FREQUENTIS Tower Pad A-SMGCS Demo "

Peter Gridling
Frequentis HQ Vienna, Austria
Senior Solution Consultant,
Advanced Digital Tower Automation

"FREQUENTIS Tower Pad A-SMGCS Demo "

SESSION ❺

" GOAMACE AVCS, K-UAMCS Demo "

HOE KIM
㈜ 고암에이스 / 상무이사
AI, Bigdate, ATM data 전문가

" GOAMACE AVCS, K-UAMCS Demo "

AVCS
보안구역내 차량통제 안전 시스템
(Airside Vehicle Control System)

항공지상 조업 안전 차량 관리, AVCS

(지상조업 특수차량)

K-UAMCS
Korea - Urban Air Mobility Control System
한국형 도심항공 모빌리티 관제 시스템

한국형 도시항공모빌리티는 새로운 항공 교통수단
다양성을 포괄하여 서비스 제공 통합 드론 관제 시스템

기관소개

(사) 한국항공교통관제사협회

㈜고암에이스 GOAMACE

(사)한국항공교통관제사협회
Korea Air Traffic Controllers` Association

2010년 1월에 설립된 우리 협회가 어느덧 창립 15주년이 됩니다.
새로운 비전과 연구를 통해 대한민국 항공산업 발전에 기여하고자 최선을 다할 것입니다.
회원 여러분의 따뜻한 관심과 지도편달을 부탁드립니다.

항공교통관제사협회 회장

인하대학교 대학원 교통경영학 석사
(현)인천공항운영서비스(주) 대표이사
인천국제공항공사 부사장
인천국제공항공사 운항본부장
인천국제공항공사 운항본부 처팀장
국토교통부 서울지방랑공청 운항관제

항공교통관제사협회 부회장

인하대학교 국제통상물류대학원 수료
(현)한국항공재단 사무국장
국토교통부 서울지방항공청 항공안전과장, 관제과장
부산지방항공청 항공운항과장
국토교통부 항공정책실 사무관

(사)한국항공교통관제사협회
Korea Air Traffic Controllers` Association

협회소개

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인사말

인사말
———

한국항공교통관제사협회를 방문해 주신 **회원 및 일반** 방문객
여러분들을 진심으로 환영합니다.

㈜고암 에이스

안전하고 체계적인 ATM, CNS 솔루션과 기술
고암에이스가 제공합니다.

Air Traffic Managerment / Communication Navigation Surveilance

한국담당 임원

신 현수, Jake Shin

Vice-President and ATM CTO

GOAM ACE, **항공교통관제사**

AVCS
Airside Vehicle Control System
보안구역내 차량통제 안전 시스템

K-VDGS
Korea - Visual Docking Guidance System
한국형 주기장 유도 안내시스템

K-UAMCS
Korea - Urban Air Mobility Control System
한국형 도심항공 모빌리티 관제 시스템

FREQUENTIS
ATM Solution Global Korea Agency Partner
글로벌 기업 프리퀀티스 한국총판

(사업분야 및 주요 솔루션)

소개자료

- FREQUNTIS Solutions

- AVCS V2

Frequentis OneATM

DIGITAL.
SUSTAINABLE.
SAFE.

FREQUENTIS

FOR A SAFER WORLD

ABOUT
FREQUENTIS OneATM

Frequentis was established to develop technologies for a safer world. This philosophy is still valid, but today our ambitions reach even further. With Frequentis OneATM we offer a holistic approach to address ATM needs today and in the future, leveraging the power of integration by uniting market-leading technologies into one open ATM ecosystem.

DIGITAL.
SUSTAINABLE.
SAFE.

Air navigation service providers seek to introduce the latest technologies in order to increase their overall performance and harmonise operations across the multiple centres they operate. The latest technologies also make it easier to adopt new organisational set-ups when and where required. This is where Frequentis leads the way, by continuously innovating, by integrating multiple solutions to simplify the way operations are run, and by achieving the highest performance in order to guarantee safety and continuity.

FREQUENTIS OneATM
FOUNDATIONS

With OneATM, Frequentis addresses the key airspace challenges with a single objective in mind: to break down both technical and organisational silos and move to collaborative operations. Doing so will drive strong improvements in all areas of airspace operations and is the basis for a safer airspace.

Simplicity, openness and performance are the foundations on which OneATM is built.

ONE AERONAUTICAL SUITE

Frequentis offers a full set of market-leading products to cover all ATM operational needs today and in the future.

PROVEN AND TRUSTED

More than 75 years of experience in safety-critical environments, with ten thousand positions installed around the globe, make Frequentis a proven and trusted partner for providing safety-relevant systems.

INNOVATING THE SAFETY CRITICAL ENVIRONMENT

Innovation is the engine that drives Frequentis. Finding the right balance between the power of innovation and the need to guarantee a safety-critical environment.

OneATM

OPEN FOR INTEGRATION

Technologies can operate as stand-alone or united in a single best-in-class system, providing strong operational advantages and productivity gains while reducing operational risks.

DRIVING SIMPLICITY & PERFORMANCE

Simplicity and performance are part of our DNA. We strongly focus on the integration of new digital technologies to bring operational performance to the next level.

ASSURING OPERATIONAL RESILIENCE

Cybersecurity and system resiliency are critical requirements in guaranteeing airspace safety. Frequentis OneATM ensures the best operational resilience throughout the entire lifecycle.

FREQUENTIS OneATM FOCUS AREAS

Frequentis OneATM utilises integration capabilities to transform airspace management in multiple dimensions. The visionary aspects and advantages of OneATM showcase our direction and the potential of our technology. Exploring the focus areas of Frequentis OneATM will reveal the impressive benefits of our integrative approach.

Remote digital tower
Rethinking airport operations: New concepts for the management of digital towers that allow for a smooth evolution to new operational models and the seamless integration of new technologies.

Actionable information management
Beyond digital transformation: Harmonised systems enable digitalisation whereby automation systems can safely identify, interpret, and exchange data then bring it to the attention of the ATCO at the right place and time.

Harmonised control centres
The power of versatility and integration: Fully expandable and modular architecture enabling the continuous addition of functionality through easy integration. Air traffic controllers can access the information and controls required for enhanced situational awareness and faster reaction times.

ATM-grade networks
Leading the way towards the digital sky: Next-generation communication technologies for both air-ground and ground-ground communication with ATM-grade reliability.

Unified aeronautical communication
Beyond voice: Seamless and harmonised communications between controllers and pilots, regardless of technological boundaries. Integrating verbal and non-verbal communication in one unified solution.

Synchronised traffic operations
Predictability beyond data – performance driven optimisation: Unique toolset optimising the entire flight operation, providing stakeholders with a combined 4D view of their operations, ensuring continuous high performance.

Accelerated drone management
Safe and compliant orchestration of new airspace users: Fair access to all users is essential in a unified airspace. Frequentis offers SWIM-compliant UTM services based on an ATM-grade back-end.

Advanced automated tower
Intelligent and connected: Seamlessly integrated flight information, surveillance and communications provide excellent situational awareness and enable automated decision support for air traffic controllers.

Open digital platform
Transition towards service-based ATM: The foundation of the OneATM ecosystem is the MosaiX platform, which hosts the applications and enables their smooth and easy integration. This paves the way for new operational concepts and environments.

Remote Digital Tower
Advanced remote sensing

Field-proven

Scalable and flexible

Turnkey solutions and services

FREQUENTIS DFS
AEROSENSE

Balancing modernisation and cost

Air navigation service providers (ANSPs) and airport operators around the world are facing increasing pressure from airspace users and competition in tower air traffic control (ATC) markets. They face the challenge of modernising air traffic control services to increase efficiency, while at the same time reducing cost and meeting performance, safety and regulatory requirements.

Business needs of airport ATC operations

In order to achieve their ambitious goals, ANSPs and airport operators are looking for options to leverage shared assets, improve operations and explore new concepts of operations.
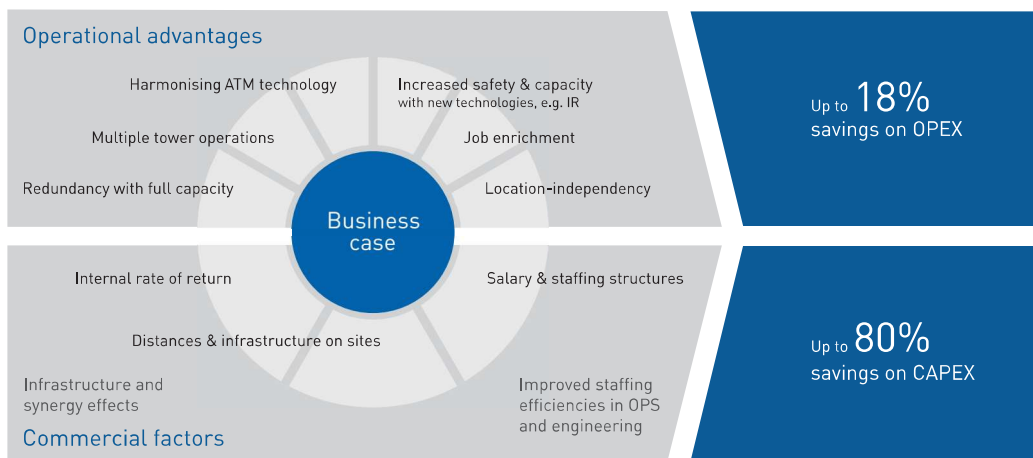
Individual solutions for different airports

Remote Digital Tower enables the provision of ATC services from different geographic positions, using a multitude of local sensors, visual and infrared technology including advanced tracking and video processing and surveillance solutions based on multi-lateration or ADS-B, in order to provide the situational awareness needed for the controller to safely operate an airport. An ATM-grade network provides reliability and performance to safely connect the airport with the remote tower control centre, where ATC operations are employed using newly designed remote tower controller working positions, featuring a complete digital tower, with ergonomics optimised for controller performance.

No two airports are the same, hence the remote tower solution uses these three building blocks – sensors, network, centre – to create a solution best suited for each airport's unique use case.

Remote digital tower	Advanced digital tower	Compact digital tower
Remotely controlled ATC	High capacity operation	All essentials for air traffic control
Contingency operation	Complex runway layouts	Integrated package
Visual enhancement	Integrated surveillance	Off-the-shelf: Turn key solution
Multi tower operation	Enhanced workflows	Compact platform; modular & expandable

Turnkey services from concept to go-live

Advanced remote sensing for ATC
A set of cameras combined with advanced video processing, object detection and tracking provides superior situational awareness. The solution offers a range of models: from cameras operating in the visual spectrum, to seamless 360° infrared and modular pan-tilt-zoom cameras.

Flexible, scalable remote tower centre
The design of the remote tower centre is essential for efficient operations. The solution can scale from providing flight information services (FIS) up to full ATC-grade operations for tower and approach.

Reliable, robust and secure network
An intelligent ATM-grade network ensures continuous performance and service thereby balancing performance and network costs.

Technical and operational support of customer process in all phases

No two airports are identical. Therefore, the Remote Digital Tower solution provides each individual airport with the exact functionality it needs to improve operations and enable new business models.
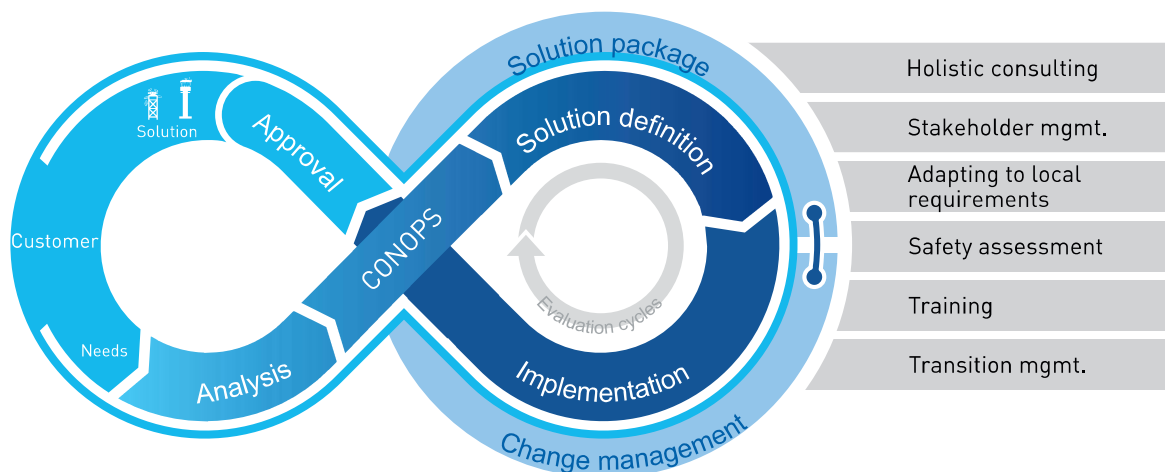
Cutting-edge technology is only one part of what is needed for a successful remote tower project. Equally important is an operational concept which is based on clear and concise captured customer needs and a sound business case. Implementing remote ATC operations includes ATS procedure adaptation and consulting, ATS training and transition, support during the regulatory approval process as well as stakeholder management throughout the whole implementation process.

Remote Digital Tower success stories

FREQUENTIS DFS AEROSENSE is a trusted worldwide partner that provides advanced turnkey remote sensing solutions for ATC. This proven combination brings together digital tower systems from Frequentis with operational and regulatory concepts and know-how from the DFS group.

German Airports (DFS)

DFS has already been successfully operating the RTC system for years. Since April 2022, air traffic at Erfurt Weimar and Saarbrücken international airport, hundreds of kilometres away, are controlled from the DFS remote tower centre in Leipzig. Both airports are equipped with remote tower technology. 360° visual and IR cameras provide a seamless panorama view, supported by a high-performance PTZ camera with visual and IR sensors. Advanced video tracking enables the detection and marking of IFR and VFR flights and vehicles, while detailed surveillance information increases situational awareness. Extension to next airport is already being planned: Dresden Airport will also be monitored from Leipzig at the end of 2023.

Brazil – Santa Cruz (DECEA, CISCEA)

This is a first-of-its-kind project in South America to provide remote air traffic control services using digital tower technology. The solution provides controllers with a real-time 360° visualisation of the airport and its surroundings in a remote operating environment. Digital support tools such as automatic object detection, surveillance labelling, image recognition and tracking are some of the major features of this solution, which will support the safety-critical and high-pressure work of controllers.

Akureyri (ISAVIA)

Sub-zero temperatures in isolated airfields pose a distinct set of challenges to airfield cameras and casings. Together with Isavia, Frequentis and DFS are exploring remote tower solutions suitable for use in extreme weather. Particularly in the north of Iceland, there will be a requirement for camera technology and protective casings that ensure consistent high performance in the face of challenging climatic conditions.

Driving safe innovation

We build on cutting-edge technology to deliver the required capabilities for ATC and beyond. Intelligent, advanced vision with innovative approaches across the whole visual surveillance chain provide the controller with an optimal user experience, ensuring situational awareness. We understand that making new technologies truly ATM-grade is an essential element in enabling innovation in safety-critical environments.

We continue to push boundaries, with advanced video processing, artificial intelligence and deep learning solutions that have the power to make airports of any size smarter. We are one of the leading participants in the EUROCAE WG-100 working group, driving change and creating standards, as well as supporting SESAR research into multi remote towers.

Advanced digital tower

Automation and digitalisation
Improved airport safety and efficiency
Full situational awareness and user experience

FREQUENTIS
FOR A SAFER WORLD

Situational awareness needs efficient integration

Air traffic controllers (ATC) are frequently in use of a wide variety of independent and individual air traffic management systems. Situational awareness is negatively influenced by using different systems at the same time, which challenges the controller especially during traffic peaks and in critical situations. The seamless integration of existing and new applications into one controller working position achieves a workflow-oriented controller environment while optimising efficiency. This ensures the fastest possible reaction time, combining clear and fit-for-purpose presentation of all essential information into one specifically designed HMI.

Key challenges for advanced digital towers and integrated controller working positions:
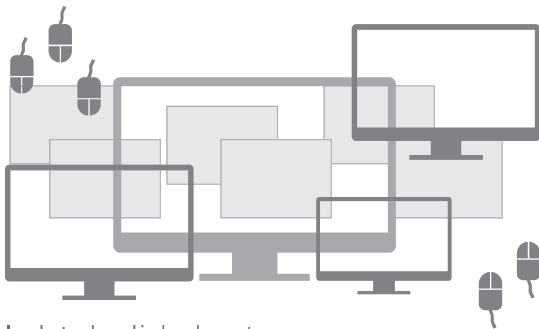
Isolated unlinked system

Integrated controller working position (iCWP)

With annually increasing air traffic figures, several major airports are forecasted to reach their capacity limits within the next years.

As most affected airports are built in highly populated areas, the variety of growth options is limited.

Hence, optimising ATC operations using sophisticated IT technology is more likely to be pursued than adding airport infrastructure, such as runways, taxiways or ATC towers.

While certain IT systems excel at performing specific tasks, the ATCO, who has to see the big picture at all times struggles to keep the necessary focus as the variety of IT systems used in his environment increases.

Consequently, technology-driven growth in capacity and efficiency will only be achieved in the long run by integrating the IT-systems in use.

The ATCO shall be able to use his ATC equipment with a single well-designed and harmonising HMI on a reduced number of screens to regain his focus.

Given the availability of solutions, which fully integrate core ATC applications, such as voice communications, flight- and weather data management and surveillance, ATCOs can refocus on their core tasks associated with maximising safety for aircraft they guide as efficiently as possible through their areas of responsibility.

Seamless digitalisation and integration

The Frequentis advanced digital tower solutions focus on reducing the ATCOs' workload and enhancing safety and efficiency by integrating the electronic flight strips with air- and ground surveillance as well as meteorological information. The combined knowledge base provides a wide variety of workflow- and decision support functions the ATCOs can access instantly throughout all flight phases, especially during ground movements.
Our approach for the advanced digital tower is the integrated controller working position (iCWP). That optionally includes the ATCO's most critical ATC capability, voice communication.

Data integration for an efficient and enhanced ATC solution

Frequentis   Stakeholders – Aviation and non-aviation
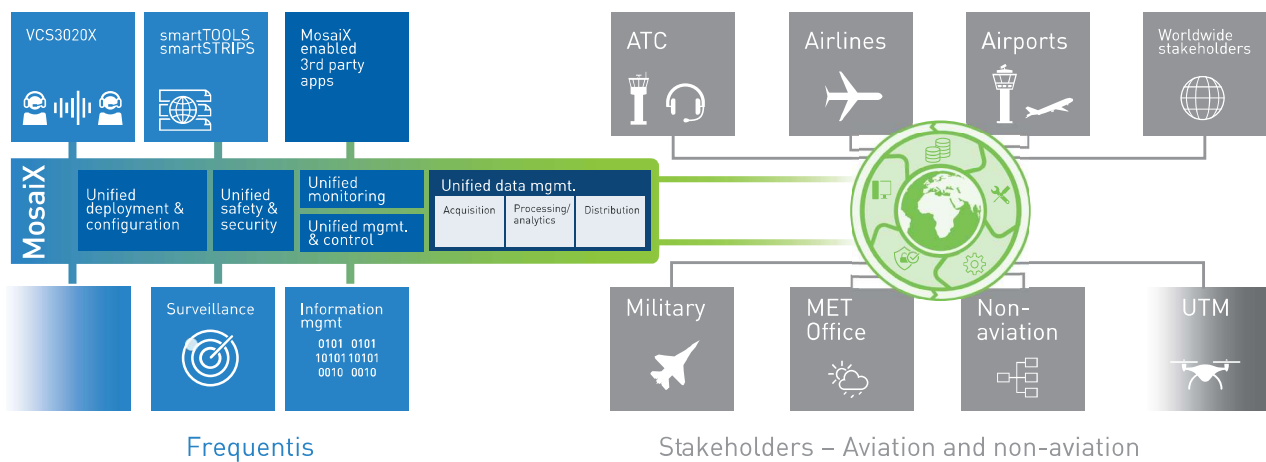
Individual solutions for different airports

Advanced Digital Tower enables the integration of ATC services as well as new technologies like UTM into one HMI, using the data migration platform MosaiX to harmonise system data into one operational display. Surveillance data, vision enhancement and apron information can be integrated and displayed, in order to provide full situational awareness for the controller to safely operate an airport while increasing performance. Third party applications and existing infrastructure do not require any different HMI and can be integrated as well into the iCWP solution.

Frequentis offers individual solutions suitable to the individual requirements.

Remote digital tower	Advanced digital tower	Compact digital tower
Remotely controlled ATC	High capacity operation	All essentials for air traffic control
Contingency operation	Complex runway layouts	Integrated package
Visual enhancement	Integrated surveillance	Off-the-shelf: Turn key solution
Multi tower operation	Enhanced workflows	Compact platform; modular & expandable

Enhanced air traffic management safety

Today's high density ATC tower environments are comprised of systems for surveillance, electronic flight strips, AGL, airport information management, weather data and voice communications. Due to the wide range of the Frequentis product portfolio, each of these application requirements is covered and embeddable in an iCWP tower solution. Hence, full backend integration between the components is given and provides a novel range of possibilities to make the ATCOs' jobs easier.

Besides the benefits given by backend integrating Frequentis products into an iCWP solution, a single and consistent HMI represents the high level of integration from the perspective of user experience. For legacy systems, which are required beyond deployment of an iCWP solution, Frequentis offers HMI-only integration. Consequently, existing systems can stay and the ideal mix between workspace innovation and well established operational workflow can be found.

Selected references

Aeroparque Jorge Newbery Tower, Argentina

EANA deployed a new ATC tower featuring ED-137-compliant VoIP voice communication and tower automation, including smartSTRIPS and smartTOOLS. The Frequentis solution is expected to enhance ATM operations and boost efficiency. In particular, the solution supports ICAO Aviation System Block Upgrades (ASBU) Block 0 and Block 1 modules in the airport operations performance area. With this deployment, EANA is leading implementation of new technologies in South America and is set up for enabling new functionalities in the near future.

Major international airport, Asia

Frequentis smartSTRIPS flight data management solution was implemented to support faster decision-making and more efficient operations. Replacing a number of legacy systems and frontend integratig others, the Frequentis solution was awarded the IFATCA 2016 Technical Award. Operational feedback suggests that the solution provides a more user-friendly experience, helping to enhance safety and efficiency. This supported the ANSP to meet the demanding regional growth trends exposed over the last years.

Amsterdam Airport Schiphol, the Netherlands

LVNL made a strategic decision to deploy a completely new tower system in accordance with the Pilot Common Project driving the SESAR deployment. Within a planned 25-year development partnership with Frequentis, the first step, which has already been successfully and timely implemented, was to deploy electronic flight strips to replace paper strips. The main design goals were to increase the capacity of ATC tower operations and to simplify decision-making. The next steps in the 25 year program comprise deployment of departure and surface management systems (DMAN / SMAN).

The Frequentis tower solutions roadmap is fully aligned with the SESAR 2020 wave of ATM research and ICAO Aviation System Block Upgrades. Thus allowing airports to rely on support to address future industry challenges according to standardised best-practice approaches.

FREQUENTIS

Integrated AMAN/DMAN
Synchronising traffic for maximised ATM and airport performance

The Integrated AMAN/DMAN (IAD) integrates our proven Arrival and Departure Management (AMAN/DMAN) products to enhance air traffic controllers' decision-making processes, particularly for mixed-mode and dependent runway operations. It improves Air Traffic Management (ATM) and airport performance by harmonising inbound and outbound traffic, increasing runway throughput, flight efficiency, and reducing the carbon footprint. Moreover, its capability to forecast traffic loads improves predictability and increases situational awareness for Air Traffic Controllers (ATCOs).

Key features

Automated arrival and departure planning

Fully compliant with the ICAO Aviation System Block Upgrades and the European Common Project One (CP1) regulation, the Frequentis IAD is the market-leading product to optimise traffic flows at airports, taking account of both arrivals and departures, and ensuring continuous high performance by the Air Navigation Service Provider.

Coordination between tower and approach

IAD allows for an early identification and management of demand capacity imbalances. Enabled by real-time predictions and common planning capabilities for tower and approach, IAD supports controllers to jointly assess the traffic situation and identify and implement the most efficient measures, such as the proper adjustment of arrival and departure rates.

Seamless integration

IAD leverages over two decades of experience in integrating AMAN and DMAN into different operational and technical environments, such as various ATM and airport systems. IAD provides interfaces with Air Traffic Flow Management and Airport CDM systems, e.g. to achieve an extended planning horizon.

IAD at a glance

- World's first Integrated AMAN/DMAN, operationally deployed for CAA Singapore
- Successfully validated within the Single European Sky ATM Research (SESAR) programme
- Leveraging two decades of experience in deploying our AMAN and DMAN products globally
- Harmonising arrival and departure traffic flows based on performance-driven optimisation
- User-friendly and common HMIs to enable joint planning by tower and approach
- Runway management support functions to optimise ATM and airport operations efficiency

FREQUENTIS
FOR A SAFER WORLD
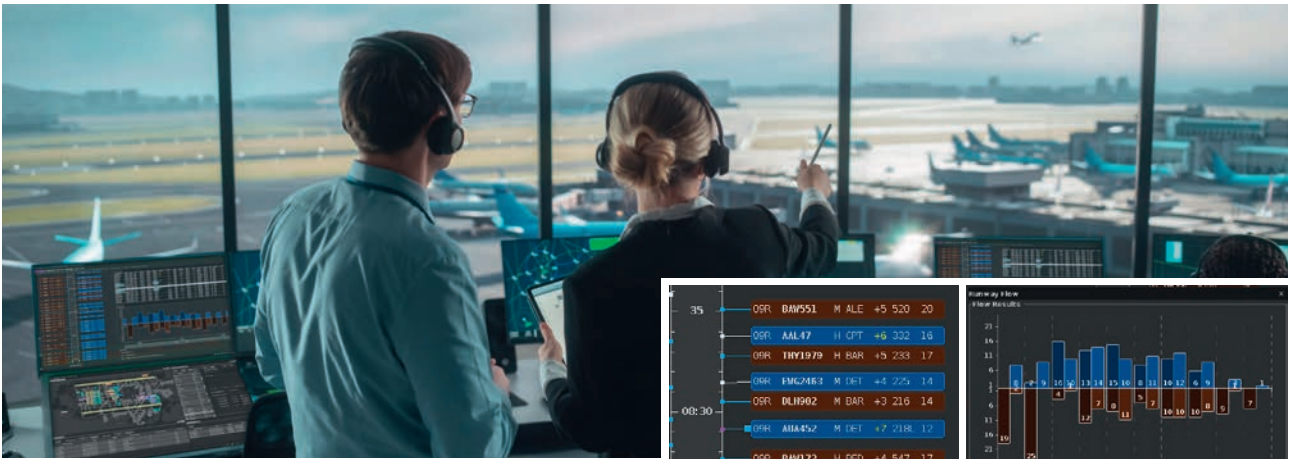
Benefits

Predictable arrival and departure traffic flows

IAD provides more accurate landing and take-off time predictions, enabling higher runway sequence efficiency and the ability to forecast and improve airport performance.

Enabling information sharing and collaboration

IAD supports tower and approach ATCOs with a common HMI and joint planning functions, and it enables automated data sharing of real-time predictions with other airport stakeholders.

Improved productivity for ATC operations

IAD enhances decision-making processes for mixed-mode or dependent runway operations and allows for a systemised approach on how arrival and departure traffic flows are organised.

Maximised airport and TMA capacity utilisation

IAD ensures a better and more balanced utilisation of the available runway resources, enabling efficient air traffic movements to and from the airport and leading to reduced delays.

Efficient flight profiles and reduced operating costs

IAD enables airspace users to fly more efficiently and to reduce taxi times, leading to significant fuel savings and reduced operating costs for the airlines.

Sustainable operations and reduced environmental footprint

IAD translates to a reduction in airborne and ground holding, leading to reduced emissions and improved sustainability. With it, IAD is a key contributor to GreenATM.

Facts & figures

2+ decades of experience since first AMAN deployment

Sustainability Award
CANSO World ATM 2021

Compliant with
ICAO ASBU and **SESAR** requirements for AMAN/DMAN integration

20+ international airports globally

CO_2 AMAN saved in excess of **1M** tons of CO_2 emissions within its >20 years of operations

550 NM AMAN horizon for London pioneering extended planning horizons

Smart AVCS v2

(Airside Vehicle Control System)

보안구역내 차량통제 안전 시스템

GOAMACE AVIATION

AVCS

보안구역내 차량통제 안전 시스템

(Airside Vehicle Control System)

항공지상 조업 안전 차량 관리, AVCS

(지상조업 특수차량)

AVCS 시스템 소개

1. 개발 현황

01 History

> Airside 이동지역 지상조업 차량 안전강화를 통해
> **지상안전사고 예방과 정시운항 서비스 확보**

2021

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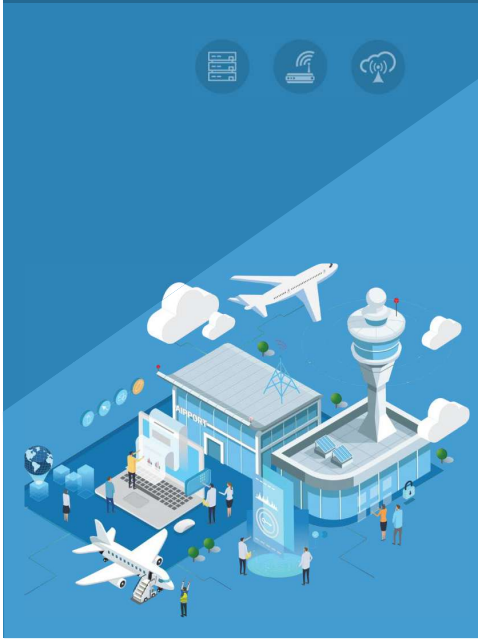
✈ **김포공항 이동지역 차량 통제 시스템 기술검증(PoC[1]) 시행**
- 시행기간 : 2021. 10 ~11월
- 내   용 : A/S 운영부 이동지역 점검차량 1대 IoT 센서 부착·운영
- 시행결과 : 이동지역 차량 안전관리 전용 플랫폼으로 적용 가능성 확인

✈ **김포공항 이동지역 차량 통제 시스템 구축 및 시범운영**
- 시행기간 : 2022. 6 ~10월
- 내   용 : AVCS 시스템 1식, IoT 센서 10개 부착·운영
- 운영결과 : 한국공항 등 4개 지상조업사 스텝카 등 고소차량 8대 참여로
             지상안전사고를 사전 예방할 수 있는 운영 효과 확인

2022

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💡 AVCS 데이터 획득 및 보정을 위해 A/S운영부 점검차량 2대 및 조업사 차량 8대 지속 모니터링 중

한국공항 KOREA AIRPORT SERVICE
- 스텝카 3대

Sharp AVIATION K
- 스텝카 2대

아시아나에어포트
- 스텝카 1대
- 휠체어리프트 1대

ATS AIRPORT SERVICE
- 스텝카 1대

2023

3

✈ **국토교통부 주관 시연회 성공 종료**
- 시행기간 : 2023. 3. 8
- 장   소 : 김포공항
- 시연결과 : (참석자)국토교통부, 한국공항공사, 인천공항공사, 지상조업사 참여
             현장 실시간 시연 및 운영 성공 결과 보고
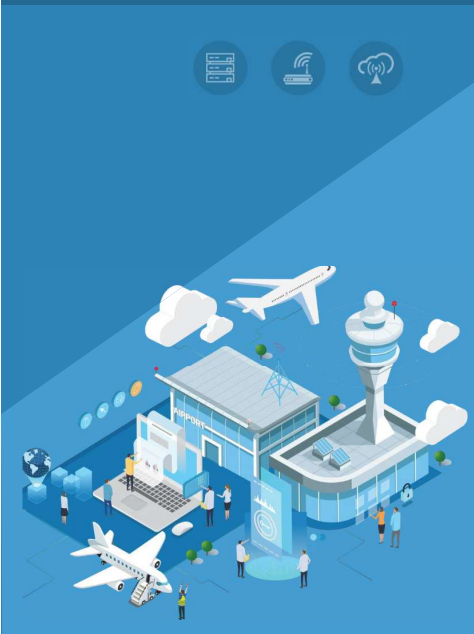
1. 특허명 : 공항의 에어사이드에서 운행 중인 지상조업차량 및 항공기를 관제 하는 관제시스템

2. 등록일 : **2024년 2월 16일**

세계최초 아이템 ICAO 소개
23' 가을 세션 (KAC)
국내 특허 등록

이동지역 차량 통제 시스템(AVCS)

CHAPTER

Ⅱ

시스템 주요 구성 및 기능

1. 시스템 구성
2. 시스템 주요 기능

01 시스템 구성

AVCS

[AVCS 통합관제 시스템]

[AVCS 전용 차량단말기]

[기준국]

RTK base station

GNSS Satellites

(AVCS 아키텍쳐 구성도)

01 시스템 구성 V2

AVCS V2

AVCS V2 Server farm

DataBase

통신

처리

모니터링

조업 업무

운영사 모니터링

운영사 조업 관리

Ads-B

AirSide

RTK-B

Internet

LTE

VPN Network

C-V2X

IoT MQTT

차량단말기

웹

조업차량

조업자

조업사 Office

모니터링

조업 업무

조업사 모니터링

조업사 업무

시스템 특징 **S**mart **AVCS V2**
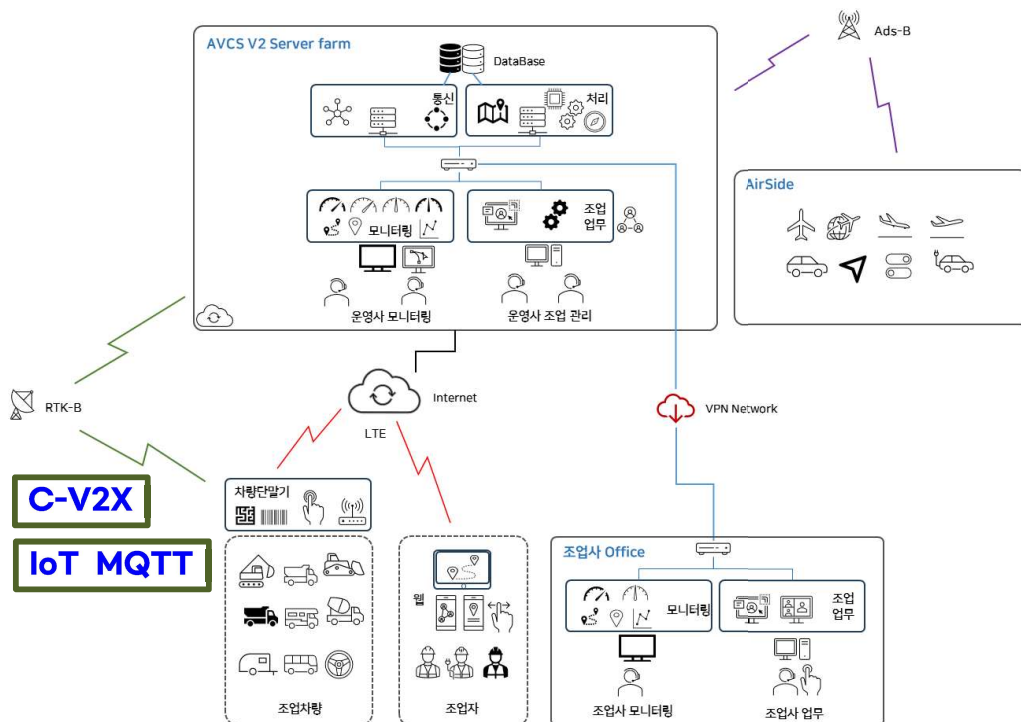
품목	AVCS **V**2	AVCS V1	비고
공항 운영 관제 플랫폼	• 통합 대시보드 • 조업사별, 장비 종류별, 작업별 모니터링 • 조업사 운영 SW 제공 • 위험/안전 운행 내역 통합 조회 • 차량 위험지역 및 위험 운행 분석	• 통합 스크린 제공 • 관제 PC 화면 • 차량별 조회, 관제 모니터링 • 차량 경로 조회	안전/위험 분석강화 (SMS* 지원)
조업사	• 조업사 모니터링 장비 • 운영 단말 장비(PC) • 차량별 운행 내역 관리		조업사 전용 SW 제공
차량용 단말기	• 차량별 경고/안내 메시지 사용자화 • 위치 및 속도, 위험 운행 정보 저장 • LED 점멸 제공	• 차량별 음성 안내 • 위치정보, 속도 정보 저장	네비게이션 APP (별도)*
유지보수	• 수리 필요 단말기 - 교체 방식으로 유지보수 • 운행 상세 정보, 사고 분석 자료 등 제공		장비교체 방식

SMS* Safety Management System
네비게이션 APP (별도)* 별도 단말 장비 추가

시스템 특징 **S**mart **AVCS V2** 차량 단말기 기능
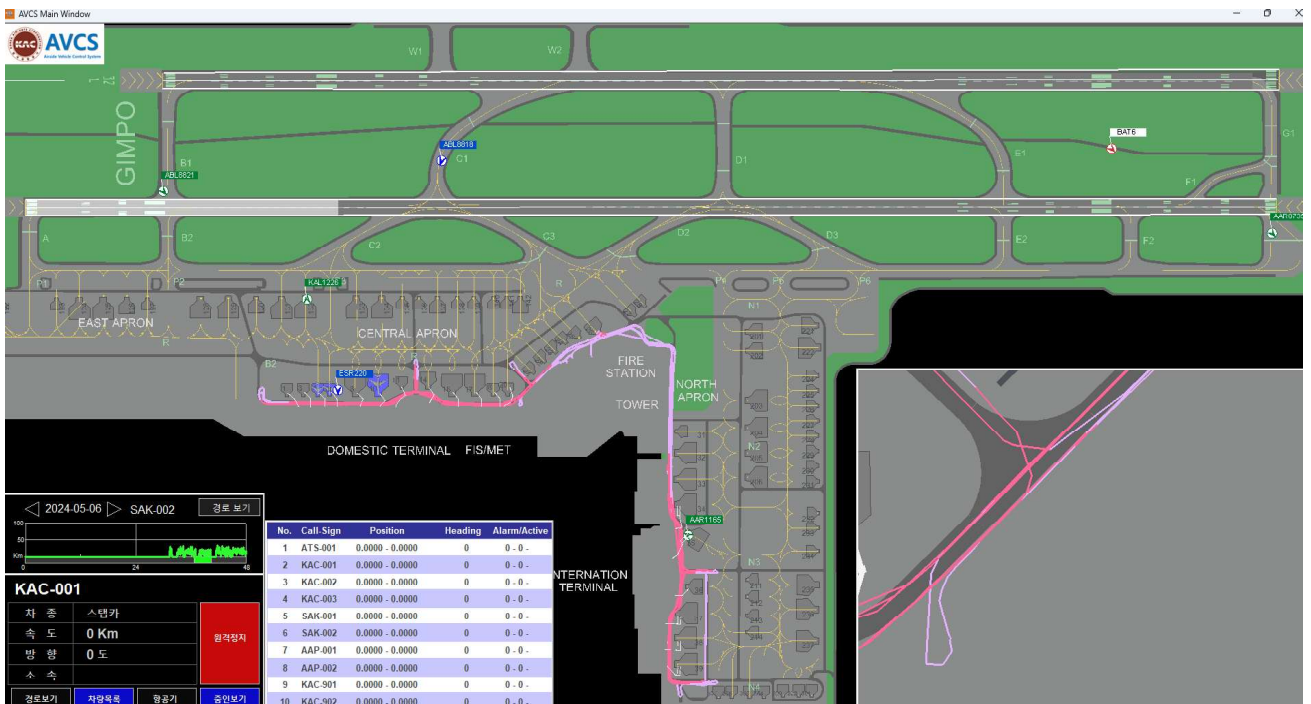

① 위험지역 음성 알림
- 탑승교 주의, 항공기 주의, 전방 차량 주의 속도 위반 주의, 사고위험 지역 주의
② 차량별 접근 금지 구역 설정
- 고소차량 접근 금지 구역 설정
③ 적색 LED 통한 알림 기능
④ 통행금지 구역 출입시 자동제어 (옵션 설치)
- 브레킹 Safty 시스템
⑤ QR 코드를 통한 운행자 인식 기능
⑥ AVCS 운행자 앱 제공
⑦ 현재 차량 위치, 속도, 차량 상태 정보를 저장

탑승교 주의 구간

속도위반 주의

사고위험 지역 주의

항공기 주의

① 위험지역 음성 알림
  – 탑승교 주의, 항공기 주의, 전방 차량 주의
    속도 위반 주의, 사고위험 지역 주의

⑦ 현재 차량 위치, 속도, 차량 상태 정보를 저장
  – 차량의 동선을 트래킹 하여 정보를 조회
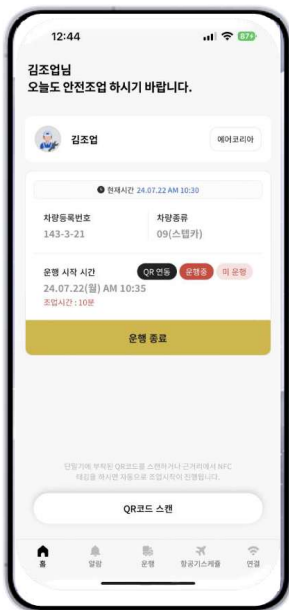
지역 부근

전방에 탑승교를 주의하세요!

지역 근접시

탑승교앞 위험 정지 합니다. !

>> Safety 실행 (자동 브레이킹)

② 차량별 접근 금지 구역 설정
  – 고소차량 접근 금지 구역 설정

① 운행자(조업사) 앱다운 로드 설치
  – 사용자 정보
    → 조업사 관리 프로그램 저장
② 운행자 QR 코드로 조업 차량 운행 인증
  – 운행 불가 운전자 식별 가능
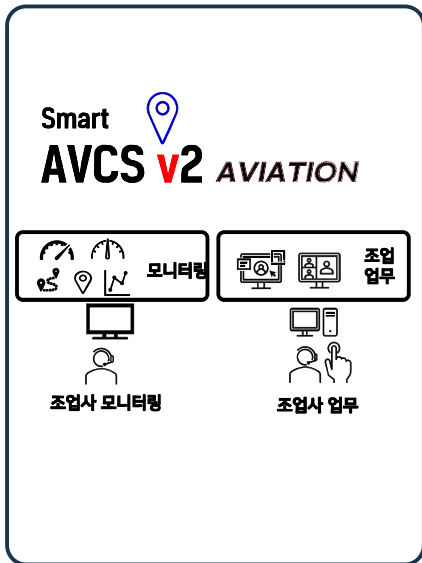   → 조업사 관리 프로그램 알림
  – 운전자 운행 기록 저장
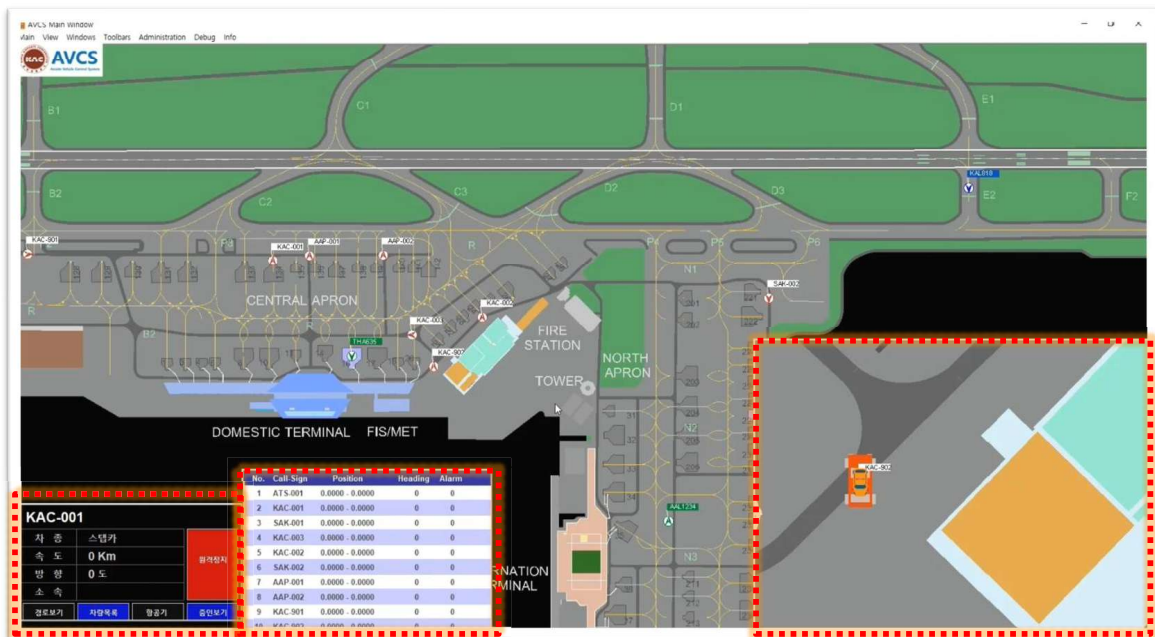③ 운행자 조업 차량 운행 이력 조회
④ 조업정보 제공 (← 조업사 정보 입력)
⑤ 항공기 도착 정보 조회 (권한 인증자)

시스템 특징 Smart AVCS V2 조업사 관리 프로그램

Smart AVCS V2 AVIATION

모니터링 | 조업업무

조업사 모니터링 | 조업사 업무

① AVCS 차량용 단말기 등록 기능
  – QR 코드 스캔후 인식된 장비 선택 등록
② AVCS 조업차량 전체 리스트 조회
  – 차량별 임무 차량 선택 등록 관리
③ 차량별 운행 이력 정보 조회
④ 현재 조업차량 모니터링 맵
  – 현재 공항 내 조업 차량 실시간 뷰
⑤ 현재 조업차량 운행자 리스트
⑥ 차량별 AVCS 위치정보 조회
⑦ 현재 차량 위치, 속도, 차량 상태 정보 조회

시스템 주요 화면 Smart AVCS V2 공항 맵 표출

- GPS 기반의 김포공항 A/S 지역 지도를 Vector Data 기반으로 제작하여 줌 인·줌 아웃 및 상하/좌우 이동을 정확하게 표현
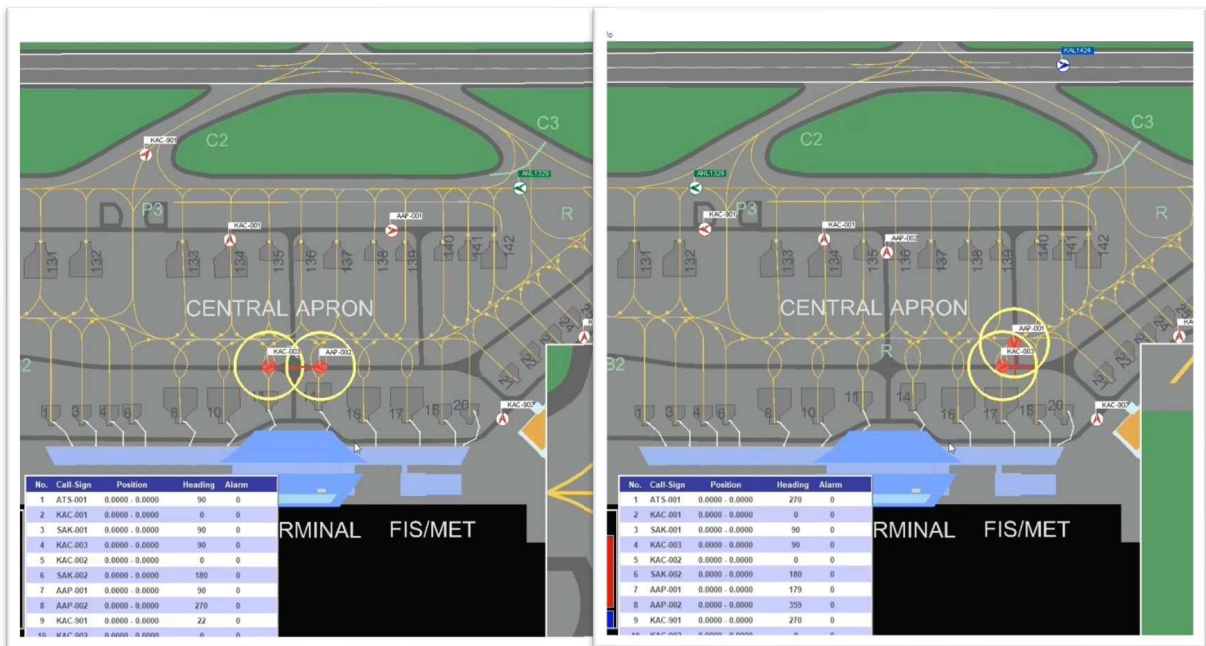- 멀티 화면 적용으로 선택 목록 및 줌 화면 동시 표출

시스템 주요 화면 Smart AVCS V2 항공기 주의 경보

- 푸쉬백 중인 항공기에 대한 인접 이동차량 운전자에게 경보

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시스템 주요 화면 Smart AVCS V2 전방 차량 충돌 경보
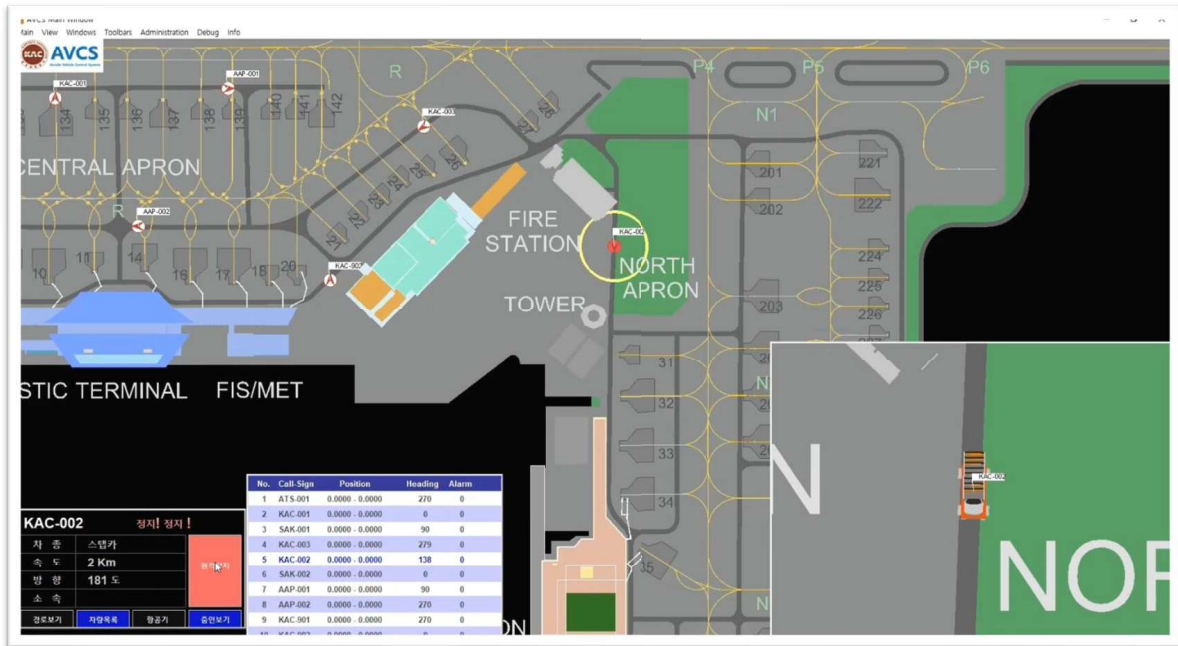

- GSE 도로 및 서비스 도로 상의 마주오는 이동차량 및 교차로지점 근접 차량에 대한 충돌 주의 경보

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시스템 주요 화면 **S**mart **AVCS V2** 위험지역 주변 자동 및 원격정지

- 위험 지역 이동에 대한 자력 정지(김포공항 6개소) 및 원격 정지제어, 차량별로 정해 진 구역을 설정 하여 동작

＊ 해외 수출 추진 현황   말레이시아 , 인도네시아 바이어 상담 (11.8)

AVCS 보안구역내 차량통제 안전 시스템
(Airside Vehicle Control System)

" Airside 이동지역 지상조업 차량 안전강화를 통해 "
지상안전사고 예방과 정시운항 서비스 확보

- 항공지상 조업 안전 차량 관리, AVCS -

(지상조업 특수차량)

UAMCS (Urban Air Mobility Control System)

DROW4D GCP
A web-based 4D Ground Control Platform
that simultaneously supports autonomous operation of
multiple heterogeneous drones

Smart **AVCS-UAMCS** 통합 관제
(Airside Vehicle & Urban Air Mobility Control Systems)
공항 이동지역내 차량통제 안전 시스템 드론도심교통관제 통합 시스템

솔루션 소개서 | 2024.10

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A-CDM milestone: In-Block
A-CDM milestone: Ground handling started

GOAM ACE CO., LTD

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- 한국공항공사, 인천국제공항공사
- ATM 전분야 솔루션 컨설팅
- AVCS, K-VDGS 솔루션 공급

AVIATION ATM & CNS NEW BUSINESS LEADER!