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BEST
北京华泰英翔空管技术有限公司

Digital Transformation in ATM

Oct 2020

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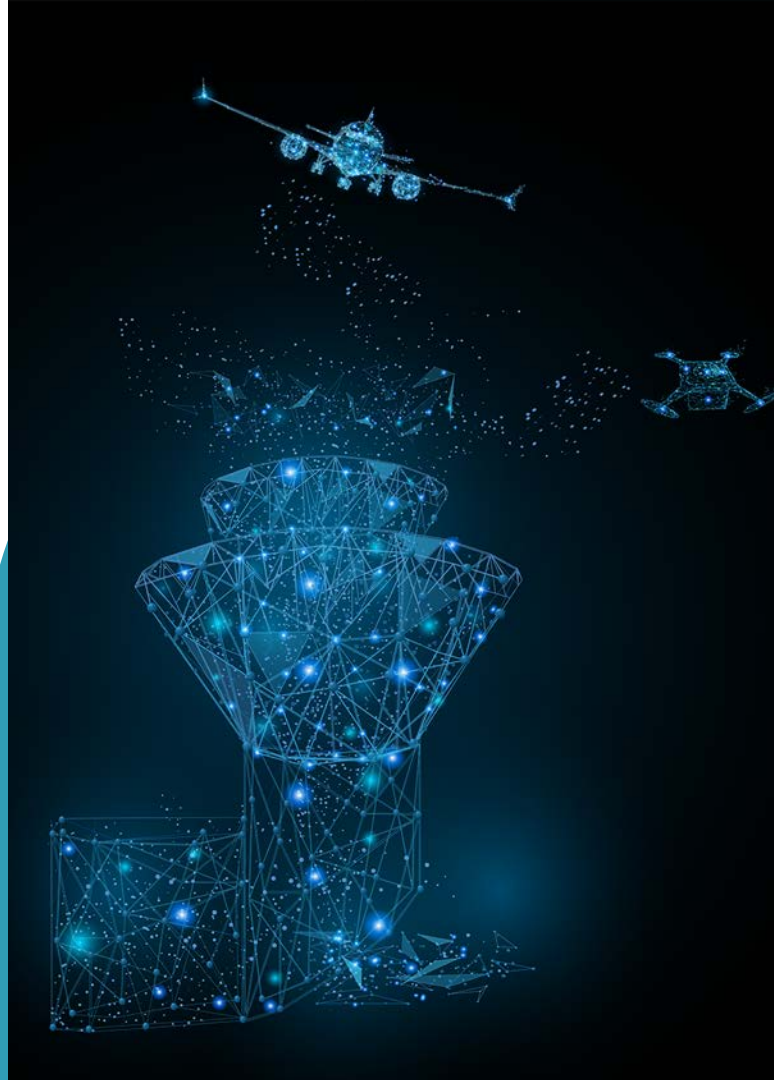
Thales Future ATM Vision



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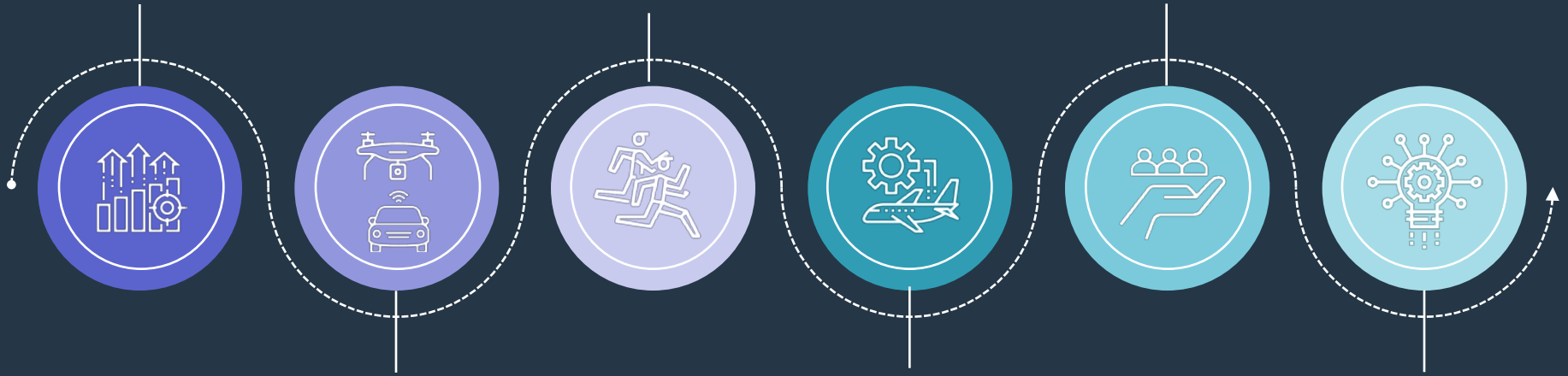
The future of airspace management

Traffic growth

Airspace becomes a rare resource

Sustainability: safety, environment, cost



Complex mobility flows incl. new vehicles

Need for more efficient aviation

New technological enablers: digital, open data, connectivity

Airspace Management Transformation towards full Automation

High level Altitude vehicles & Infrastructures (STM/HATM)

2050
Pilot less commercial aircraft

Aircraft

2020
Operational efficiency Flight & Airport Surface

2025
Single Pilot Operation in cruise

2030
Single Pilot Operation in all flight phases

UTM/UAS

2018
Automated LOS

2020
BVLOS

2022
Urban Air Mobility

2024
Auto. BVLOS w/ Sense & Avoid

2028
Widespread Auto. Operations at scale

Unmanned collaborative autonomous aviation systems

ATM

2020
Non safety critical ATM/CNS application

2025
ATCO Assistance

2030
Partial ATC Automation

Full ATC Automation

SESAR JOINT UNDERTAKING

SESAR JOINT UNDERTAKING

ATM automation will increase thanks to Disruptive digital technologies such as Artificial Intelligence

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ATC functions will move progressively into the digital era

1. ATM non safety critical applications
2. ATCO Assistance
3. Partial ATC Automation
4. Full ATC Automation

- Traffic predictions (ATFM)
- Monitoring ATC performance
- User eXperience feedback for HMI optimization
- Training
- Maintenance

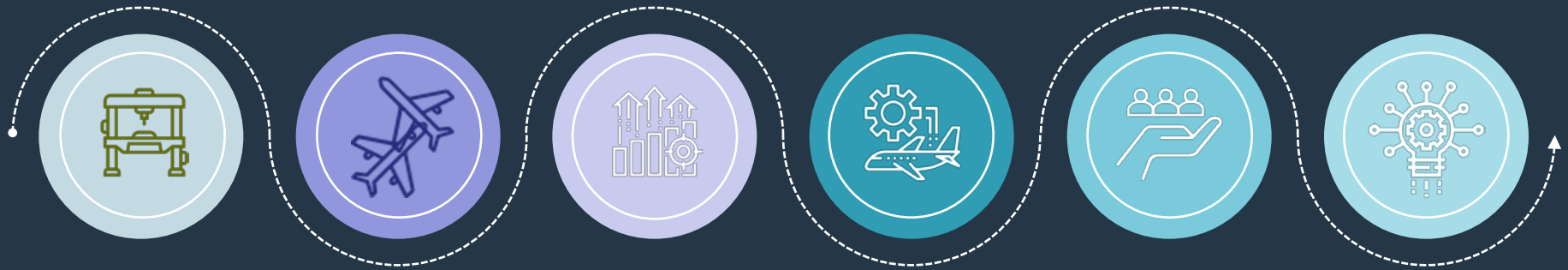
- Safety Nets - conflict detection
- Safety Nets - conflict resolution
- Surveillance Data Function
- Monitoring Aids
- Flight Data Function
- Air Ground Data-link Function
- Aeronautical Information System
- Dynamic airspace management

Operational Benefits perspectives with Artificial Intelligence

Resilience monitoring
Weak signal analysis, ML based anomaly detection

Airspace complexity
Workload assessment, optimal allocation, Environment footprint assessment

Support to ATCO
Efficiency, pressure assessment

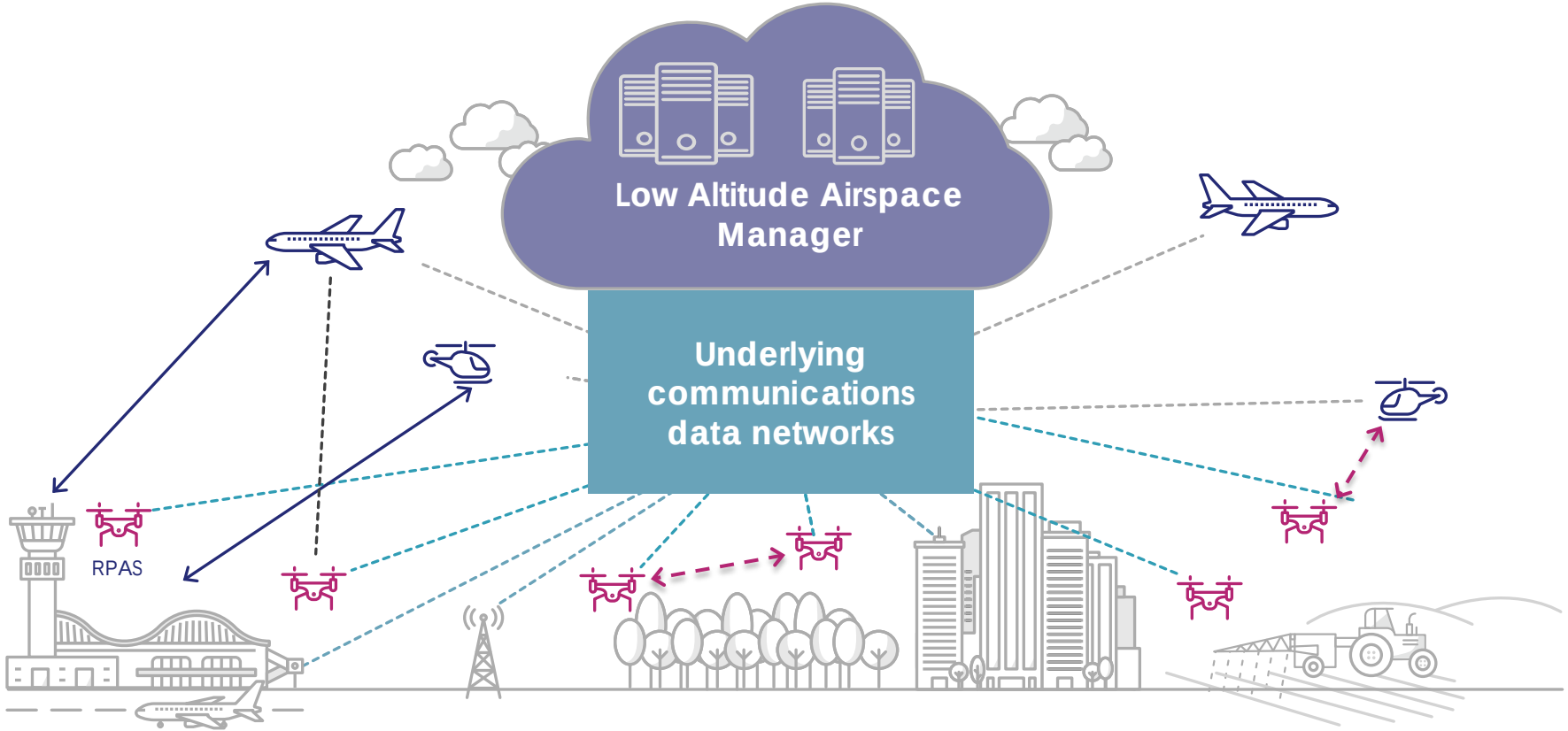


Conflict resolution
quickly identify possible solution to solve conflicting traffic

Traffic forecast
Optimised ETA, ETO, CTOT Weather event forecast

Robustness improvement
Infinite testing capacity, permanent testing, better coverage, hundred millions of validation tests

Integrating Drone Traffic into Managed Airspace



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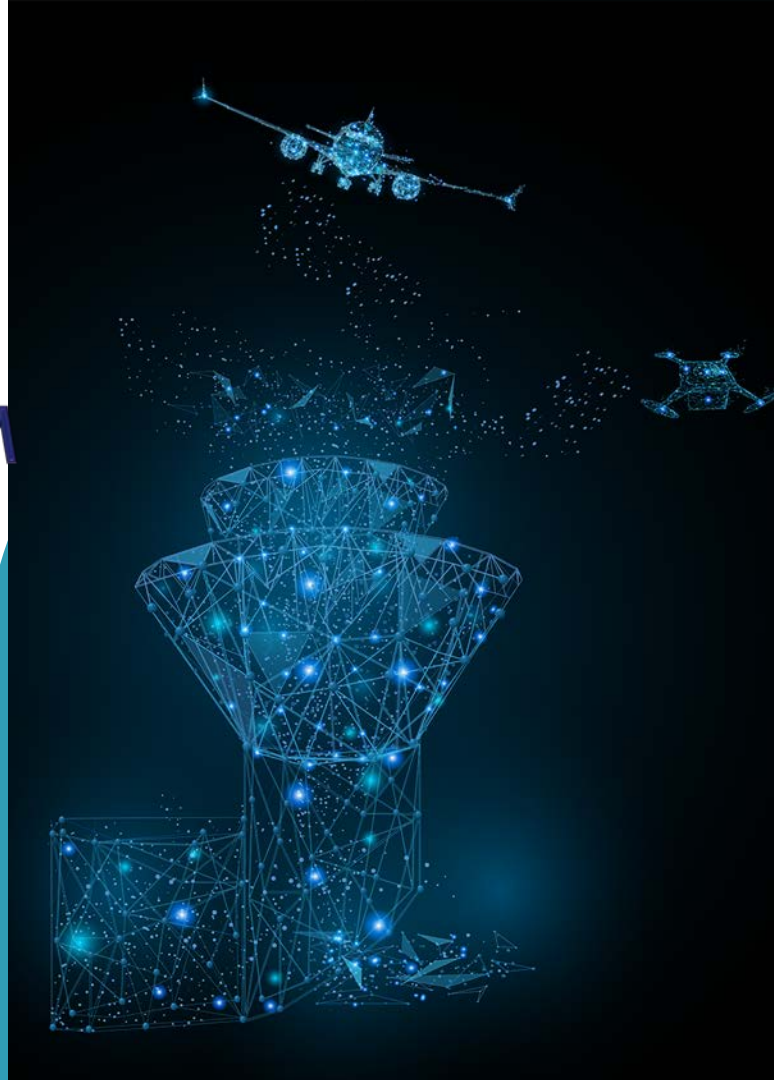
Key Enablers for Future ATM



New Operational Concepts

TopSky ATC

Achieving maximum efficiency and seamlessness

- Optimised and efficient **use of airspace at regional level** requires the implementation of an integrated network of ATC Centres (ACCs and TMAs) which **share a common ATM system**

- Key requirements include:

  - **seamless data sharing** between all ATC Centres
  - the responsibility **for the provision of ATM services for a given volume of airspace can be moved seamlessly within and between ATC Centres**
  - Common view of the airspace status: all ATC Centres know the current system wide configuration
  - ATC Centres can be **disconnected** and **managed independently**; the airspace allocations to manage such cases are adaptable

Modular and distributed architecture - ATC centres are continuously synchronised (SWIM-IOP)

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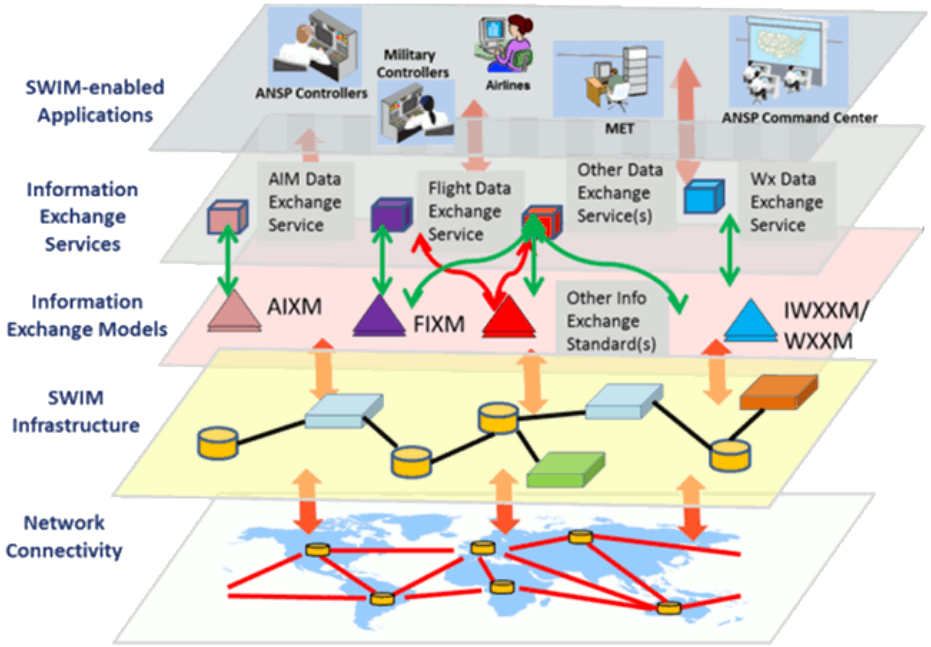
SWIM Overview



SWIM technical infrastructureSWIM

Blueprofile

Real-time high performance data exchange
Mainly Flight Object during execution phase

Yellow profile

Near real time medium performance data exchange
Weather data, Digital NOTAM, Extended AMAN, ...

Purple profile

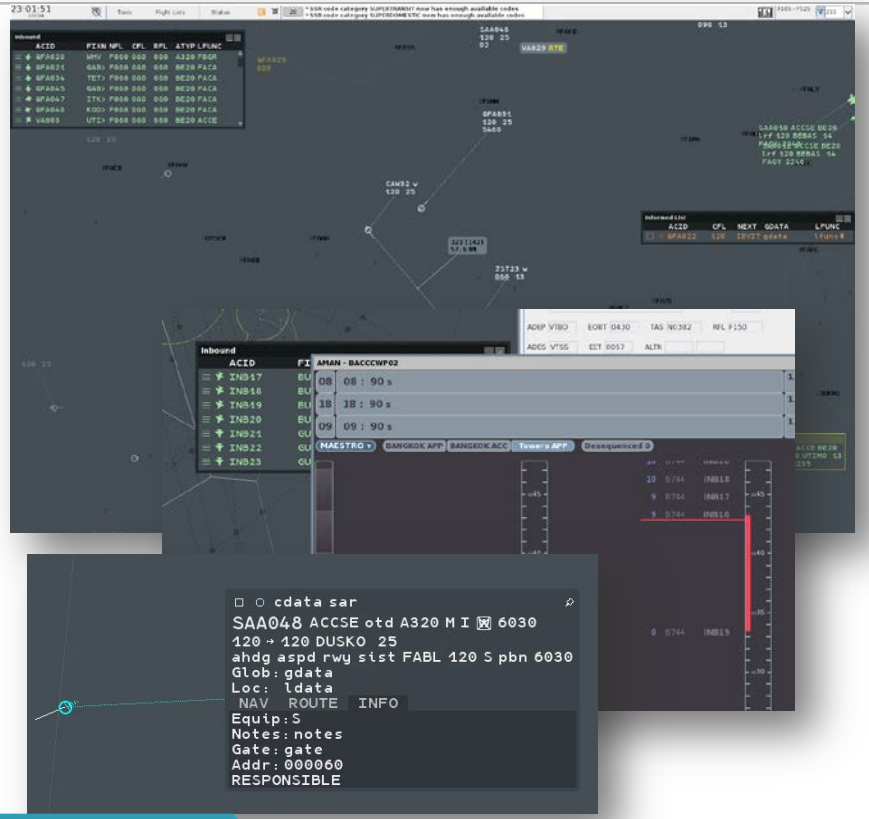
Advisory ground-aircraft data exchange
Weather data, Digital NOTAM

Green profile

Civil-military data exchange
Flight plan, Flight object, ...

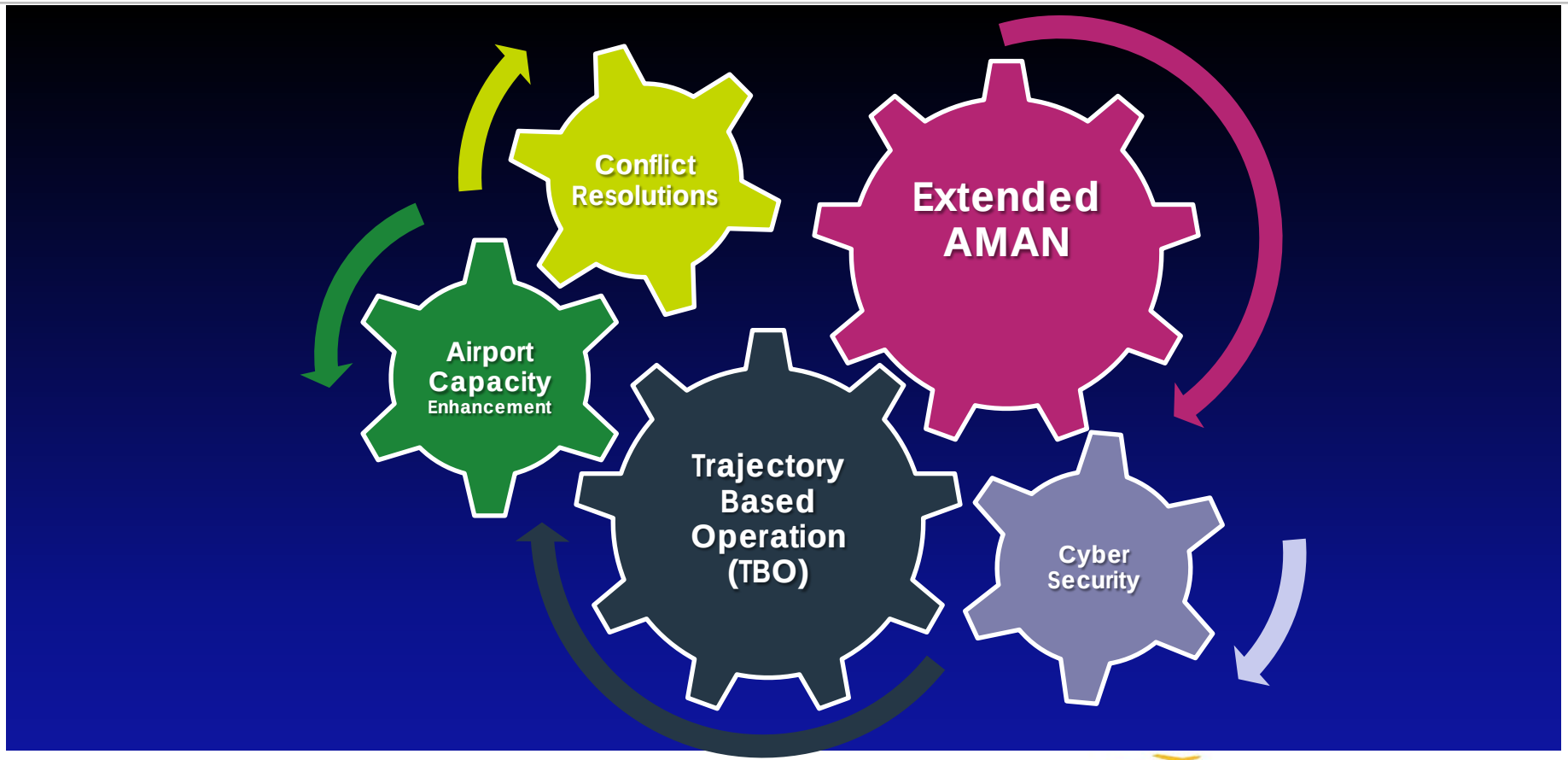
New ATC HMI

- Reduces workload, showing just the right information at the right time
- Fast and easy data input
- Customisable display settings, including track labels, flight data lists and maps
- Automatic danger area, military and restricted airspace management
- Integrated controller-pilot datalink interface
- Real time weather situation display
- Arrival and Departure management tools help to reduce airspace congestion
- Current and future workload analysis and management tools



Reduced Air Traffic Controller workload and enhanced safety

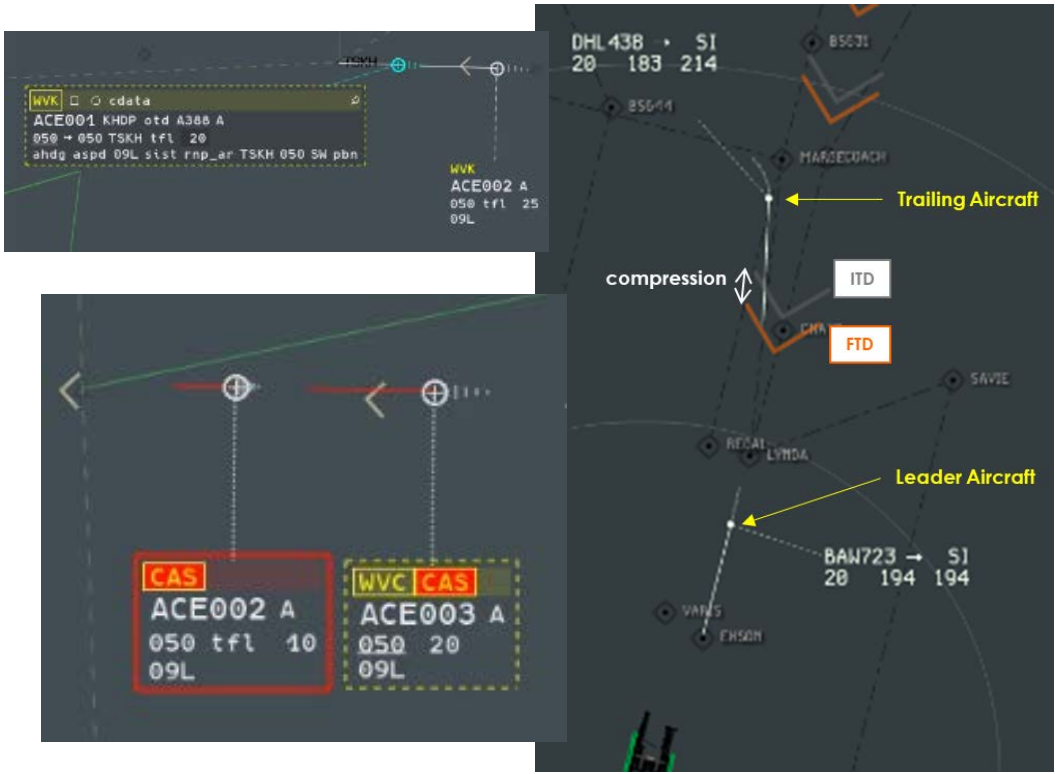
Other Enablers for Future ATMs



Airport Capacity Enhancement

- **Chevrons to indicate optimal spacing between arrival flights according to new ICAO RECAT**
- **Adapting in real time the separation distance to the situation assist controllers**
- **Catch-Up (CU) warning when the trailing aircraft is predicted to cause an infringement**
- **Infringement Alert (IA) when the required spacing has been violated**
- **Speed Deviation (SD) when the approach speed is different than expected for this aircraft type**
- **Sequence Alert (SA) when aircrafts pair in incorrect order according to the known arrival sequence**

Integrated Approach Spacing Tool (AST)



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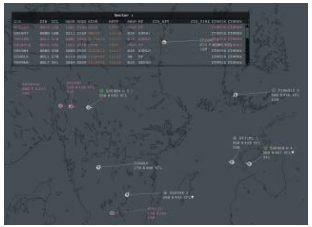
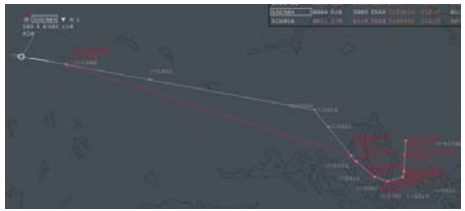
Trajectory Based Operations (TBO)

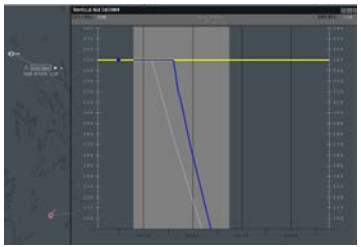
- Manage flight sequences with time control of the trajectory
- To assist the controller with trajectory processing tools and HMI



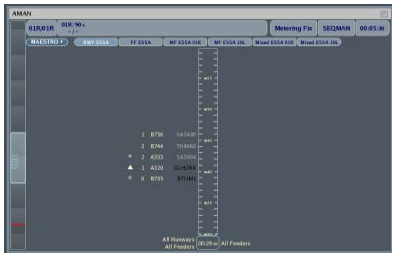
EPP trajectory display (CWP)
RTA conformance (FDP)



2D route consistency (FLIPCY)



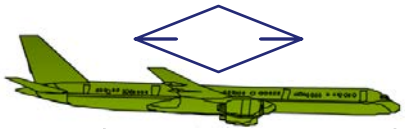
Trajectory Prediction (FDP-TP)



Arrival sequencing (AMAN Maestro)

ADS-C and CPDLC
(Air/Ground Datalink)
ADS-C和CPDLC

ATCO Tools
(MTCD, CDR, etc ...)



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Deploying Cybersecurity Protective Solutions for ATM systems

- Insertion of infected USB key on Online system
- Login usurpation on Online system
- Remote access to ATC LAN and gain admin on Online system
- Spoofing of ADS-B radio signal
- Spoofing over radar data network

- CPDLC Controller or Pilot usurpation CPDLC
- Malware injection in maintenance
- GPS radio signal time spoofing
- Spoofing of Aeronautical Information
- Malware injection in software supply

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Thanks for listening

Together we can build the
Digital Sky of the Future

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