

# FLY SEC

Optimizing time-to-FLY  
and enhancing airport SECurity



Funded by the Horizon 2020 Framework Programme  
of the European Union for Research and Innovation



# Letter from the coordinator



Increased passenger flows at airports and the need for enhanced security measures from ever increasing and more complex threats, lead to long security lines, increased waiting times, as well as often intrusive and disproportionate security measures that result in passenger dissatisfaction and escalating costs.

As expressed by the International Air Transport Association (IATA), the Airports Council International, (ACI) and the respective industry, today's airport security model is not sustainable in the long term.

The vision for a seamless and continuous journey throughout the airport and efficient security resources allocation based on intelligent risk analysis, set the challenging objectives for the Smart Security of the airport of the future.

FLYSEC, a research and innovation project funded by the European Commission under the Horizon 2020 Framework Programme, developed and demonstrated an innovative integrated and risk-based end-to-end airport security process for passengers, while enabling a guided and streamlined procedure from landside to airside and into the boarding gates, offering for the first

time an operationally validated innovative concept for end-to-end aviation security.

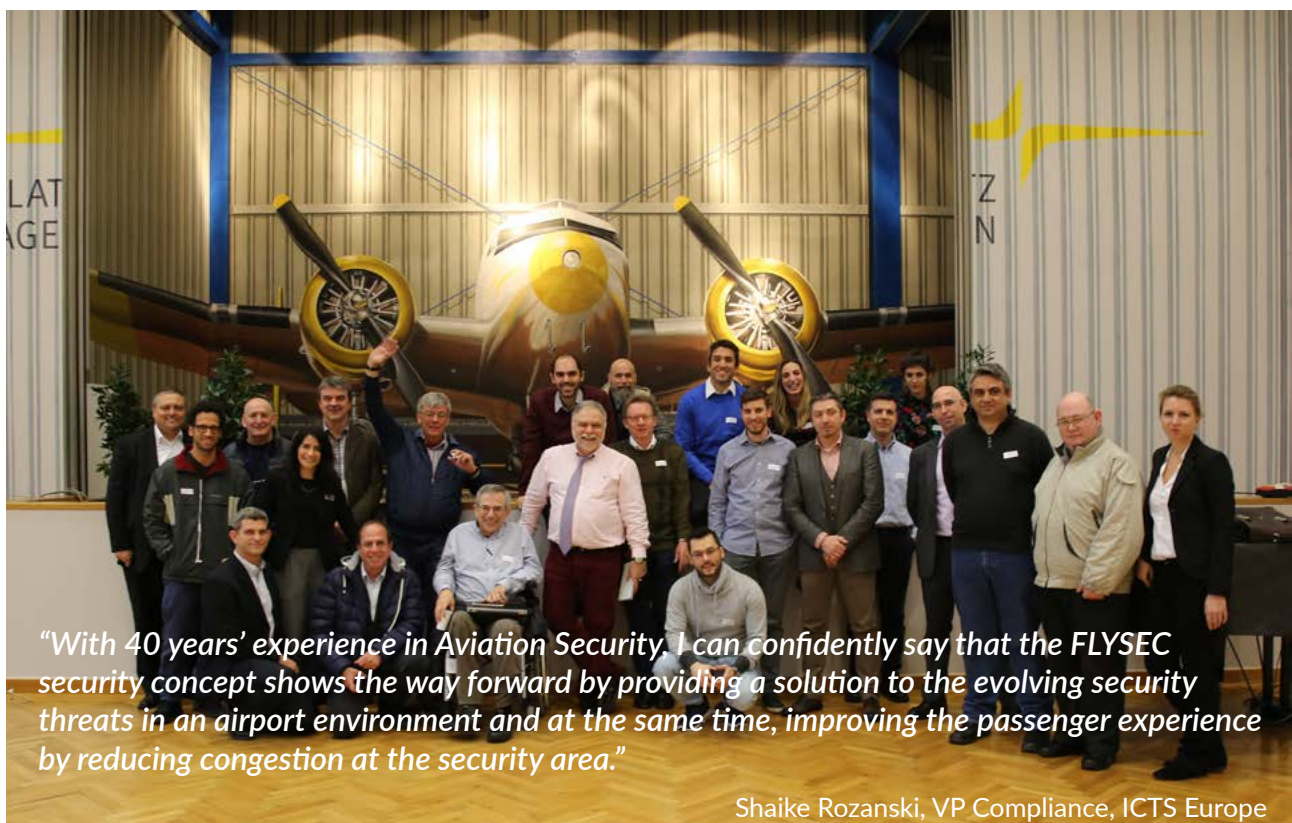
With a consortium of eleven highly specialised partners, coordinated by the National Center for Scientific Research "Demokritos," FLYSEC developed and tested an integrated risk-based security system with a PoC (Proof Of Concept) validation field trial at the Schönefeld Airport in Berlin, and a final pilot demonstration under operational conditions at the Luxembourg International Airport.

The FLYSEC final event in Brussels on June 28, 2018, gave the opportunity to a targeted security experts audience to learn more about the project and its achievements.

Many thanks to all partners who contributed to the success of FLYSEC!

**Dr. Stelios C. A. Thomopoulos**

FLYSEC Project Coordinator  
Institute Director & Head of ISL  
Integrated Systems Laboratory  
Institute of Informatics & Telecommunications  
National Center for Scientific Research "Demokritos"





# Introduction to FLYSEC

The FLYSEC project addressed the European Union's research priority for improving the aviation security chain and aligned with the roadmap and recommendations reflected within the IATA/ACI Smart Security programme. FLYSEC facilitates the three main principles specified in Smart Security: **strengthened security, increased operational efficiency and improved passenger experience.**

FLYSEC developed and demonstrated an innovative, integrated and end-to-end airport security process for passengers, while enabling a guided and streamlined procedure from landside to airside and into the boarding gates, and offering for the first time an operationally validated innovative concept for end-to-end aviation security.

FLYSEC activities included:

- An innovative process facilitating risk-based screening to achieve a measurable increase of throughput at airports,
- The deployment and integration of new technologies and repurposing existing solutions towards a risk-based security paradigm shift,
- The improvement of passenger facilitation and customer service, bringing Security as a Service into the airport of tomorrow.

Technically, FLYSEC achieved its ambitious goals by integrating new technologies on video surveillance, intelligent remote image processing and biometrics combined with big data analysis, open-source intelligence and crowdsourcing.

Also, existing technologies such as mobile application technologies for improved passenger experience as well as RFID for carry-on luggage tracking and quick unattended luggage handling were repurposed and integrated into the FLYSEC solution.

FLYSEC initially performed a Proof of Concept test at Schönhagen Airport of Berlin, followed by a final field test at Luxembourg International Airport. The latter was executed in a real operational environment involving active security personnel.

The successful Lux Airport field test marked the first implementation of SMART SECURITY within the EU Programme for Research and Innovation.

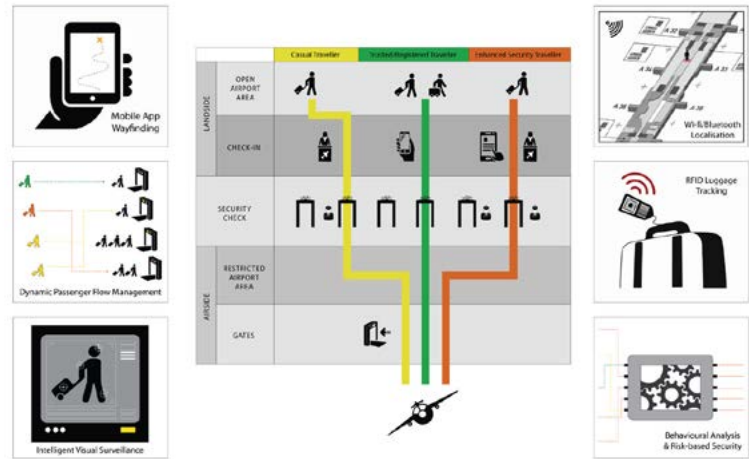


# FLYSEC Security Concept

FLYSEC provides an innovative concept for airport security based on

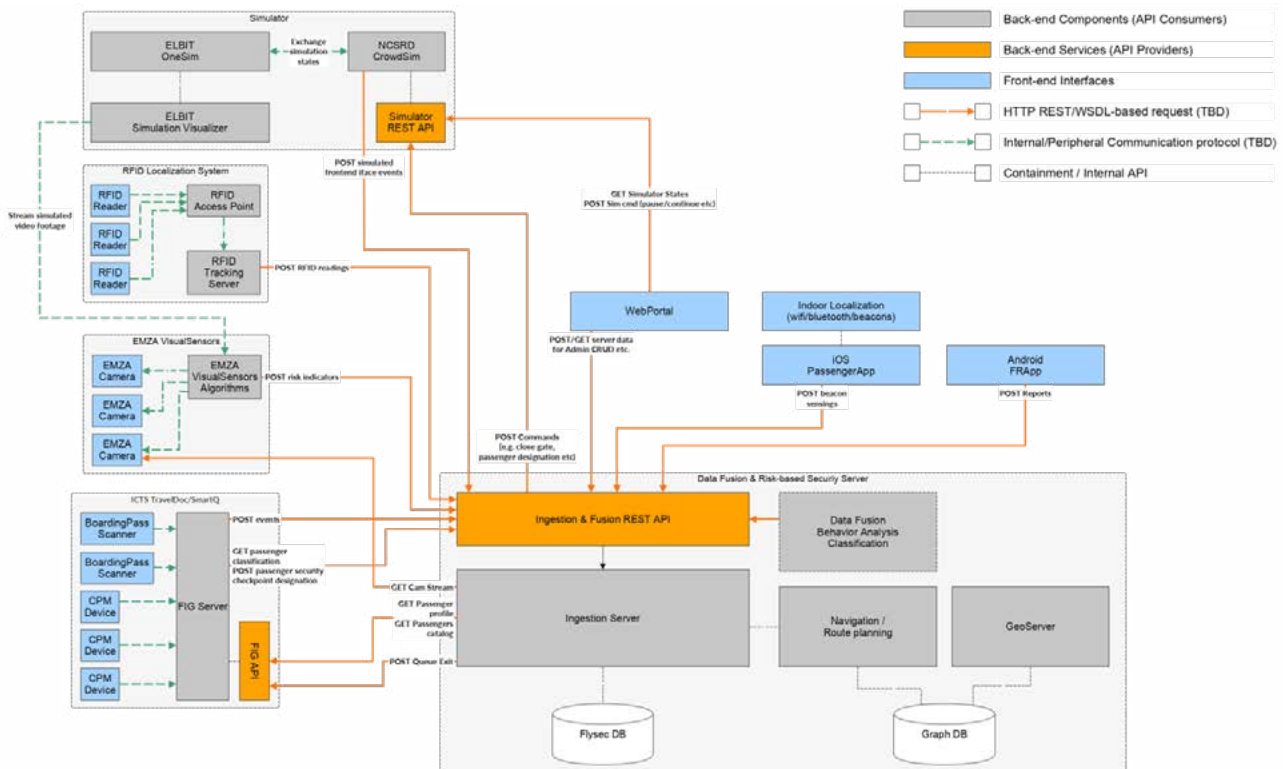
- (i) passenger facilitation,
- (ii) risk-based security and
- (iii) outcome-focused results.

The concept is based on social acceptance, legal compliance and ethics-by design. In the FLYSEC Secure Tunnels scenario the passengers are differentiated to Trusted, Casual and Enhanced. This gives an indication for differentiated screening of passengers as well. The tunnel is implemented as a virtual path from the landside, through the security check and to the airside where technological components offer intelligence and risk-based security correlations through passive tracking and intelligent analysis.



# FLYSEC System Architecture

The overall strategy of the FLYSEC Work Plan is based on the agile development of the FLYSEC components and system centered around the validation and operational testing methodology: from the simulation fast-track test-bed to the operational testing and Proof of Concept, and to the final field test in a real operational environment.



# FLYSEC Integrated System Components

## Visual Sensors

Visual Sensors monitor specific airport areas and sends to the management centre real-time information about the number of people in the area, unattended luggage, congested areas and relevant behavioural indicators, e.g. running, loitering. Information is then sent to the Management System and an alert is raised in the Control & Command Portal when necessary.



*“With the new generation of visual sensors the airport experience offered by FLYSEC can be come more pleasant as well as safer for millions of travelers.”*

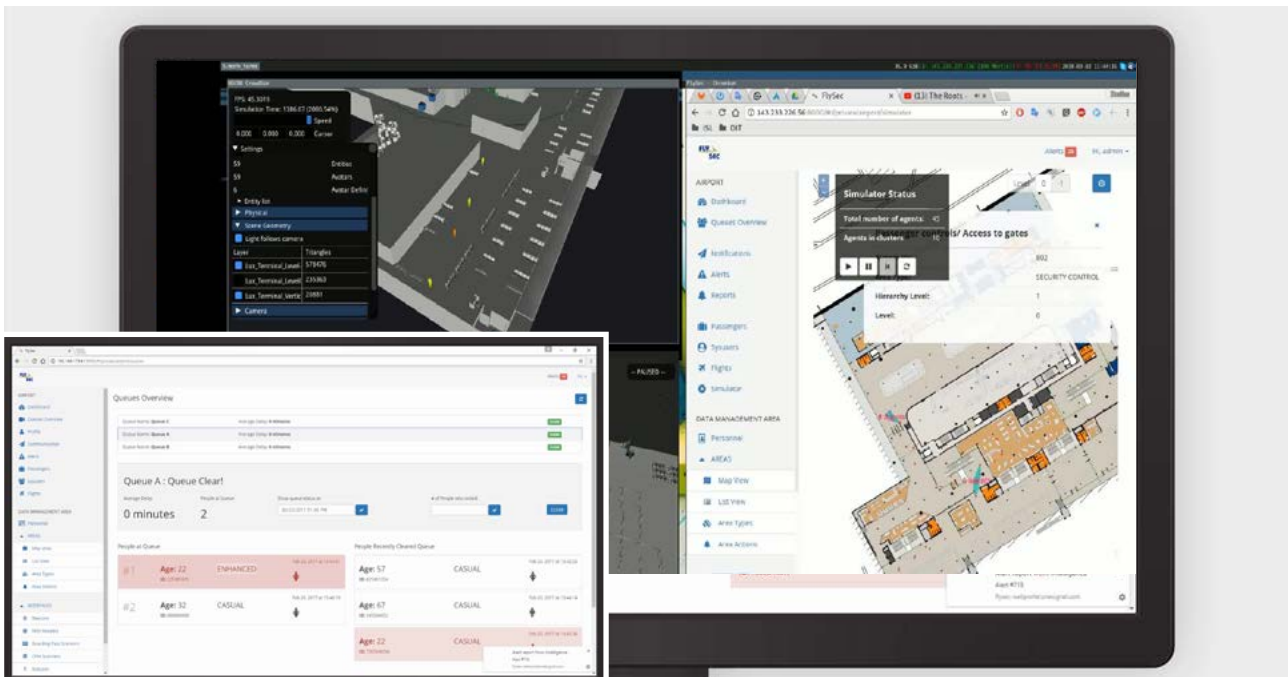
Zeev Smilansky, CTO, Emza Visual Sense Ltd.

## Fusion & Risk Based Alerts

The Fusion Center collects and use the passenger-related information from the TravelDoc, the Visual Sensors, and the manual entries from the security personnel and applies the FLYSEC fusion algorithms in order to classify the passengers into different security levels: Trusted, Casual, and Enhanced risk. The FLYSEC Fusion Center uses collected information from sensors and security personnel to provide enhanced situational awareness, issue alerts and notification to the Control & Command Portal.

## Web Based C2I System

The FLYSEC Command, Control and Information (C2I) Portal is intended for use by the security personnel of the airport. The purpose is for security personnel and system administrators to be able to manage and monitor all airport-related data. Portal users - administrators and security personnel with different access levels - receive information from mobile app users (passengers and other people present at the airport), cabin luggage data, front-end interfaces data (cameras, beacons, RFIDs, labels), flights data and airport areas. The portal also offers the possibility of sending push notifications (e.g. security alerts) to all the other FLYSEC system users. The C2I is empowered by the intelligence offered by the Fusion and Risk Based Alerts component.



*“The FLYSEC project demonstrates how cooperation between subject matter experts from the fields of technology, operational security and academic research can deliver innovative solutions for challenging environments.”*

Yochai Legum, CTO, ICTS Europe Systems



# FLYSEC Integrated System Components

## Technologies for improved passenger experience

### TravelDoc

The TravelDoc includes a Passport Reader. Following a passport scan, the checked-in passenger is identified with name, age, itinerary and security signs displayed. The system sends passenger data to the FLYSEC Management System and the checked in passenger receives a risk classification.



and passenger location correlation input to the Fusion system upon request for security purposes.

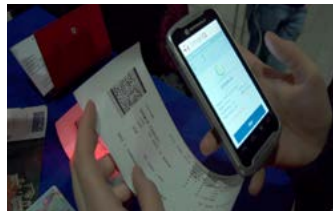
### Beacons and Indoor localisation

Bluetooth indoor beacons are positioned at strategic points and provide information to nearby mobile apps. This information is used for passenger's location data and for fusion and correlation with other location indicators.



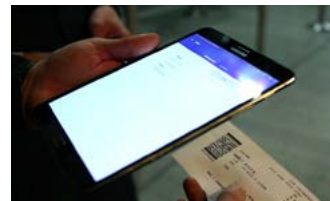
### SmartQ

Following a scan of the passenger's boarding pass, the SmartQ assigns to the passenger an appropriate security check queue taking into account the FLYSEC risk-based classification. The passenger can receive information regarding their assigned queue lane through the mobile app.



### Security Personnel Mobile App

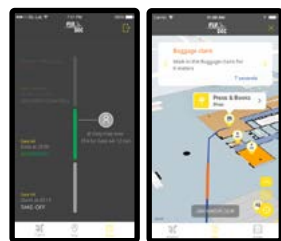
The airport's security personnel employ the use of mobile applications enabling them to create alerts and to provide data input to the FLYSEC fusion engine. The user of the application receives a username and a password in order to securely log in and use the application.



The user interface design has the goal of making the application simple to use thus making the process of sending information fast and efficient.

### Passengers' Mobile App

The mobile app for passengers offers airport way-finding, real-time navigation and positive boarding features including assisted security checkpoint walk-through for Trusted/Registered travellers. Data models design and indoor GIS standards applied are used to make the App easily reconfigurable for use within any airport. The App was optimised over multiple testing activities to improve the overall user experience while enhancing security management and available intelligence as it is integrated with the Fusion and Alerts system.



### Integrated Simulation, Scenario Editor, Training and Assessment

Advanced simulation framework, including crowd simulation, gates and tunnel modeling and accurate 3D modeling, supporting two functions:

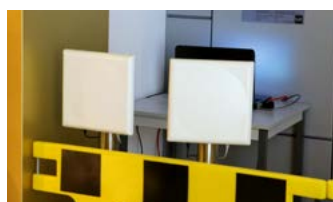
- The development and integration of the system as a hybrid simulation testbed.
- A training tool for commanders and decision makers within the airport personnel.

The FLYSEC simulation platform includes airport operational flow and passenger/personnel crowd simulation and supports User-defined simulation scenarios, Multiple behaviour models, integration with the FLYSEC Web Portal as well as distributed simulation and Integration with third-party simulators



### Carry-on luggage tracking

Carry-on luggage tracking component is based on recommended standard passive UHF RFID technology. It is used both in security checkpoints as well as in selected indoor areas of interest within the landside and airside. It is designed as a modular and context/range-adaptable system, providing carry on luggage management features, unattended luggage detection



# Proof of Concept at Schönhagen Airport

The Proof of Concept, organized by the European Aviation Security Center, was the first on site testing of the FLYSEC innovative airport security concept and took place on February 23, 2017 at the Schoenhagen airport in Trebbin, Germany, with attendance from multiple airport security stakeholders.

The POC successfully demonstrated:

First deployment in a relevant environment of the FLYSEC integrated system which includes airport command and control, passenger and security personnel mobile applications, smart queue management, travel doc PNR based security, RFID scanners and readers, beacons, and visual sensors: all supported by intelligent analytics and advanced fusion algorithms.

The FLYSEC features demonstrated include:

- Flow management
- Passengers' risk assessment and classification
- Passenger's guidance from the entry to the security check point to gate
- Real-time risk assessment of airport areas:
- Trespassing
- Unattended luggage
- Real-time monitoring and alert generation regarding passengers, airport areas, luggage and security lines.

With the feedback and lessons learnt from the PoC, the FLYSEC project is progressing towards the final version of the FLYSEC system to be demonstrated during the field test at the Luxembourg airport.



***"Proudly, we provided the testbed for the first implementation of the integrated FLYSEC system at Schönhagen Airport near Berlin."***

Prof. Wolfgang Rehak, Vice-President of the Board, EASC



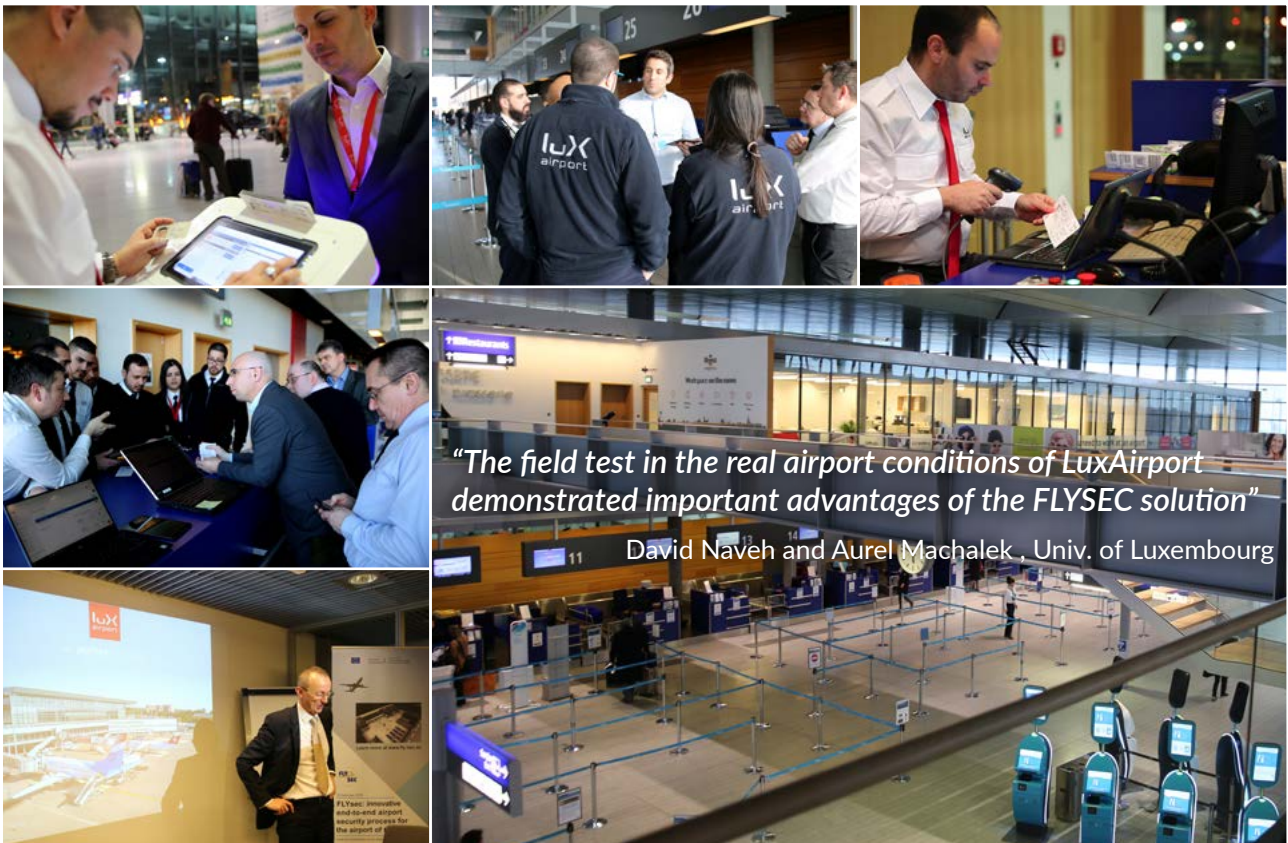
# Final Field test at Luxembourg Airport

The FLYSEC final field test was the first deployment of the innovative airport risk based screening and security concept in an actual operational airport environment with Lux-Airport security personnel, practitioners and security managers operating the FLYSEC system and components.

The integrated FLYSEC System successfully deployed and demonstrated:

- A mobile application for passengers, including features such as routing and navigation, positive boarding and assisted security walkthrough, assisted shopping and time management.
- A mobile application for security personnel with location-based alerts, incident handling capabilities and notifications, queue monitoring and assisted passenger and behavior screening
- The TravelDoc mobile kiosk and terminal for travel document scanning, enhanced validity verification and integration of PNR data in the FLYSEC risk classification service
- A SmartQ component for smart security queue management integrated with transparent risk classification assessment algorithms
- The RFID carry-on luggage tracking system for unattended luggage detection and fast retrieval service
- A Beacon-based localization system for enabling location based passenger services, also offering location correlation capabilities to the security fusion algorithms
- A web based command and control portal, providing holistic airport real time monitoring and security checkpoint management as well as communication capabilities which include integrated passenger simulation module for training and decision support
- Risk Classification and Enhanced situational awareness fusion and machine learning services, correlating input from heterogeneous sources, behaviour and risk indicators and generating relevant alerts
- The FLYSEC simulation platform for airport operational flow and passenger/personnel crowd simulation including realistic 3D visualization of Luxembourg Airport Terminal

The successful Lux Airport field test marked the first implementation of SMART SECURITY within the EU research programme.





# Future of FLYSEC

Evaluation of the FLYSEC system included a large range of engaged stakeholders, including airport higher management and security practitioners, law enforcement agencies, airport commercial/sales, passengers' departments and others.

The FLYSEC project may be closing at the end of July 2018, however its impact and next actions are to follow in the short, mid and long term.

FLYSEC validated an innovative concept and identified opportunities in process optimization and regulatory framework

FLYSEC provides promising and enabling technical solutions which will also be further developed for a closer to market technology readiness level, including computer vision analytics, AI and machine learning algorithms as well as on the fly identification and screening techniques

Finally, the alignment between FLYSEC and the IATA/ACI Smart Security programme paved the path for the promotion of FlySec into a certified Smart Security implementation.



As the risk-based screening paradigm shift is further adopted and developed in other border modalities and security applications, the FLYSEC project provides the reference validated implementation within the framework of the EU Horizon 2020 and beyond.



# FLYSEC Consortium

## National Centre for Scientific Research “Demokritos”

Greece

The Integrated Systems Laboratory (ISL) is part of the Institute of Informatics and Telecommunications (IIT), one of the five Institutes of NCSR Demokritos, the largest multidisciplinary research centre in Greece. ISL, with a staff of over 45 full-time, diverse and highly skilled researchers and developers, is a well recognised and highly respected research partner and project coordinator in the context of European Research on Secure and Resilient Societies. NCSR, through ISL, is the FLYSEC Project Coordinator, providing key innovations in intelligent analytics and fusion, risk based alerts and anomalies detection, indoor localization and mobile apps, C2I system, and passenger simulation platform.



## EXODUS S.A.

Greece

EXODUS S.A. is a software house with a strong portfolio of major customers in sectors such as Banking, Telecoms, Utilities, Business Consultancies, Media, covering a wide range of demanding Web and Mobile applications, including transaction heavy intranets and extranets, e-learn and e-payment. EXODUS main role in FLYSEC is the integration of individual modules into a unified FLYSEC system.



## C.G-Smartech

Israel

C.G-Smartech provides end-to-end innovation, strategy, R&D and business development consulting services. We design tailor-made business opportunities, innovative solutions and systems, that efficiently lead our customers all the way to their success story. In FLYSEC we had the privilege to lead WP1: End User Requirements and Architecture. This WP focused on shaping the baseline for the project, by defining the project's reference scenarios and the operational requirements, resulted with the project system architecture.



## Elbit Systems Ltd

Israel

Elbit Systems Ltd. is an international high technology company engaged in a wide range of programs throughout the world, with a broad portfolio in defence, homeland security and commercial applications. Elbit main role in FLYSEC was based on its comprehensive simulation framework for indoor arenas. The simulation allows (near) real time modelling of many thousands of entities in complex indoor environments, accurate modelling of the actual structures and of human crowd behaviour. Using this technology would allow testing and optimizing the various concepts for airports' security.



## ICTS UK

United Kingdom

ICTS UK is one of the largest subsidiaries of ICTS Europe, premier provider of innovative security services. ICTS Group employs some 15,000 employees in twenty-one subsidiaries across Europe, all of which are closely linked, sharing resources, information and goals. In the UK and Ireland alone, ICTS has some 3,800 employees. ICTS has about 30 years of aviation security experience, gained in more than 80 airports world-wide. The company integrated into the FLYSEC system and field tests its advanced solutions TravelDoc and SmartQ.





## EMZA

Israel

Emza is a pioneer and leader of visual sensors for IoT: fully trainable, AI-based machine-vision visual sensors that can work off battery power for years, yet are able to offer advanced machine vision applications such as people counting, face detection and space utilization.



## European Aviation Security Center e.V.

Germany

The European Aviation Security Center e.V. performs Research and Development projects in the field of Aviation Security. Located at one of the largest airports of General Aviation, we are providing test and training facilities to innovative solutions and support to reach readiness-to-market in the civil aviation sector.



## Luxembourg Airport

Luxembourg

Lux-Airport is a boutique international airport which strives to offer you the quality and standards of a large hub airport with the shortcuts, comfort and efficiency of a regional one. Although small, the airport prides itself on having almost 3.6 million passengers a year, 938.000 tonnes of cargo, 7,400 parking spaces, 76 direct flight destinations and 15 different airlines. Located in the heart of Europe, the airport strives to provide convenience and comfort to all its travellers at all stages of their journey. Luxembourg Airiport hosted the Final Field Test.



## University of Luxembourg

Luxembourg

SECAN-Lab Research Group (led by Prof Thomas Engel) of the University of Luxembourg has made its contributions to FLYSEC relying on the experience within the Group in analysing human behaviour in diverse contexts such as augmented and virtual reality and vehicular mobility. Based on excellent relations with relevant organisations in Luxembourg such as the LuxAirport, Civil Aviation Authority and the security services, SECAN-Lab planned, prepared and coordinated the final test at the Luxembourg Airport.



## Embry-Riddle Europe

Germany

Embry-Riddle Europe is the independent European branch of Embry-Riddle Aeronautical University. Main tasks are to provide bachelor and master courses for all areas in aviation, mainly aviation management courses including aviation law and politics as well as aviation security. ERAU supported the FLYSEC consortium with its expertise on Privacy, Ethics and Aviation Law.



## Epsilon International SA

Greece

Epsilon International SA is a leading GIS Technologies Organization with history since 1985. EPSILON has accomplished in recent years more than 200 major GIS and remote sensing projects in worldwide partnership, for instance with ESRI DE. The company conducts original research & technology development for new products, delivers consulting services and provides GIS & remote sensing applications. EPSILON main contributions included GIS indoor functions and standardisation activities.





#### Contact information

Project Coordinator :

National Centre for Scientific Research "Demokritos"  
Integrated Systems Laboratory, Institute of Informatics and Telecommunications  
Patriarchou Grigoriou and Neapoleos St.15310,  
Aghia Paraskevi, Attiki, Greece

**Stelios C.A. Thomopoulos, PhD**  
Email: [scat@iit.demokritos.gr](mailto:scat@iit.demokritos.gr)

**Dimitris M. Kyriazanos, PhD**  
Email: [dkyri@iit.demokritos.gr](mailto:dkyri@iit.demokritos.gr)

Phone: +30 (210)6503150

#### Further information

[www.fly-sec.eu](http://www.fly-sec.eu)

#### Join us



H2020FLYSEC



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All participants in FLYSEC testing, filming and dissemination activities have signed a comprehensive informed consent form according to the General Data Protection Regulation (GDPR) (EU) 2016/679. For any relevant inquiries or requests please contact Ms Eleonora Doukoudaki at [edoukoudaki@iit.demokritos.gr](mailto:edoukoudaki@iit.demokritos.gr)



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