
HungaroControl
THE FUTURE
OF ATM

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ABOUT

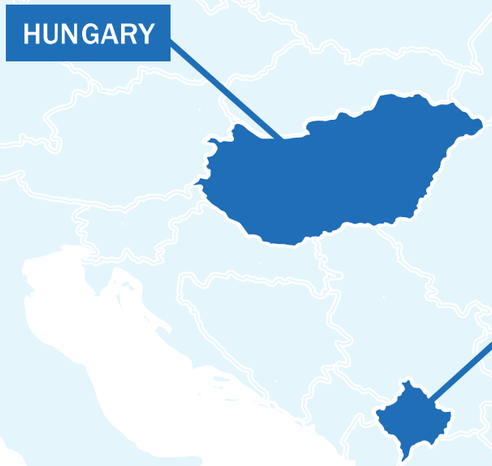
PROFILE

HungaroControl is a provider of specialist professional services and a certified provider of air navigation services; we deliver safe and efficient air navigation services to more than one million flights annually in the Hungarian airspace and in the upper-airspace of Kosovo.

OUR MISSION

In the process of creating a single European airspace, HungaroControl pioneered multiple domains in the ATM industry, resulting in highly complex, tailor-made and world-class system.

HUNGAROCONTROL IN NUMBERS (2023)



RECORD TRAFFIC
1 MILLION+ MOVEMENTS

1 079 237
Movements in Hungary's airspace

152 215
Movements in KFOR sector

EUR 29.5 m
CAPEX (2022)

29,1%
ROAE (2022)

EUR 130.7 m
Annual turnover (2022)

775
Employees
200 ATCOs, 358 ATSEP

AT THE FOREFRONT OF ATM INNOVATION

ADVANCED ATM SYSTEM
2005

20+ years experience developing complex and customized system, thus creating one of the most innovative ATM system in the world.

Partnering with

THALES

REMOTE SERVICE PROVISION
2014

Providing ATM services in the upper airspace of Kosovo from the Budapest ACC, since 2014.

Partnering with

NATO OTAN

FREE ROUTE AIRSPACE
2015

First to introduce FRA operations saving millions of miles, thus reducing travel time, airline cost and CO2 emissions in the European sky.

Partnering with

FIRST GENERATION DIGITAL TOWER
2016

World's first and only ANSP to operate a medium sized airport from a remote tower facility.

Partnering with

SEARIDGE TECHNOLOGIES

ATM R&D
2017

Delivering solutions from concept to operation, we are actively shaping the Single European Sky.

Partnering with

sesar JOINT UNDERTAKING

NEXT-GEN DIGITAL TOWER
2024

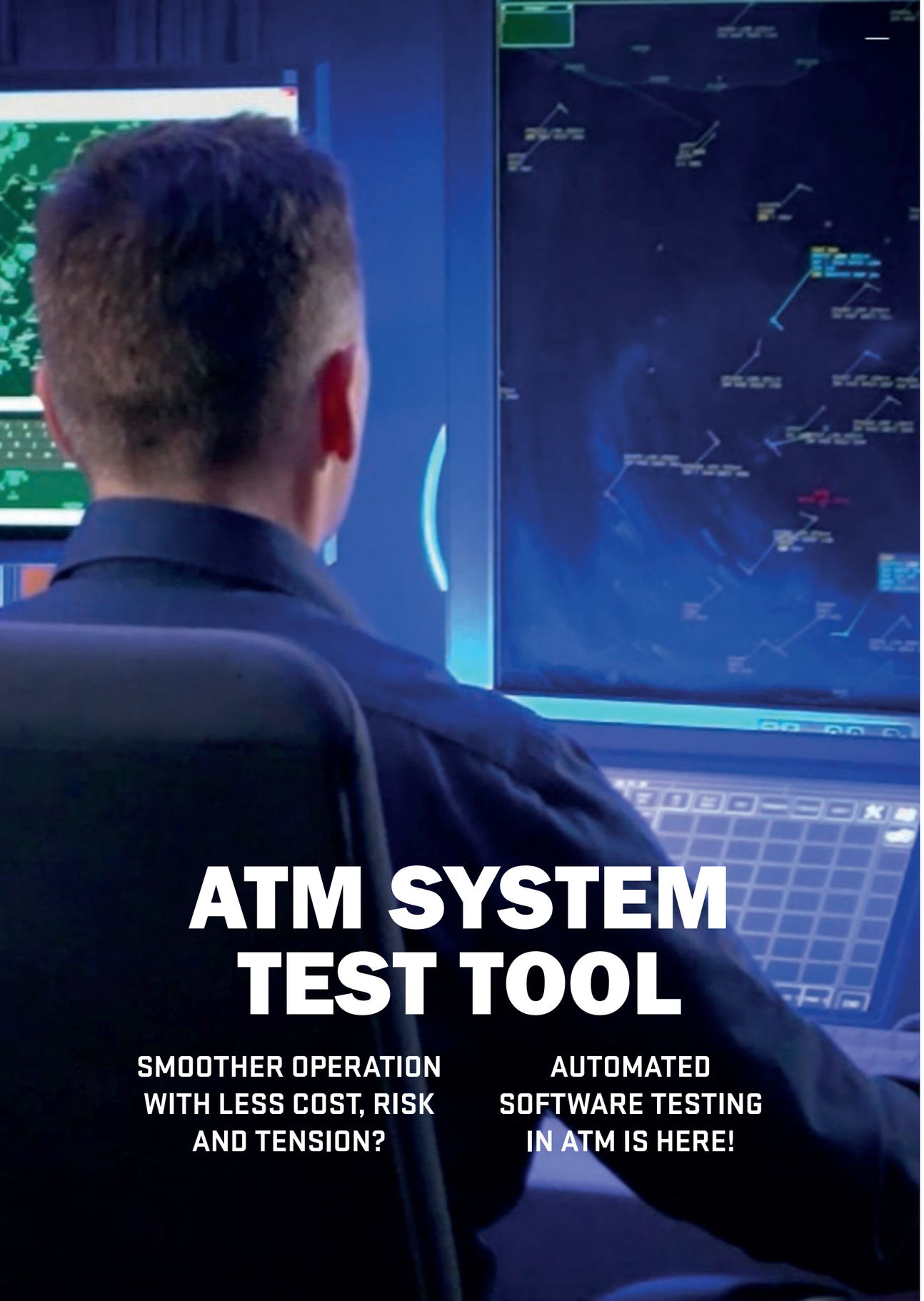
Deploying a fully-capable, integrated second generation digital tower facility.

Partnering with

indra

PIONEERING TEST AUTOMATION IN ATM

01



BEST OF BOTH WORLDS

HungaroControl

100+ YEARS EXPERIENCE IN ATM

The Hungarian ANSP delivers safe and efficient air navigation services both in Hungary and in the upper-airspace of Kosovo.

HungaroControl is the pioneer of complex, tailor-made automated software testing in the ATM domain.

THE 1ST OFFICIAL TEST RUN - DECEMBER 2023

1st official test run has been performed at HungaroControl prior to the operational implementation of the major software upgrade of the main ATM system (MATIAS)

All the main functionalities were covered or at least touched by the run of the test series.

- 325 test cases
- runtime duration 11-12 hours
- identified issues: 8

The test tool also discovered phenomena that were not revealed by the traditional manual testing process running parallel to it.

PROOFIT premium services

15+ YEARS EXPERIENCE IN TEST AUTOMATION

ProofIT is a highly specialized software test automation company for B2B customers in safety critical industries.

Providing it's own low code test automation platform, we help mitigate operational risks and empower our partners to do so.

- Number of **automation experts:** 20+
- Number of **successful projects:** 150+
- Number of **test Executions:** 5 million+

PROVEN AND TRUSTED AUTOMATION ACROSS SECTORS

The test tool used for the first time in the ATM industry already has many references, the experience gained in external industries greatly helped the adaptation of the test tool to ATM system.

- Banking
- Public Administration
- Automotive

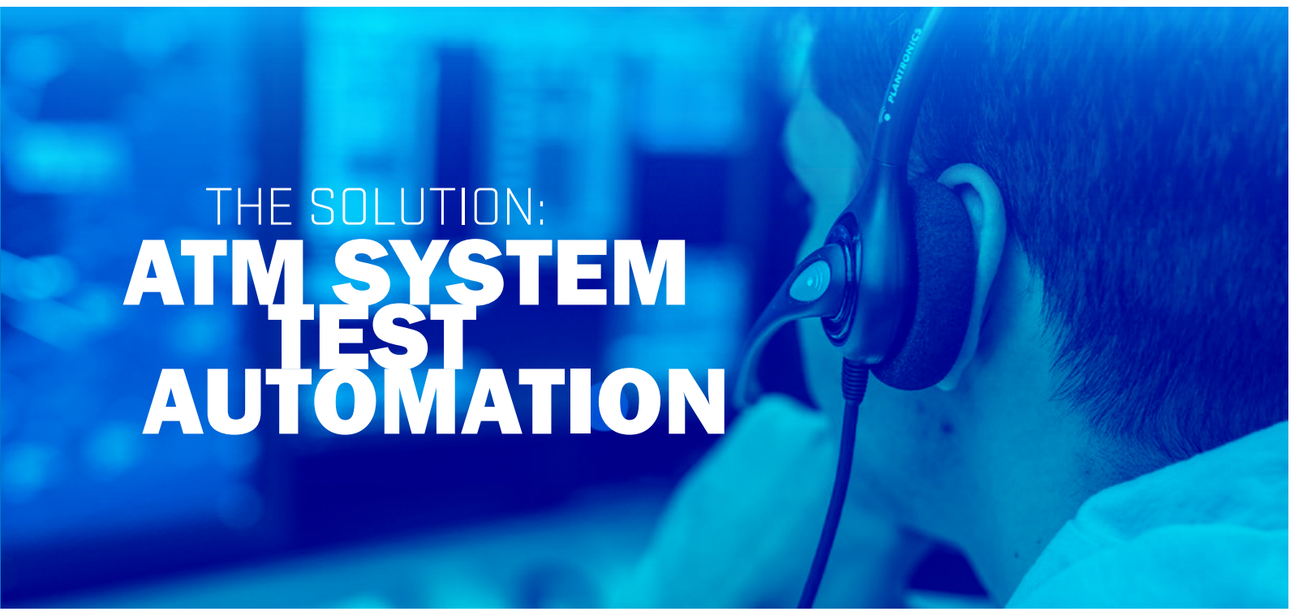
MANAGING ACCELERATED CHANGES IN ATM

CAPACITY ISSUES
ATCO and expert capacity issues are a day-to-day challenge for ANSP executives, testing also requires human resources.

REMAINING RISKS
Insufficient test data and test coverage, as the preparation of even relatively simple flight situations for testing purposes requires far more activity than just testing.

ATM DOWNTIME THREAT
Manual regression testing involves hundreds of minor incidents yearly, which could cascade to higher severity, and potentially preventable blackouts.

TIME PRESSURE
Testing a highly complex ATM system manually is time consuming even with a dedicated team of experts, which results in slow feedback and long time-to-market for new capabilities.



THE SOLUTION:
ATM SYSTEM TEST AUTOMATION

KEY BENEFITS

SAFER

Reduce risks with wider coverage, denser safety nets with less human resource

Bugs and humans usually don't get along very well. Automated testing takes the human risk out of the equation, while it allows for more tests to be run and requires less time.

FAST LANE

Avoid risks and directly apply the results of 5 years of R&D

The solution is based on a proven, deployment-ready automation platform with vendor and technology agnostic approach. Our test cases are designed in line with aviation industry specific standards and processes.

ENHANCED VALUE

Increase productivity and creativity of your experts

Your key assets are your experts. Automated ATM software testing could save you up to 90% of the hours spent with manual regression testing, while it does not require software developers. Thus your experts can focus on real expert tasks.

CUSTOMIZED

Benefit from the collaboration and services offered by an ANSP and a test automation expert

ATM system test automation is already a reality, but it also needs implementation and customization. HungaroControl's team of experts are ready to support your processes in the field of ATM system development, integration and testing.

VALUE PROPOSITION

Flight Safety

Reduced number of incidents
Greater test coverage results in a safer sytem and a higher rate of error detection

Reduced operational risks
During the testing process no deviation will go undetected

Less escalation
As a result of more accurate testing, less security and supervisory escalation is required

Auditable test results
Automated test reporting supports a simplified documentation for the relevant authorities

Efficiency

Unleashed human capacity
Instead of highly repetitive testing, the skilled workforce can perform tasks with higher added value

Cost-effective
As a result of automation, working hours and overtime can significantly be reduced

Real-time feedback
The ATM software supplier and operator receives feedback on emerging errors real-time

Shorter downtime
Due to fewer system errors and accelerated processes, partial or complete downtime is reduced

Automation

Fully automated
During testing no human intervention is required

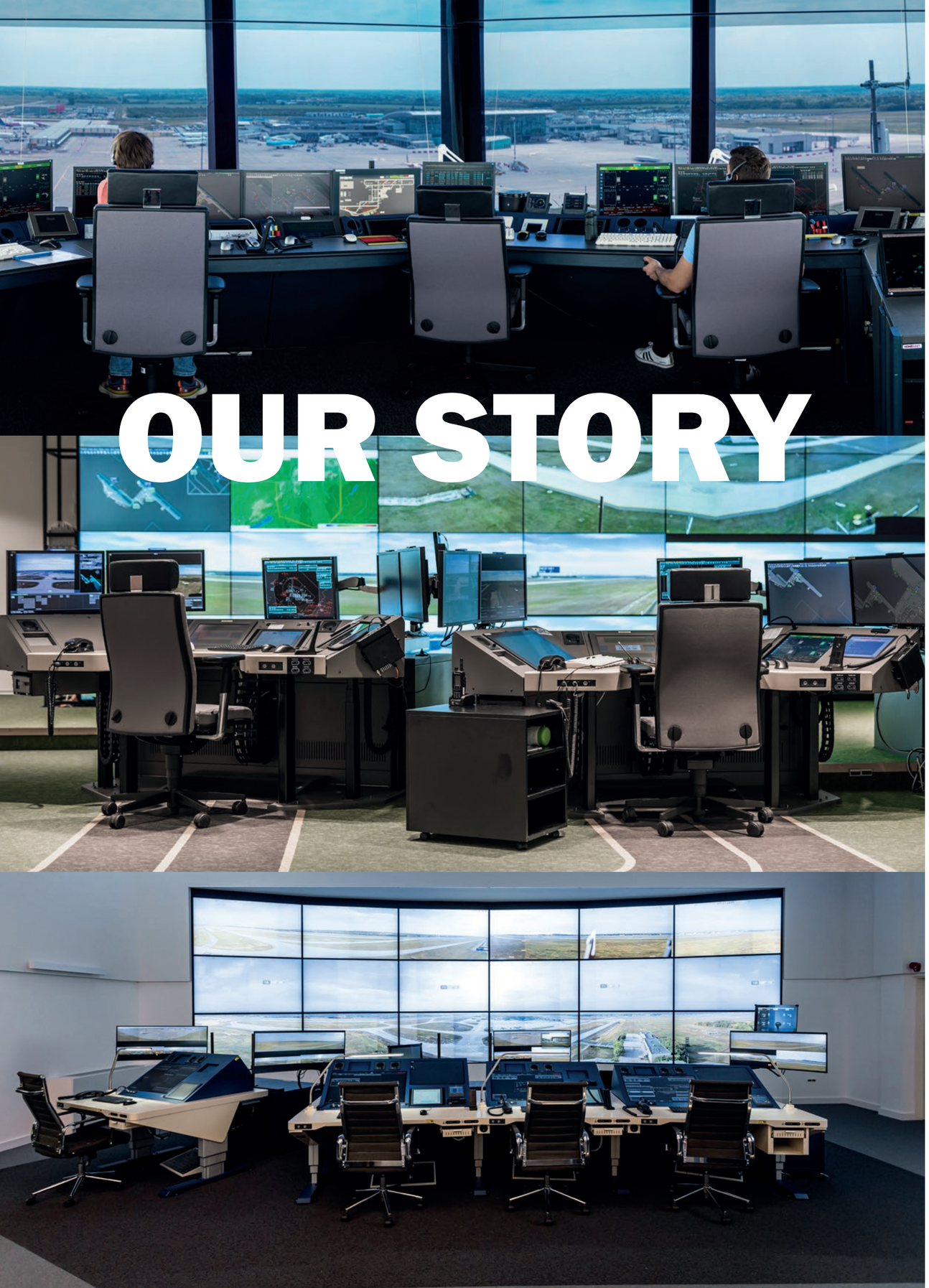
Training made simple
The management of the system is easy to learn even without programming skills

Future proof solution
The test system can support any ATM system, technology mix and test types

Real life testing
The test system is capable of simulating any parameters, events, and processes

NEXT-GEN DIGITAL TOWER

02



OUR STORY

DIGITAL TOWER PROGRAM PHASES

2013
Start of the planning, design and installation phase

2016
SESAR Very Large Scale Demonstration

2017
Launch of world's first Digital Tower for a medium-sized airport (LHBP)

2024
Operation readliness of world's first second generation Digital Tower at LHBP

2025
Full Digital Tower capability (main & contingency / simulator Digital Towers)

FIRST GENERATION

Visualization is new, all other elements are duplicated

Flat, matrix **videowall**

Multiple viewpoints, but panoramic is dominant

Integration limited to A-SMGCS and the video system

4 separate controller working positions

New features: PTZ, labelling, video tracking etc.

OPERATIONAL EXPERIENCE

During 2022 over 900 live operational hours completed, half of them with no real tower available!

4000+
hours of live operations

20 000+
movements handled

90%
of the time in good visibility – using cameras

60%
of the time dual runway operations

90%
of the traffic was IFR flights

SPECIAL EVENTS HANDLED SMOOTHLY:

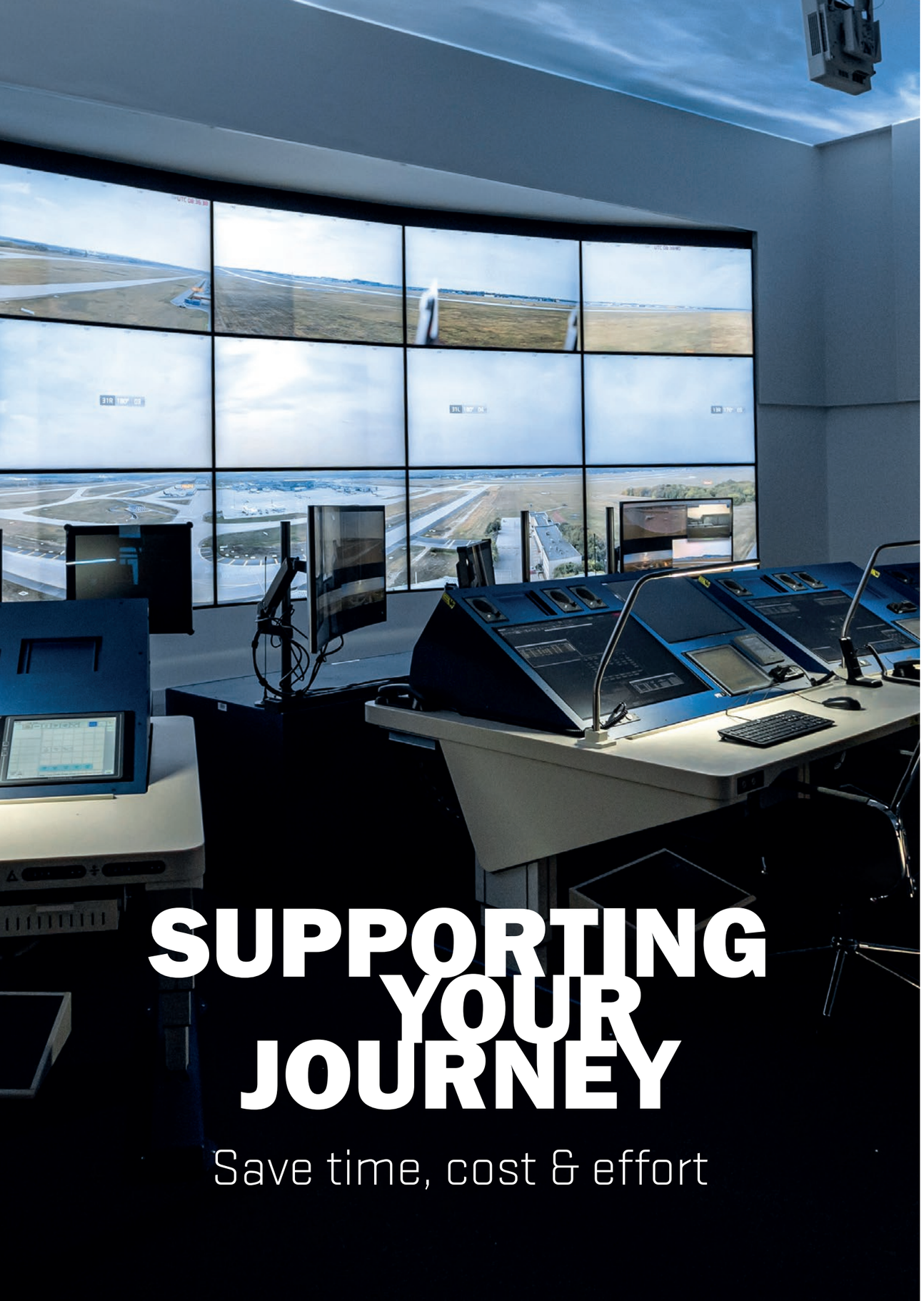
Emergencies

Training flights

Airspace and airport restrictions

NEXT GENERATION

- Highest level of system integration
- Simplified and compact CWPs
- Sophisticated built-in safety net
- Flexible use of visual surveillance



SUPPORTING YOUR JOURNEY

Save time, cost & effort

PIONEERING THE DIGITAL TOWER CONCEPT

World's first operational digital tower
for a medium-sized airport
with 100 thousand+ movements / year

8+ years

hands-on experience and substantial CAPEX in ops and implementation

Zero safety events

related to digital tower operations

100% success rate

ATCO transition to digital tower

Next-gen

digital tower solution provides the highest level of integration

CREATING VALUE

COST

UP TO -50%

A tailor-made digital tower solution with added know-how will result in significant savings.

TIME

UP TO -60%

Reaching the summit is always easier, quicker and safer with an experienced guide.

EFFORT

UP TO -70%

Learning from other's experience eliminates the risks of a major project failure and minimizes avoidable efforts.

NEXT-GEN DIGITAL TOWER – BENEFITS

ENHANCED SAFETY

Next generation digital towers perform better than conventional infrastructure, providing improved visibility and improved situational awareness even in adverse weather conditions.

INTEGRATED

Modular integrated digital towers offer seamless integration to existing system environment and a sophisticated single HMI which improves safety and reduces workload.

SCALABLE

Digital towers are more versatile than traditional tower solutions especially in the case of multi-airport operations allowing ANSPs to efficiently manage human capacity that is adaptable to traffic demand.

COST-EFFECTIVE

Traditional tower refurbishment or construction costs are no longer a headache. A digital tower solution is a sustainable, easy-to-deploy and cost-effective alternative with an estimated 30-50% reduced cost.

MULTI-PURPOSE

Contingency infrastructure can be physically separated from the aerodrome without limitations. Single or multi-remote solutions adapt to the unique needs of the service provider.

ACCELERATED

Compared to construction sites or refurbishments, deploying a virtual tower does not necessarily need a new facility, therefore the project timespan can be radically reduced.

BASED ON EXPERIENCE NOT FANTASY

CHALLENGES INCLUDE	WE'VE GOT YOU COVERED
UNCHARTED TERRITORY Hitting dead-ends along the way are part of the natural learning curve, however most project timelines do not tolerate going back to the starting line again and again.	**PROVEN METHODOLOGY** Our experts posses over a decade track record in planning, design, implementation and operations. This extensive experience is incorporated and built into our second generation system. Our methodology is robust, solid and proven.
ANSP-TECH PROVIDER RELATIONS Choosing the right functionalities and system setup is crucial and always unique. The wide range of services offered by technology providers carry a high risk of shifting focus from what your needs demand.	**ANSP2ANSP** An Air Navigation Service Provider's best ally is a fellow Air Navigation Service Provider. We know your painpoints, understand your needs and support you to only implement what you need and not what is offered out on the market.
ATCO ACCEPTANCE Your system is all set, but how will your ATCO's respond? If Human Factors aspects are not considered your concept has a higher risk of failure. An otherwise well functioning system setup may cause unnecessary work fatigue, or decreased situational awareness compared to physical infrastructure.	**ATCO SATISFACTION** One cannot underestimate the significance of ATCO acceptance. Putting humans first and focusing on concept feasibility resulted in content and passionate air traffic controllers. Special attention was paid to every detail from ambient lighting to an integrated HMI.
MANAGING THE AUTHORITY Preparing the required documentation for the Aviation Authority could prove challenging for an ANSP.	**REGULATORY APPROVAL SUPPORT** Giving proper assurance for the Authority – and even EASA - that digital towers are a safe alternative required extensive effort. Our 8+ years in live operations prove that we were successful and are ready to support you.

PROVEN AND TRUSTED. GLOBALLY.

SINGAPORE

CONTEXT In order to prepare for the future, the Civil Aviation Authority of Singapore (CAAS) embarked on the Smart Tower Prototype (STP) project to evaluate the feasibility of digital tower operations at Changi International Airport.

SOLUTION As part of a delivery consortium, HungaroControl applied its experience in digitalising tower operations to support the concept development and design planning of CAAS' STP at Changi International Airport.

RESULT Smart Tower Prototype was succesfully implemented.

DUBAI

CONTEXT Faced with the need to bolster operational resilience, Dubai Airport needed to rethink how their contingency solution could be strengthened through application of advanced video surveillance technology.

SOLUTION As part of a delivery consortium, HungaroControl was responsible for supporting the concept development and business case for digital tower implementation at Dubai International Airport and Dubai World Central.

RESULT Based on the Operational Concept Dubai Airport contingency solution was successfully implemented.

KINGDOM OF SAUDI ARABIA

CONTEXT In 2020 SANS made a move towards digitalizing its tower services. As a first step, one existing airport – Al-Ula – and one new development – the Red Sea International – are going virtual.

SOLUTION As the major consultant, HungaroControl provided full support for the concept development and ConOps creation as well as critical safety, human factors and regulatory documentation for both aerodromes.

RESULT Deliverables supported the foundations for a virtual tower strategy for the Kingdom and cleared the way towards regulatory acceptance and deployment.

DIGITAL TOWER SERVICE PORTFOLIO

1 CONCEPT DEVELOPMENT & ANALYSIS

Preparation
- Site survey
- Business requirements definition
- Requirements management

Concept Planning
- Concept of operations
- Safety and Human Factors planning

Concept Feasibility Analysis
- 3D modelling and simulation
- Hazard identification and Human Factors Impact assesment
- Cost benefit analysis

2 DESIGN

- Project Planning
- Change Management Planning
- Human Factors and Risk Assessments, Requirement Identification
- Technical and Operational Requirement definition and User testing

3 IMPLEMENTATION

- Operational Transition Planning
- Safety and Human Factors Assurance
- Project Execution Process
- Project Control and Assurance
- Change Management Execution
- Operational Training Foundation

4 VALIDATION & ACCEPTANCE

- Pre-operational Validation
- Operational Training Delivery
- Safety and Human Factors Case

UTM SOLUTIONS

Creating an advanced
UTM ecosystem

03

CURRENT OPERATING ENVIRONMENT

1 TECHNOLOGY

The **mydronespace** mobile app, and the authority interface **IXO console** provides basic information and functions to the parties in accordance with the statutory designation.

2 END-USERS

In the **hobby** segment, about 5-10% of the end-users are currently registered in the application. They have negative experiences with the current framework.
Automated system have appeared in the **business** segment, the number and complexity of operations is increasing.
From the **state** side, we received requirements for more sophisticated control functions, and also there is an increase in the UAS, remote pilot and operation numbers.

3 LEGISLATION, ADMINISTRATION

Temporary segregated airspace obligations over populated areas significantly **reduce the willingness** to carry out operations in a regular manner.
The **exact position of the drones is not known,** forcing this with the help of some mandatory beacon would be a solution.
Fragmented database and authority processes - some registration administrative processes might take longer (up to half a year).
UAS operations with **Business purpose are less supported** (specific or certified category).

4 FRAMEWORK

At the **state** level, there are no precise tasks and responsibilities defined in regulations.
Our current services **are free**, but the maintanance is not financed by the state.

The GOAL is to create

A USER-FRIENDLY UTM ECOSYSTEM

that catalyzes the drone industry

- In accordance with the transformative programs set out in Hungary's Drone Strategy and HungaroControl's strategic plans
- Through a complex service portfolio that satisfies both state, business and hobby needs
- With the central role of HungaroControl, in a commercially sustainable model
- With the active participation of key stakeholders from the public sector and affected state institutions

HUNGAROCONTROL'S ACTIVITY

WITHIN THE DRONE INDUSTRY

THE BEGINNINGS

2019 – 2020
Introduction of EU regulations

- Mydronespace mobile app development and introduction
- IXO-Console authority interface development and introduction
- Active participation in the legislative codification process

2021
Hungarian Drone Strategy

- Hungarian Drone Coalition domestic drone strategy and leading UTM U-Space working group

2022
UTM Concept development

- Market research, benchmarking
- Stakeholder analysis
- Internal competence development
- UTM ecosystem concept development

Participating in international R&D projects: USIS, SAFEMODE, SESAR PJ.34, PJ.13

2023

UTM system tests

In the first semester of 2023, testing the system of UTM developers present on the international market.

The main purpose was to expand our knowledge about UTM system functions, as well as to assess the needs of the state and civil stakeholders.

UTM ConOps

Preparation of the UTM Concept of Operations document.

Its goal was to lay the foundations of a UTM ecosystem that responds to the challenges of the current operating environment, takes into account industry development and international trends, and is based on the needs of a wide range of stakeholders.

Technical specification

Detailed specification of requirements related to the UTM system.

This is mainly based on the experience we gained from the system tests and the proposals made by our state and civil partners.

THE PROCESS

Step 1:
Analysing international regulatory and technological trends

- There is no national-level ***"off-the-shelf"*** system that provides full functionality;
- Improvements will have to be made to meet our end-users' - mostly state - needs;
- Connection to **business and government third-party system** (meteorological service, obstacle and other databases, maps, official database) is **key to creating the entire UTM ecosystem.**
- Communication with drones can be realized on the **existing 4G/5G mobile communication networks** (e.g. GNSS based position data);
- The UTM system provides information for separation from individual static landmarks and other known air traffic, but **cannot guarantee its completeness**. In order to ensure a high degree of safety, it is necessary to use the integrated on-board system (Sense and Avoid).

Step 2:
Putting together the key components of the UTM ecosystem

- Building a critical infrastructure element with high reliability, high availability and accuracy
- ATM - UTM interface (between traditional air traffic control and drone management system)
- Establishing an integrated air situation display
  - Displaying the current position of cooperating drones (up to 100-150 meters, via existing terrestrial mobile communication technology)
  - Potential to integrate system for detecting non-cooperative drones
  - Display of general air traffic position data
- Ensuring access to a national level, unified database
- Enabling BVLOS operations
- Automated strategic and pre-tactical conflict assessment

Step 3:
Creating a service portfolio so that end-users can achieve a real increase in efficiency

GO FROM CONCEPT TO A MARKETABLE SERVICE

In order go from concept to a marketable service a business case and business specification was created based on the research of market standards and detailed analysis of both the expense and revenue sides.

EXPENSE

- An extensive **market research** was carried out regarding the available UTM system and, together with key domestic users, the most advanced ones were subjected to **functional tests**. The results were analyzed in detail.
- Based on detailed technical descriptions, **indicative price offers** were requested from 9 market players. The results were synthesized.
- Additional, **connecting market services** were assessed that could potentially support the service portfolio and the provision of service (customer service, pricing and invoicing)
- Additional **business cost elements** were identified that are essential for service provision (IT, HR, mgmt., etc.)

REVENUE

- **Market segmentation** was carried out
- Various **user personas** and customer journeys were developed in each market segment
- **Value propositions** were compiled using core and third-party services based on the previously identified preferences
- **Value based pricing strategy** was developed
- Appication of **international benchmarks** and different **forecasting methodologies,** taylored to the domestic environment

UTM ADVISORY SERVICES

CONCEPT DEVELOPMENT AND ANALYSIS

- business and operational requirements definition
- environment specific methodology development
- comprehensive market 'research'
- UTM system evaluation methodology
- UTM system overview, evaluation and ranking
- UTM system tests planning, execution and evaluation

Concept of Operations

DEFINITION

- technical specification development
- business and services specification development
  - stakeholder identification and analysis
  - value proposition
  - user needs
  - user personas
  - market segmentation
- business case development
- cost-benefit analysis
- pricing strategy

Technical Specification
Business Case

HungaroControl