

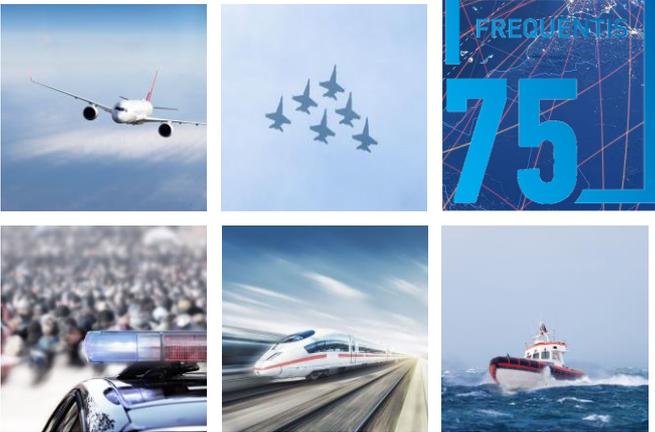


FREQUENTIS
FOR A SAFER WORLD

Specialist for communication
and information solutions
for safety-critical control centres

**5e réunion des fournisseurs de services de
navigation aérienne (ANSP) de l'Afrique.**

28 mars – 1erAvril – Lomé - Togo



500+
customers

150+
countries

>90% of our customers are
government agencies



40,000+
working positions using
Frequentis solutions



33%
of the world safer with
Frequentis networks



90% of all air
passengers globally served
by Frequentis customers



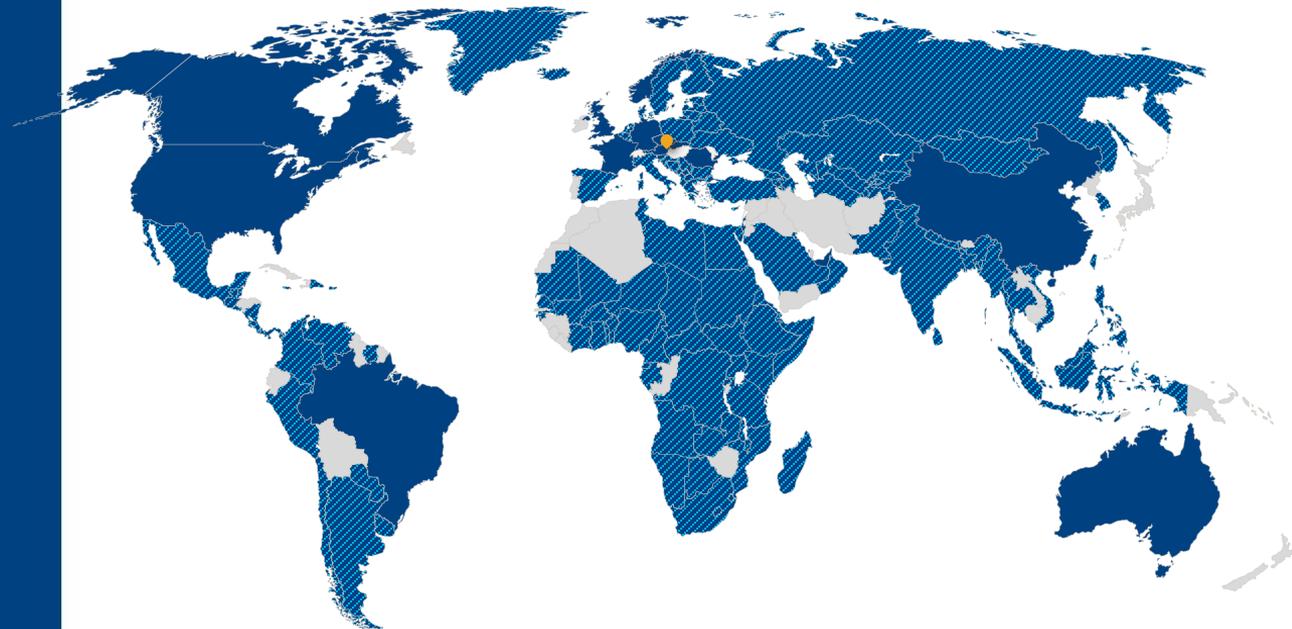
#1 in GSM-R
dispatcher terminals



240,000 km
largest maritime coastline
protected

A strong network around the world

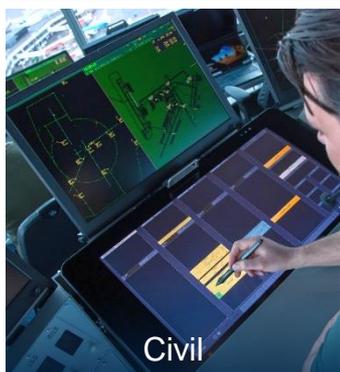
FREQUENTIS
75



■ Regional offices ■ Sales representatives ● Frequentis HQs

We are the only company focusing solely on safety-critical control centres

Air Traffic Management



Civil

- Air navigation service providers
- Aeronautical data service providers
- Flight information service providers
- Airports
- Unmanned traffic service providers
- Space agencies



Defence

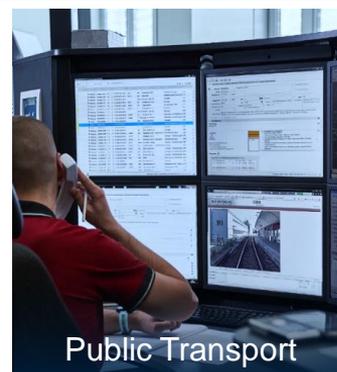
- Air force
- Army
- Navy
- Homeland security
- Joint forces

Public Safety and Transport



Public Safety

- Police forces
- Fire services
- Emergency and medical services
- Critical infrastructure for industries



Public Transport

- Heavy rail
- Urban rail



Maritime

- Coast guard / navy
- Offshore
- Port authorities
- Search and rescue

Air Traffic Management

Digital.
Sustainable.
Safe.

+ more

27,000+

Working positions worldwide

330+

Customers

95%

of all passengers worldwide supported by Frequentis

130+

Countries

FROST & SULLIVAN

Recognised as tier 1 ATM leader

+ more



Digitalisation

Virtualisation

Integration

Automation

Air navigation service providers



Flight information service providers



Aeronautical data service providers



Airports



Unmanned traffic service providers



Space agencies



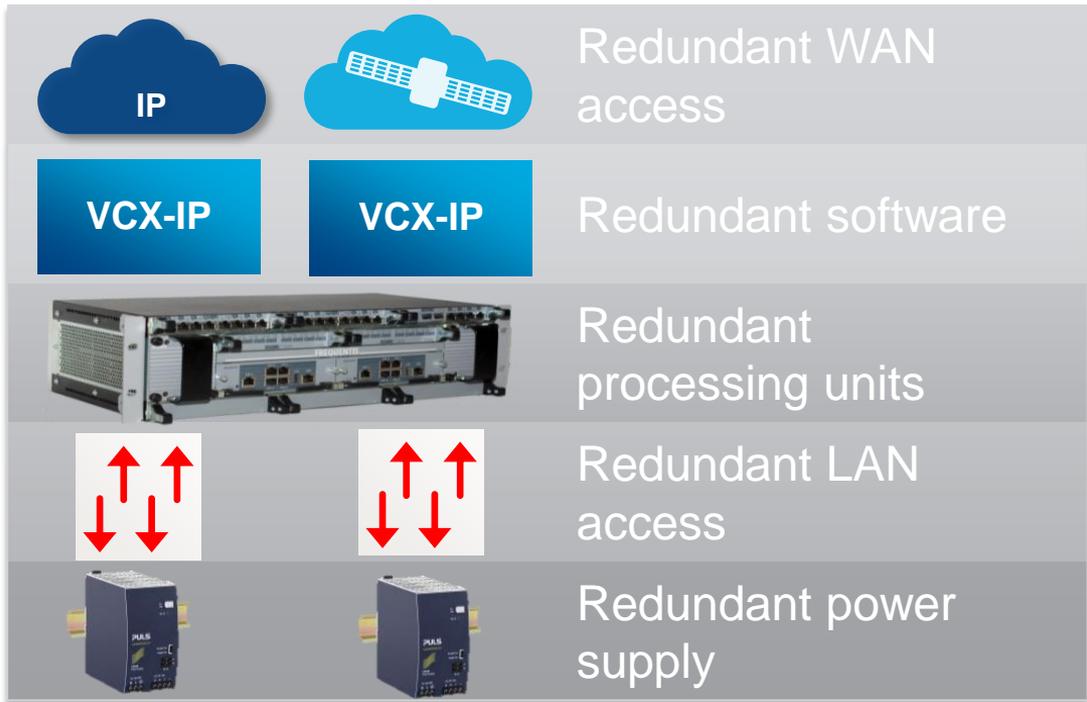
Digital. Sustainable. Safe. | At a glance

ATM selected references



Highest safety and availability for TRUE ED 137 compliance

VCX-IP offers multi-level redundancy



VCX-IP



Standard: ED 137 & ED 153

- It is a TRUE ED 137 compliant Voice & Data Gateway

ECHO

- It supports Dynamic Delay compensation above the ED 137 (200 ms) – Even a VSAT double hop is not problem

A/G & G/G

- We can convert analogue and digital signals into a ED 137 IP packets

Bandwidth Savings

- Savings in ATM use case not only IP header & payload compression
- Unique calculation models

MEVA III – Aeronautical Communications Network for Caribbean States

Phase out legacy to increase the efficiency, reliability and security of ATC operations

- G/G, A/G, AMHS and Radar data
- Installation, Design and Disaster Recovery solutions
- Upgrade from VSAT to add MPLS



24/7
network operation by Frequentis

Pan-American
network establishing

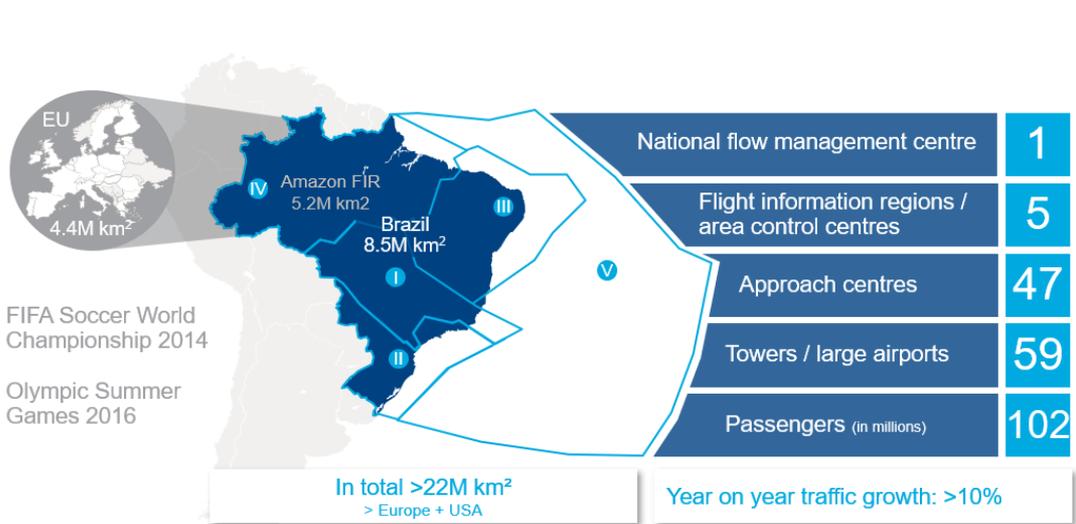
18
V-SAT stations in 16 ANSPs

99,90%
availability

- The project is an important part of ICAO's efforts to create a phased transition from legacy communication to state-of-the-art technologies through a collective, regional solution.

ATN-Brazil – Next Generation converged & hybrid ATN Network

Migrate to **ED-137** compliant solution to increase the efficiency, reliability and security of ATM



voice and data service delivery points
 converged network serving operational and administrative applications
 hybrid network integrating satellite and terrestrial TDM- and IP WANs
 umbrella network management including network simulation

1st
 SDN Air Traffic Management network
 >90% Satellite bandwidth reduction

Dynamic Delay compensation for A/G for
echo free voice

99,9997% end-to-end availability

VSAT, MPLS and E1 lines

- This ATM-grade network solution provides DECEA a high level of operational flexibility and scalability for future Brazil ATM demands

PENS

Implementation of operational VoIP for CFMU in course of PENS Service

- 6 Area Control Centers (ACC)
- 6 Network Management Operations Centers at all ACC
- 1,500 A/G media gateways (vitalsphere)
- Voice-over-IP ED-137 compliant
- IT Security Certified



- VCX-IP based PENS VoIP solution is ready to be used for any-to-any ground/ground ANSP communication

References AMHS

Number one in AMHS – with 100+ systems around the world



AMHS success stories

AIDA-NG, CADAS-ATS & CADIR

ASECNA

AMHS Stage 2

Locations: Abidjan, Bangui, Banjul; Bissau, Douala, Libreville, Malabo et Moroni

- 8 countries – Last commissioning in February 2022.
- Up to 35 user terminals per country (licensed, could be more)
- Fully AMHS / X.400
- Conversion both ways between MET / TAC messages and IWXXM
- Conversion both ways between FPL messages and FIXM



Virtualized AMHS Systems in Operation

- ✓ **NATS, UK** (in operation since 2015)
- ✓ **SITA, USA** (in operation since 2019 – cloud based)
- ✓ **Airservices, Australia** (in operation since 2020)
- ✓ **MATS, Malta** (in operation since July 2021)
- ✓ **EUROCONTROL NM, Brussels and Paris** (Brussels in operation since August 2021, Paris will follow in October 2021)

References for Contingency Systems in Operation

- ✓ **HKCAD, Hong Kong** (Hong Kong Airport, ATC Main Center and ATC Backup Center)
- ✓ **Airservices Australia** (ATC Main Center Brisbane and ATC Backup Center Melbourne)
- ✓ **Airways New Zealand** (ATC Main Centre Christchurch and ATC Contingency Center Auckland)
- ✓ **ANWS Taiwan** (Main Centre ANWS North ATS Park and Contingency Centre ANWS South ATS Park)
- ✓ **CAAS Singapore** (Changi Airport, Main ATC Center and Contingency ATC Centre)
- ✓ **DOTC Philippines** (Main ATC Centre Manila and Contingency Centre Mactan)
- ✓ **EUROCONTROL CFMU** (Brussels and Paris)
- ✓ **DFS, Germany** (Langen and Karlsruhe)
- ✓ **NATS, UK** (Swanwick ATC and Test Center)
- ✓ **Skeyes, Belgium** (Main and Contingency Centre at Brussels)
- ✓ **DSNA, France** (Main and Contingency Centre at Bordeaux)
- ✓ **Skyguide, Switzerland** (Main and Contingency Centre at Geneva)
- ✓ **LPS, Slovakia** (ATM Main and Contingency Centre at Bratislava)
- ✓ **BHANSNA, Bosnia** (Sarajevo and Banja Luka)
- ✓ **Croatia Control, Croatia** (Main and Contingency Centre at Zagreb)
- ✓ **DGMAN, Oman** (Main and Contingency Center at Muskat)
- ✓ **DGCA, Kuwait** (Main and Contingency Center at Kuwait City)

VCS3020X – trusted by 27,000 air traffic controllers every day

World market leader in ATC Voice Communications



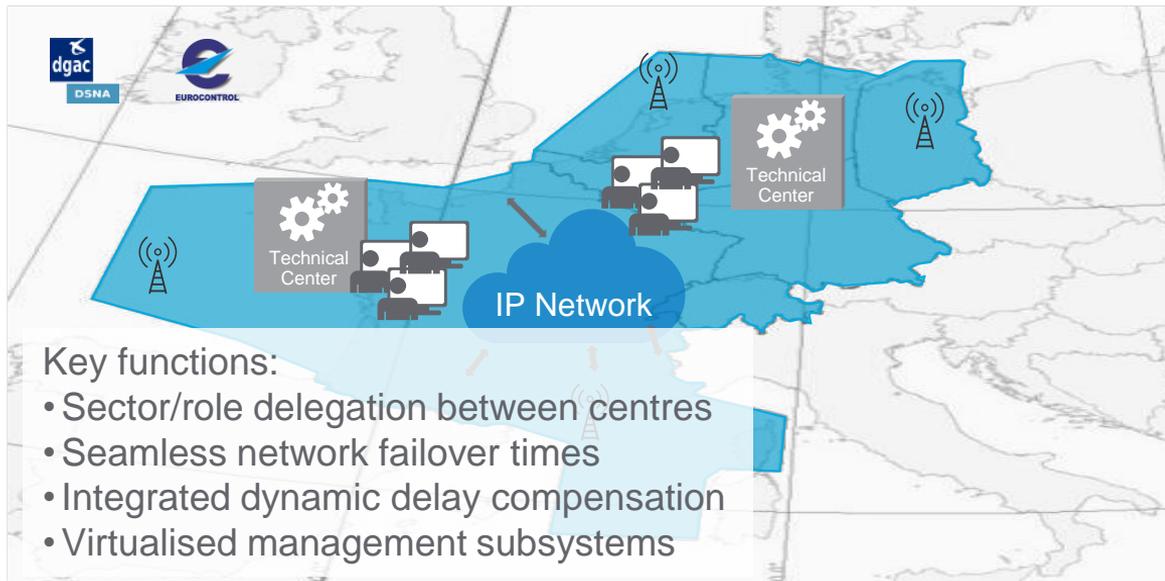
80+
countries

> 23M
operating hours

500+ successful
Project deployments
around the globe

FABEC N-VCS: Worlds first cross-border virtual center using VoIP

Need for operational and technical interoperability moving towards Single European Sky



Key functions:

- Sector/role delegation between centres
- Seamless network failover times
- Integrated dynamic delay compensation
- Virtualised management subsystems

100

pos. and 7 remote radio sites in first out of 6 ACCs

250

CWP

peak load and stability

600

ED-137 IP radio channels

6M flights/year

Europe's busiest airspace



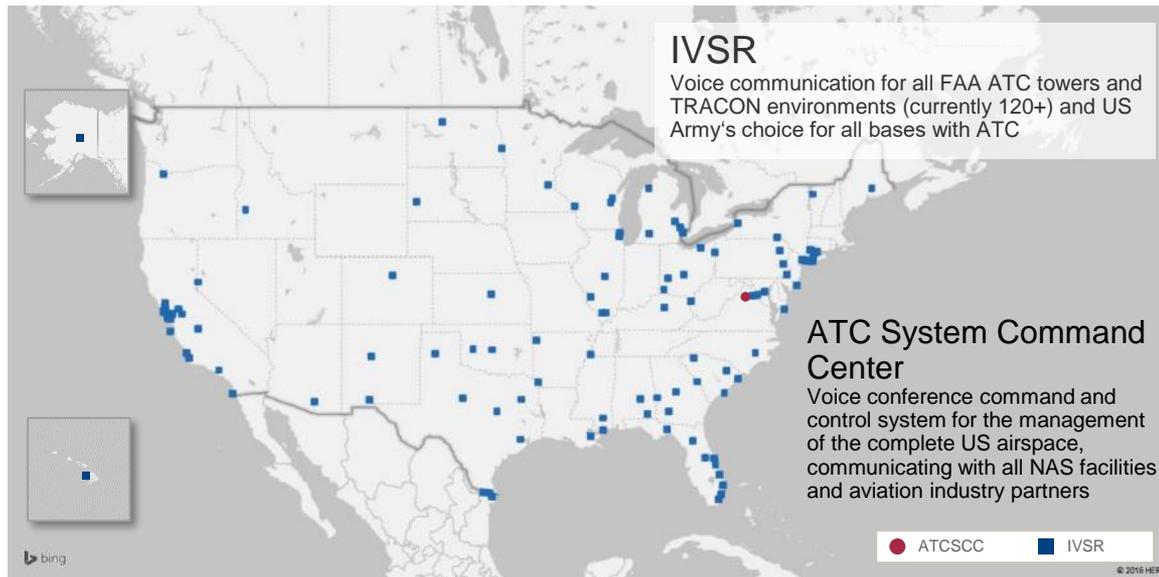
» “N-VCS will enable new strategic ATM development, such as dynamic airspace sectorisation.” - Maurice Georges (DSNA)

“In order to maintain our high safety and performance levels, we must rely on a robust technology base.” - Jac Jansen (MUAC)



FAA IVSR: Largest air traffic control VCS rollout program in the world

Ensuring reliable communications in the world's busiest airspace



>1,500

operator positions

681,244

movements p.a.
Dallas/Ft. Worth
3rd biggest airport worldwide

25%

of the US Tower & TRACON environment already upgraded to IVSR: 120+ systems

1,000

conferees for US-wide air traffic flow management and disaster recovery

» “Over the last decade Frequentis has proven to be a dependable partner to the FAA. Their outstanding technical expertise is supporting the NAS modernization to enhance operational efficiency and safety of the flying public.” – Dan Duncan, FAA IVSR program manager



NASA MOVE: Space flight voice communications for all NASA missions

Assure mission-critical communications for all manned and unmanned space flights



Picture source: NASA

NASA space operation centers with VCS3020X
Space flight centers, tracking & data relay, deep-space communication

>4,000
operator positions and 18 systems delivered

5 types
of operator positions – reduced from 23 different types

National program for all major NASA sites to reduce types of operator positions

>1,000
operator positions using Voice-over-IP (VoIP)

Logistics & maintenance
Cost reduction through standardised solution

» “The 3020 system for the MOVE program is the first system worldwide using mission critical VoIP in a large scale. It impressively shows the maturity and scalability of the technology.” - Dieter Eier, Frequentis USA

Danube FAB – End-to-end IP System for Bulgarian and Romanian airspace

Networked all-IP VCS deployments providing end-to-end VoIP communications



A vital milestone towards the Single European Sky Vision

ROMATSA

BULATSA

200

positions

Upgrade

Migration from 7.1 to 8.0 in live operation

Direct VoIP

connecting ACC Sofia and ACC Bucharest

ED-137 to the max

Linked session Voice compression

http://www.danubefab.eu/en/articles_30/-- 12.htm

» “The partners in the Danube FAB programme are setting a vital milestone towards the Single European Sky Vision,” - Frequentis CEO Hannes Bardach



Drone integration & management

Seamless information exchange between all stakeholders

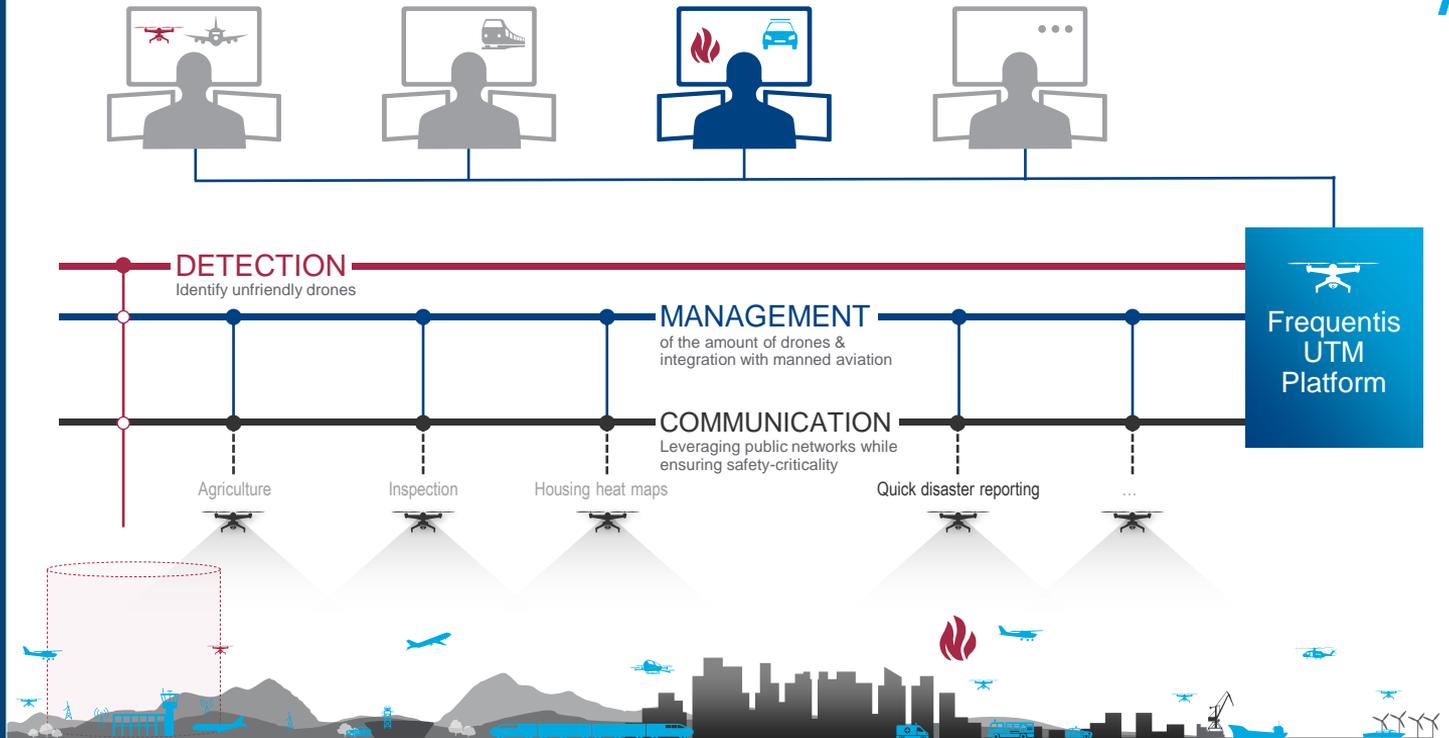
Interoperability and standardisation are key enablers to build the ecosystem.



Large scale demonstration



First ATM/UTM integration system in the EU



← Uniting the things that fly →

Leap frog to a state-of-the-art solution – benefitting from ATM experience

FREQUENTIS
FOR A SAFER WORLD

FREQUENTIS turns 75

Innovation and continuity for a safer world



ATRICS

Strengthening our tower portfolio

Focus

Tower traffic
management

Domain

Tower and airports

Key solution

TowerPad
A-SMGCS incl. AI-
based routing & guidance



Frequentis Orthogon

Helping airlines
to save costs

Focus

Traffic
synchronisation

Domain

En-route, approach,
tower, airports

Key solution

Arrival and
departure manager,
4D trajectory
planner

