LOGIPIX

About LOGIPIX

Logipix is a global developer and manufacturer of industrial-grade, AI-powered video surveillance solutions, founded in 1996. Logipix International Corporation designs and delivers high-end, application-specific systems for complex operational environments. Logipix serves international markets through close cooperation with partners and customers worldwide, focusing on reliability, scalability, and long-term performance.
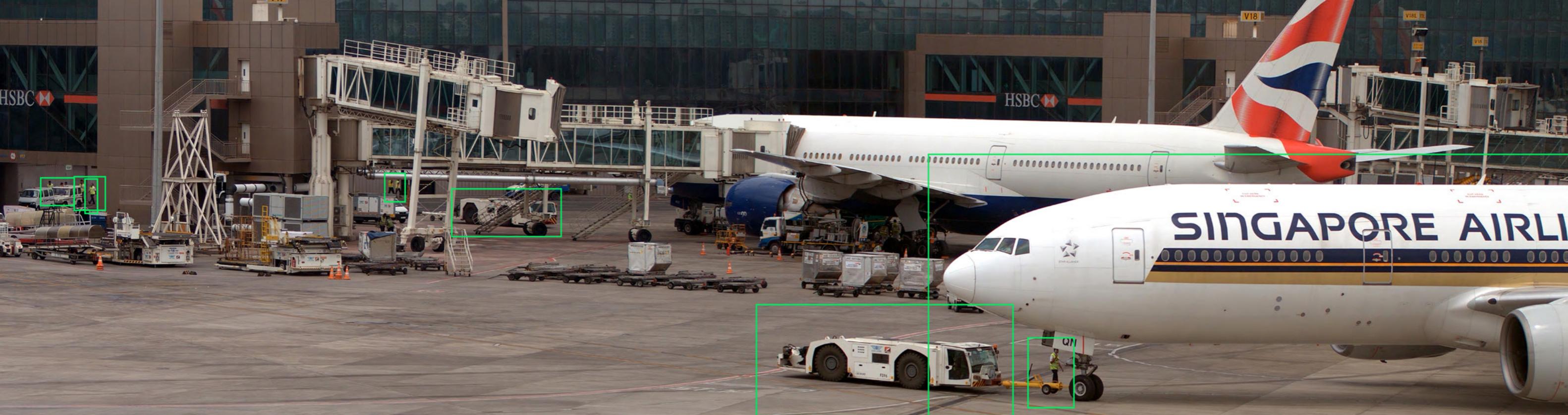
Airside Augmented Reality
Solution

ALL IMAGES IN THIS BROCHURE WERE TAKEN BY LOGIPIX CAMERAS

Airside Operations Under Growing Pressure

Air traffic is steadily increasing, while airports face strict physical, regulatory, and operational limits. Runways, taxiways, and aprons cannot be expanded endlessly, yet expectations for faster turnaround times, higher safety standards, and uninterrupted operations continue to rise. At the same time, airports must manage these growing demands with limited resources, reduced flexibility, and constant pressure to optimize costs.

The airside is one of the most complex and sensitive operational environments. Any inefficiency, blind spot, or delayed response can quickly cascade into safety risks, congestion and costly disruptions. Traditional monitoring and control methods struggle to keep pace with today's traffic density and operational complexity.

To support more landings and takeoffs without compromising safety, airside management must evolve beyond conventional systems.

LAARS (Logipix Airside Augmented Reality Solution) was specifically developed to meet this challenge.
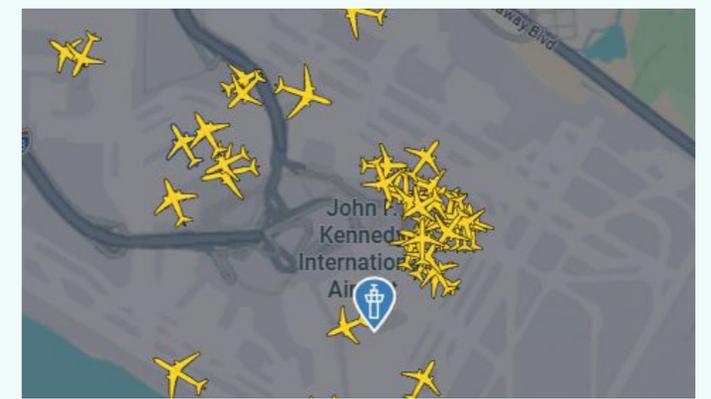
Airside Augmented Reality Solution

LAARS is an intelligent, video-based monitoring solution designed specifically for airside environments. It enables airports to securely manage increasing traffic volumes, improve operational efficiency, and maintain full control of airside activities – without the need for physical expansion – by delivering comprehensive situational awareness, real-time insights, and data-driven operational support.

The system combines ultra-high-resolution video surveillance with AI-based computer vision and augmented reality, while seamlessly integrating existing airport information sources. LAARS monitors the entire airside with exceptional detail, automatically detecting, classifying, and tracking both cooperative and non-cooperative objects across runways, taxiways, and aprons. Operator attention is guided through intelligent alerts and contextual overlays, allowing ground processes to be managed more efficiently and with greater confidence.

High-resolution live video streams are enhanced with graphical and textual information that supports faster comprehension and more accurate decision-making.

LAARS proactively improves safety by predicting critical proximity situations, automatically detecting operational irregularities, foreign object debris (FOD) and runway incursions. In addition, advanced glide path monitoring provides continuous visual and analytical oversight of aircraft approaches, supporting safer landings and improved situational awareness in challenging visibility or traffic conditions.
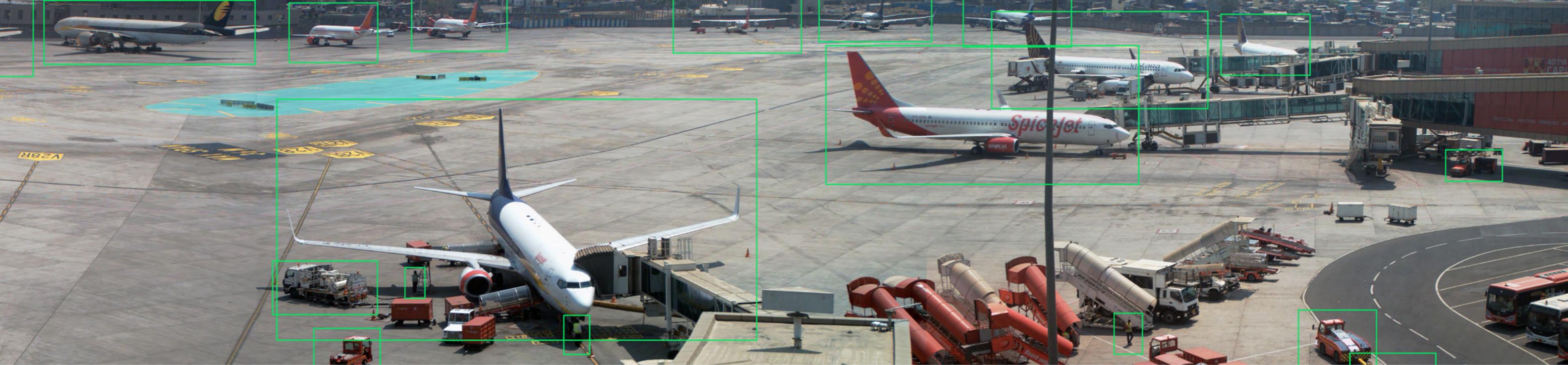
LAARS is the right solution if you aim to...

Improve operational efficiency and control

- Monitor and register object movements and ground processes across the entire airside

- Enhance visibility for ground controllers, airfield controllers, security operators, and all airside operation departments

- Identify and address operational bottlenecks using AI- and Computer-Vision–based airside monitoring

- Automate the calculation of aircraft ground times from landings to takeoffs

## Increase safety and regulatory compliance

- Automatically detect and prevent runway incursions through continuous monitoring of runways, taxiways and aprons

- Support safe aircraft approaches and landings with advanced glide path monitoring

- Enforce airside traffic rules consistently without adding workload to human operators

- Reduce the risk of incidents caused by foreign object debris (FOD) through automatic detection

Enhance situational awareness

- Increase overall situational awareness to reduce the number and severity of airside incidents

- Implement image-based access control for different object types in designated airside zones

Support analytics and investigation

- Automatically collect data to help generating airside statistics and area-usage reports

- Support incident investigation and post-event analysis with advanced object-based archive search
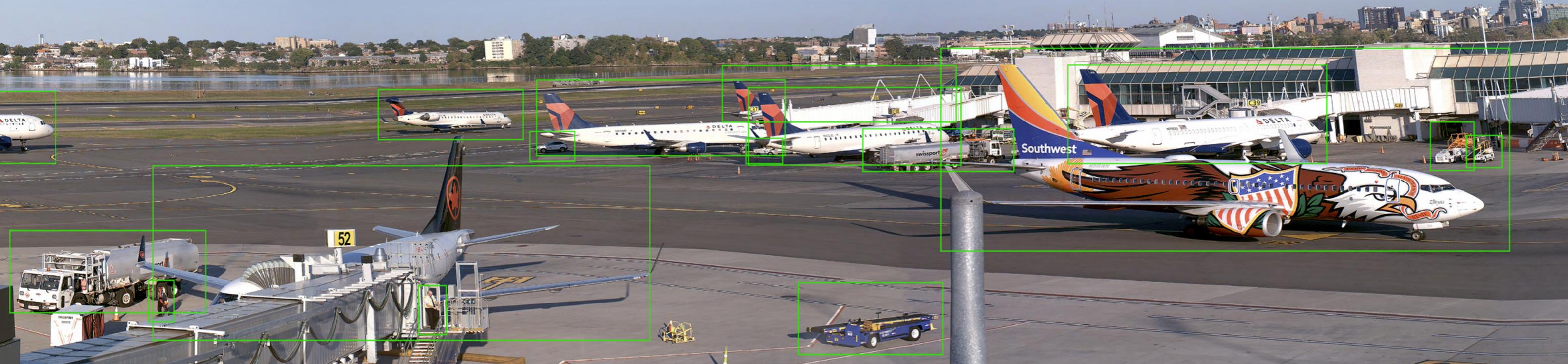
Financial Impact and Cost Optimization

- **Supporting strategical decision**
  The system supports both short-term and long-term strategical decisions by providing information on airport usage.

- **Optimizing area usage**
  Utilizing Computer Vision-based data, various airside statistics and calculations can be created on area occupancy, which helps realize explicit business benefits.

- **Avoiding financial loss by preventing accidents**
  LAARS provides AI technologies to prevent various incidents, which helps avoid significant financial loss.

- **Undoubted visual evidence**
  Using the high-resolution footage, any situation can be investigated to details. Hundreds of megapixels and fine details provide an undoubted evidence on demand.

- **Significantly less cameras are needed**
  Logipix is a cost effective system. As only a few cameras are needed to cover an entire airport, installation and maintenance costs can be kept strikingly low.

- **Reduced human resource demand for maintenance**
  Logipix hardware are capable of self-maintenance, thanks to their built-in self-cleaning and deicing systems.

- **Proactive hardware monitoring**
  LAARS remotely monitors device health and provides early alerts on potential failures, enabling preventive intervention and avoiding costly repairs and downtime.

- **Adaptable system structure**
  We always consider the specific structure and characteristics of airports to best adapt the system for the current project. Moreover, LAARS has a flexible hardware structure that can be easily rearranged in case of future airside developments.

- **Maximized system uptime**
  Logipix provides uninterrupted system availability as all their components are developed to operate with high MTBF (Mean Time Between Failures).

- **Designed for long-term**
  Our engineers developed leading-edge technologies that ensure the system avoids both physical and technological obsolescence for a long time.

Safety and Operational Efficiency Benefits

- **Superior visual coverage**
  LAARS provides complete airside coverage with visual capabilities beyond human perception. Ultra-high-resolution panoramic video streams of hundreds megapixels enable controllers to safely manage aircraft and ground vehicle movements while protecting personnel and passengers.

- **Increased operational efficiency**
  By introducing AI-powered monitoring, LAARS enables managing ground processes at a higher level of situational awareness, improving both safety and overall airside operational efficiency.

- **Real-time Decision Making Support**
  LAARS functions as a Real-Time Decision-Making Support system (RTDMS), continuously highlighting the most relevant events, objects, and situations on screen to support fast, informed operational decisions.

- **Rapid detection and removal of FOD**
  The system automatically detects FOD (Foreign Object Debris) in the Airside Operating Area (AOA) and supports immediate response by alerting operators and guiding securing and removal procedures, minimizing operational risk and potential disruptions.

- **Increased situational awareness**
  LAARS continuously monitors airside activities to help prevent incidents and detect unauthorized access to restricted areas in real time.

- **Customizable traffic enforcement**
  The system supports customizable traffic rules and automated enforcement, helping reduce traffic violations and improve the safety of air crews, airport personnel, and passengers.

- **Automatic LND and TOF registration**
  LAARS automatically registers landings and take-offs, including precise measurement of aircraft time spent on the airside.

- **Secured perimeter area**
  The solution provides advanced, Video Content Analysis–based perimeter monitoring and as an alternative the system can integrate third-party perimeter intrusion detection systems (PIDS), using their alerts to trigger automatic camera actions such as intelligent zooming.

What Makes LAARS Unique

- **Designed specifically for airside operations**
  Logipix has developed a comprehensive system focused exclusively on airside tasks, operational workflows, and safety-critical processes.

- **Airside-optimized Video Content Analysis**
  LAARS provides Video Content Analysis specifically designed to track, register, and analyze airside object movements and to prevent incidents unique to airport operating areas.

- **Purpose-built airside software architecture**
  The software platform has been developed specifically for airside environments, ensuring reliable performance under complex operational and regulatory conditions.

- **Comprehensive monitoring**
  Operators and controllers receive coherent visual and textual information about aircraft, vehicles, personnel, and ground processes through a single, integrated user interface.

- **Guided Operator Focus**
  LAARS functions as a real-time decision-making support system, guiding the focus of operators and controllers to help them understand airside situations faster and respond more effectively.

- **End-to-end, AI-assisted airside monitoring**
  The solution combines Artificial Intelligence–based video monitoring and Augmented Reality–supported visualization.

- **Multi-department usability**
  LAARS can be used simultaneously by multiple airport departments, supporting coordinated operations without overloading the network.

- **Advanced sensor fusion and system integration**
  Logipix integrates existing airport systems such as Airport Operational Databases, radar systems, range finders, and positioning technologies including ADS-B, MLAT, and A-SMGCS. Using proprietary sensor fusion technology, LAARS merges visual data with external sensor inputs into a single operational view.

- **Ultra-wide airside coverage with minimal hardware**
  Even the largest airside areas can be covered in high resolution using only a few multi-sensor panorama cameras, significantly reducing installation and maintenance costs while improving spatial transparency.

- **Effective Context-Aware Monitoring**
  Logipix enables rapid assessment of distant situations without losing visual context, displaying panoramic and zoomed views simultaneously for seamless situational awareness.

- **Full-resolution data processing**
  Logipix has developed proprietary technologies to handle extremely large visual datasets and to utilize the full sensor resolution during live monitoring and analysis.

- **Cost-efficient transformation of non-cooperative objects into cooperative ones**
  Through the integration of Logipix's transponder-based Object Identification Module, LAARS can cost-effectively identify objects that are otherwise non-cooperative. Once equipped with Logipix transponders, vehicles, assets, and personnel become reliably identifiable and trackable, significantly improving situational awareness and operational safety.

- **Long-term storage with intelligent data management**
  LAARS provides extended storage periods through intelligent storage management, balancing long-term data availability with optimized system performance.
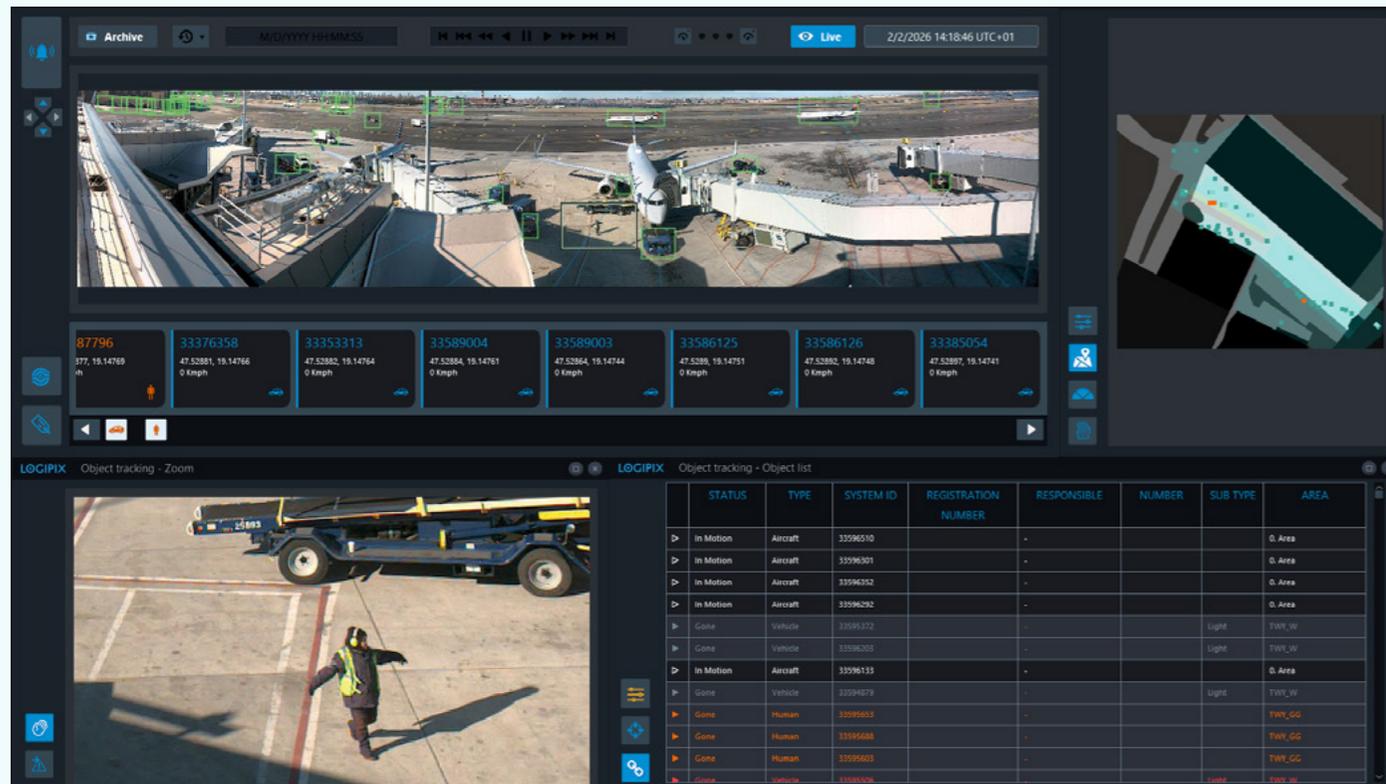
Designing Your Project

3D Model of Visual Coverage

Each Logipix project begins with a customized 3D coverage model of the airside. This planning phase visualizes the complete operational environment and enables precise optimization of camera placement, required resolution, and coverage areas based on the customer's operational needs and airside layout. The 3D model ensures full situational visibility, eliminates blind spots, and supports a cost-efficient system design before installation begins.
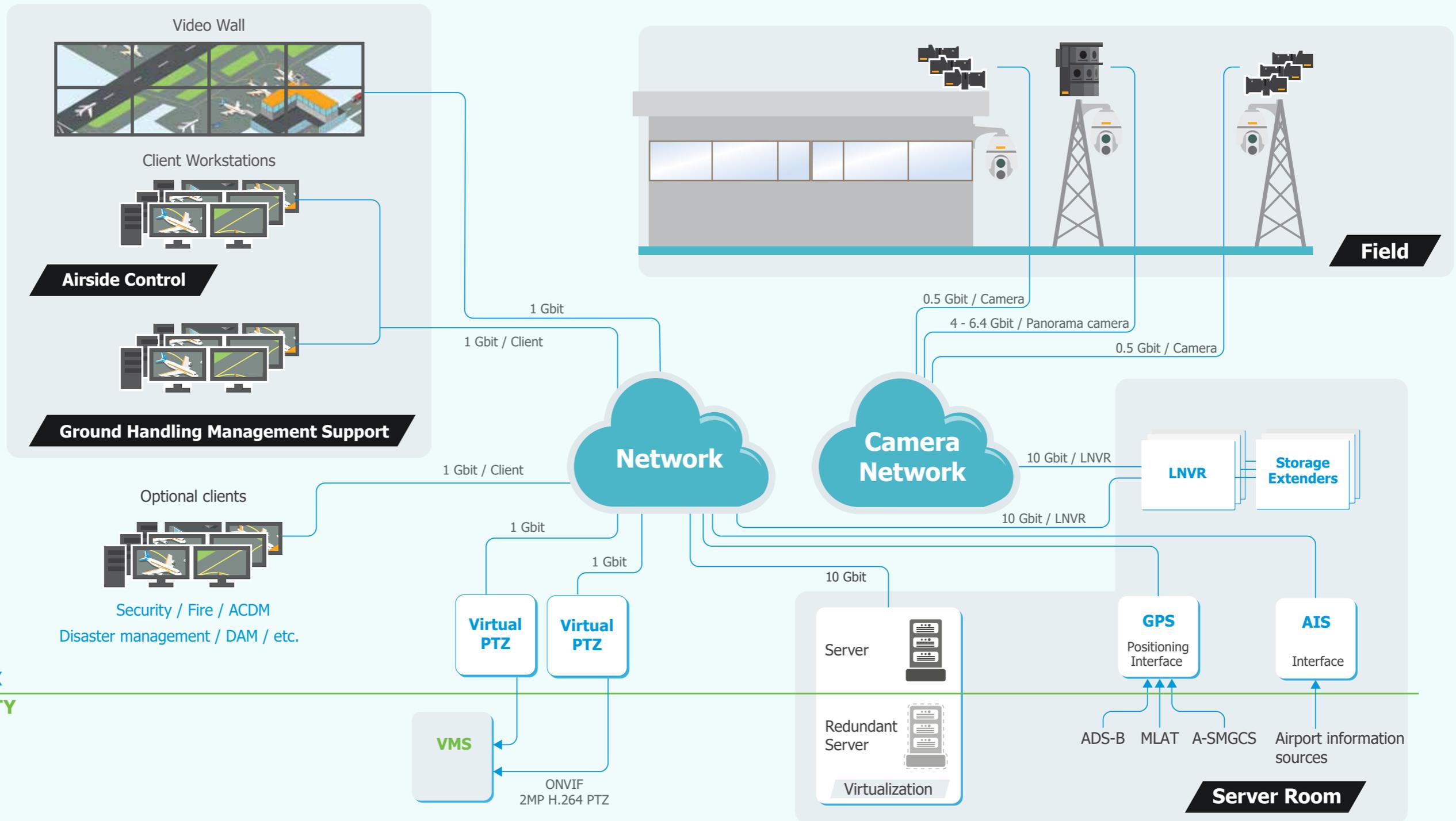
Based on the 3D coverage model, Logipix defines the optimal camera locations and system configuration to meet operational, safety, and performance requirements. The planning process determines the minimum number of multi-sensor panorama cameras required to achieve full airside coverage at the necessary level of detail. Where structural constraints or operational layouts create blind spots, single-sensor cameras are strategically integrated to complement the panoramic system and ensure complete visual coverage.

Legend
- 300MP Panorama camera - Human detection by VCA (50+ ppm)
- 6MP PTZ - Detailed observation (350+ ppm)
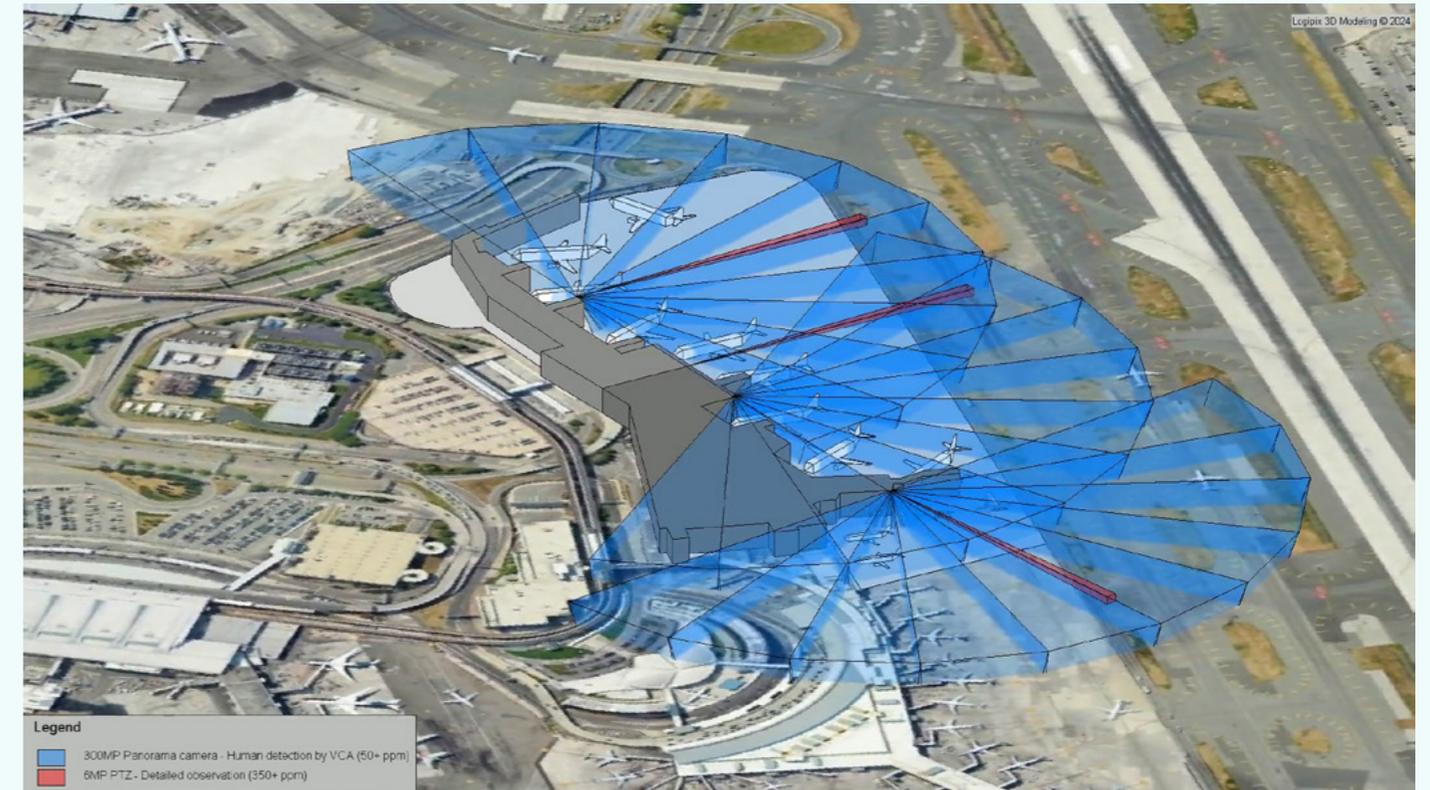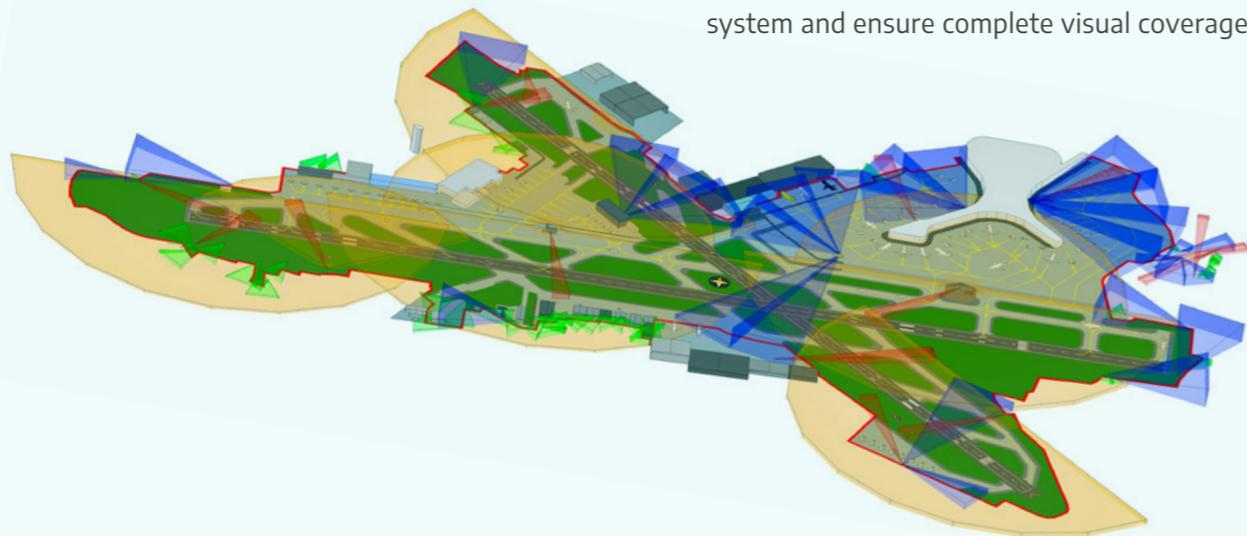
System Extension

The Logipix solution is built on a modular and scalable architecture that supports seamless system extension. Airside coverage can be expanded by adding cameras and sensors, while additional LAARS functionalities can be easily unlocked through software upgrades.

This approach enables the activation of new analytical, monitoring, and automation features without hardware replacement or system downtime, ensuring long-term adaptability to evolving operational and regulatory requirements.

Video Wall

Client Workstations

Airside Control

Ground Handling Management Support

Field

Optional clients

Security / Fire / ACDM

Disaster management / DAM / etc.

1 Gbit

1 Gbit / Client

0.5 Gbit / Camera

4 - 6.4 Gbit / Panorama camera

0.5 Gbit / Camera

1 Gbit / Client

Network

Camera Network

10 Gbit / LNVR

LNVR

Storage Extenders

10 Gbit / LNVR

1 Gbit

1 Gbit

10 Gbit

Virtual PTZ

Virtual PTZ

GPS

Positioning Interface

AIS

Interface

LOGIPIX

3RD PARTY

VMS

Server

Redundant Server

Virtualization

ONVIF
2MP H.264 PTZ

ADS-B   MLAT   A-SMGCS   Airport information sources

Server Room

Technology Overview

Airside Coverage and Visual Enhancement

LAARS provides video monitoring with extreme high-resolution to observe everyday operations at the airside. These images can effectively supplement normal observation. Logipix image sensors, the panorama cameras provide vision at a much higher performance, than the human eye is capable of. These sensors constantly take images of the entire airside area with enormous resolution and the embedded intelligence continuously analyzes the view.

The entire airside can be covered using only a few panorama cameras. These cameras are interconnected and provide a comprehensive coverage. Within the covered area objects are tracked uninterruptedly, even when they move across multiple camera images.

Logipix Panorama Cameras deliver 160-400 MP video streams at up to 20 fps, which forms a revolutionary quality improvement in video monitoring. It means users can watch a continuous live stream and they can zoom in on any area of interest any time and get fine details even at far distances. In areas with less artificial lighting, Logipix thermal image sensors or high sensitivity black and white sensors deliver useful visual information.

ZOOM AREA

Monitoring with Logipix Panorama Cameras

Even a single Logipix Panorama Camera is capable of monitoring a vast airside area. By observing large, continuous panoramic images, users gain superior spatial orientation, as the monitored space is presented as a unified view rather than fragmented across multiple screens.

Monitoring with ultra-high-resolution panoramic imagery significantly accelerates access to relevant visual information. Operators can rapidly zoom into areas of interest within a single panoramic view. When zooming in, the selected area is displayed in a dedicated zoom window, while the full panoramic image remains visible at all times. This allows operators to simultaneously examine fine details and retain full situational context, ensuring precise interpretation and confident decision-making.

LAARS ensures reliable monitoring under all lighting and weather conditions typically encountered at airports. Aircraft and ground vehicle movements can be continuously tracked across the airside, including during adverse weather and nighttime operations.

For enhanced foreign object debris (FOD) detection, Logipix also offers a dedicated FOD camera equipped with a cluster of high-sensitivity black-and-white sensor. By leveraging the infrared spectrum and high-contrast imaging, this specialized camera enables faster and more reliable automatic detection of small objects on movement areas, significantly improving FOD monitoring efficiency and response times.


ZOOM AREA
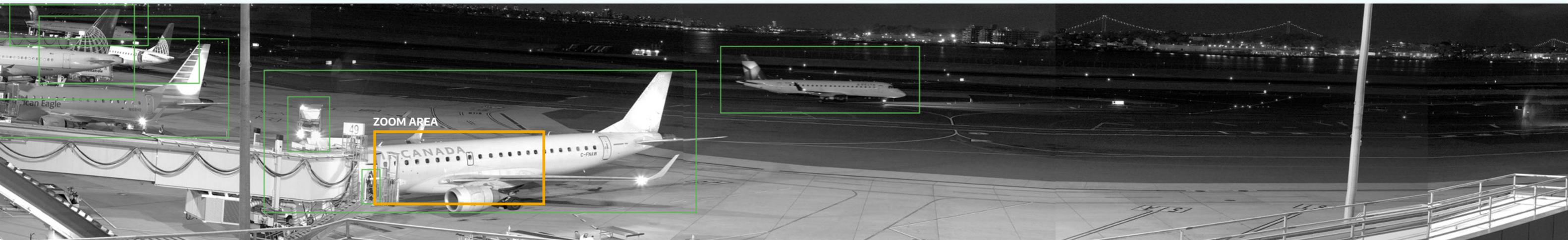
Recording & Storage

LAARS continuously records full size video streams and stores them in a fail-safe file system distributed across multiple hard disk drives. This architecture ensures high availability and data integrity, even in the event of individual storage component failures. In the case of incidents, irregularities, or investigations, recorded footage can be reviewed in full resolution to support accurate analysis.

As the video streams are based on intra-frame–coded JPEG2000 images, each individual frame represents a complete, high-quality image. This allows any single frame to be used as irrefutable visual evidence in critical situations, without the artifacts or dependencies typical of inter-frame compression.

To further enhance system reliability, the Network Video Recorders (NVRs) are designed with built-in redundancy. Each recorder is equipped with dual power supply units and dual main power connectors, ensuring uninterrupted recording even in the event of power supply or feed failures. This redundancy safeguards continuous operation and long-term data preservation in safety-critical airside environments.
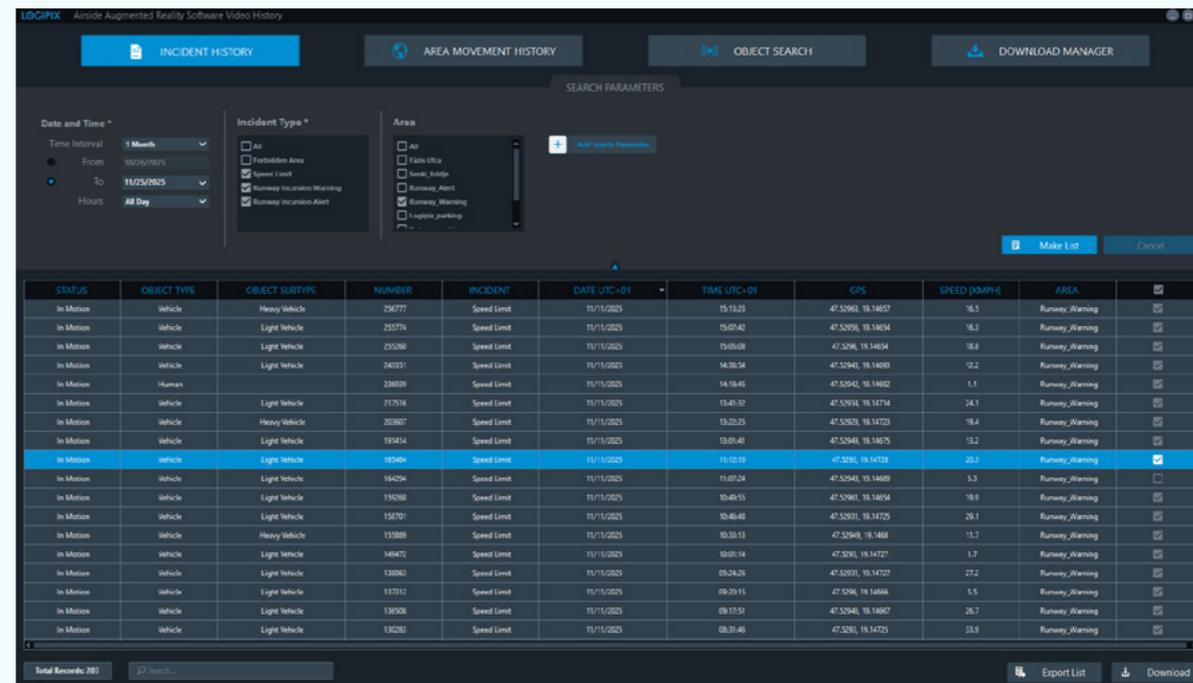
Online Archive

The LAARS software allows operators to search the archive while real-time monitoring is ongoing, without interrupting live operations. Archive searches are not limited to time-based queries; instead, operators can retrieve recorded footage by searching for specific objects, their movements, and their operational status. This object-based approach enables fast and precise access to relevant events, significantly reducing investigation and response times.

Video History

LAARS provides fast and efficient archive search through an in-memory airside history database. This advanced search functionality enables operators to quickly retrieve recorded events based on specific incidents, movements within designated areas, or individual objects.

To navigate the large volume of historical data effectively, LAARS offers multi-level filtering options. Operators can, for example, search for a particular violation type committed by a defined object class within a selected time period. Object statuses and area-related conditions can also be queried, supporting detailed analysis, operational review, and informed decision-making. To provide an even more targeted example, operators can check all registered airplanes that moved on a selected taxiway within the time frame of interest. They get the exact number in no time, and they can get the visual confirmation on demand.

High-resolution videos are available for each list items, even from multiple camera angles. Selecting a list item, the program displays thumbnail images from all relevant cameras, therefore operators can download those videos that best fit their needs.

Intelligent Airside Control with AR

Beyond recording and displaying ultra-high-resolution video streams, LAARS enhances monitoring efficiency through a wide range of AI-powered Video Content Analysis (VCA) functions. These capabilities actively support airside operations by automatically detecting, analyzing, and in certain cases predicting incidents.

Augmented Reality in LAARS enhances live camera images with context-aware visual elements. Color-coded object indicators are overlaid directly on the video image to clearly highlight detected aircraft, vehicles, and personnel. Detailed informational labels associated with these objects are displayed beneath the panoramic image, ensuring that critical data is always accessible without obscuring the visual content.

Automatically generated warnings and alerts guide the attention of operators and controllers to relevant situations. As a Real-Time Decision-Making Support System (RTDMS), LAARS intelligently optimizes front-end visualization by filtering the large number of system events based on operator intent and operational priorities. Only the most relevant situations are highlighted, allowing operators and controllers to focus on critical events as they unfold.

This combination of AI-driven analysis and carefully layered augmented visualization improves situational awareness, accelerates response times, and supports safer, more efficient airside operations while helping to prevent incidents.

Glide Path Monitoring

LAARS provides continuous visual and analytical monitoring of aircraft glide paths during approach and landing. Using high-resolution visible light and thermal imaging combined with AI-powered Video Content Analysis, the system tracks aircraft trajectories in real time and compares them with defined glide path parameters.

For this purpose, LAARS employs a specially developed dual-vision bullet camera optimized for glide path observation. The camera combines a 20 MP visible-light sensor with a 1.3 MP thermal sensor, enabling reliable monitoring both during daytime and night operations. The dual-vision design ensures consistent aircraft detection and tracking under challenging lighting and weather conditions.

Landing & Takeoff

The solution detects landings and take-offs with high precision. The module automatically identifies and registers the exact moments when aircraft wheels touch down on or lift off from the runway. Evidence images are stored with embedded time codes in the image header, and detailed reports are automatically generated for fast and easy review. When transponder data is available, Logipix also calculates the exact time aircraft spend at the airport.

ZOOM AREA

Object Tracking

Logipix Video Content Analysis (VCA) algorithms are designed to accurately detect, track, and classify objects under a wide range of visibility conditions. Both cooperative and non-cooperative objects can be identified and tracked. The VCA differentiates five basic object types: aircraft, heavy vehicles, light vehicles, humans, and foreign object debris (FOD). These object classes can be filtered directly within the monitoring interface.

In addition to tracking objects on the airside, Logipix provides precise positional information. The solution delivers real-time GPS coordinates for both cooperative and non-cooperative objects. Furthermore, when available, position data from integrated airport systems such as ADS-B and MLAT is incorporated. By utilizing this sensor fusion capability, LAARS achieves enhanced geopositioning accuracy.

Object Tracking with the Logipix Transponder System

As an optional extension, LAARS can be complemented with the Logipix Transponder System to enhance object identification and tracking. Miniature IoT-based transponders can be assigned to vehicles, assets, or personnel, enabling reliable identification of cooperative objects even in visually challenging environments. Transponder identification and GPS position data are received by Logipix Panorama Cameras and fused with computer-vision–based tracking, providing resolution-independent identification across the full field of view. By selectively equipping objects with transponders, LAARS cost-effectively transforms non-cooperative objects into cooperative ones, improving situational awareness and tracking accuracy across the airside.

Geofencing

The Logipix Geofencing function allows to virtually map existing airside zones on camera images. These configured zones facilitate orientation and accelerate object search for operators. They can easily find objects during live monitoring or archive search, as the objects always carry their current zone IDs. Operators can also filter for zones to list all their current objects.

Geofencing function also allows to virtually assign various object and/or time-based airside rules to the designated zones.
For instance these rules can specify the speed limit for various object types within the zones and also define access rules. LAARS uses these configured rules for automatic detection functions.

Virtual Fence

Operators and controllers can designate temporary zones and they can define various rules to these areas. They can simply draw around a static object or a desired area and apply relevant rules. The activated rules take effect on this area and trigger different warnings or alerts.

Runway Incursion Detection

LAARS provides continuous monitoring of runway, taxiway, and runway-adjacent areas to detect and prevent runway incursions in real time. Using ultra-high-resolution panoramic cameras combined with AI-based Video Content Analysis, the system automatically identifies and tracks aircraft, vehicles, and personnel entering or occupying protected runway zones.

The solution continuously evaluates object positions and movement patterns against defined runway access rules and operational states. When an unauthorized or conflicting presence is detected—such as a vehicle, aircraft, or person entering an active runway—LAARS immediately generates visual and textual alerts, guiding operator attention to the situation before it escalates.

Runway incursion detection enhances safety by providing an independent, camera-based safety layer that complements existing air traffic control and surveillance systems. By improving situational awareness and enabling early intervention, LAARS helps reduce the risk of runway conflicts, supports safe aircraft operations, and contributes to overall runway safety management.

Situational Awareness

With the help of computer vision technologies Logipix is able to enhance situational awareness at the airside. AI-powered features help prevent incidents by tracking real-time position of objects, predicting their future status and alerting users in time.

Proximity alert function uses dynamic proximity areas around objects. The size of these areas vary based on object type, speed and airside zone. In case the proximity areas of objects are overlapping, the system immediately alerts the user. This function mostly protects parking aircraft and vehicles from dangerously moving objects.

Collision prediction function helps prevent collisions among moving objects by applying Motion Behavior Analysis and Motion Path Estimation. The system analyzes the motion dynamics of the moving objects and calculates their motion vectors. In case the motion vector of an object is pointing to another one, the system predicts a possible collision area and alert the controller instantly who can react in time and warn the pilots or drivers. If the objects seem to miss collision the warning or alert signal ceases immediately.

Automatic Traffic Enforcement

Logipix Video Content Analysis (VCA) provides automatic detection of airside traffic violations for both cooperative and non-cooperative vehicles. Traffic rules can be individually defined for different vehicle types and designated airside areas.

The system reliably detects overspeeding, line crossings, traffic light violations, and unauthorized parking within monitored zones. When a violation occurs, LAARS immediately generates a warning and highlights the event on the monitoring interface. In addition to real-time alerts, each violation is automatically registered and documented with time-stamped evidence images, supporting enforcement, reporting, and post-event analysis.

FOD Detection

Foreign Object Debris (FOD) poses serious safety risks to aircraft and airport personnel and inevitably appears on runways, taxiways, and apron areas during daily operations. Manual FOD inspections are resource-intensive and cannot provide continuous coverage.

LAARS addresses this challenge with automated FOD detection for continuous airside monitoring. The system detects and classifies inorganic debris as well as animals, with detection sensitivity determined by the applied camera resolution.

For maximum efficiency, Logipix offers a dedicated FOD panorama camera featuring a high-sensitivity black-and-white sensor operating beyond the visible light range and leveraging infrared spectral information. With long-shutter night operation, 240 MP resolution, and a 104° horizontal field of view, the camera enables accurate, wide-area FOD detection.

Beyond detection, LAARS supports the complete FOD management workflow by registering debris sources, providing precise geopositioning, and recording all actions for investigation and continuous safety improvement.

RTDMS – Front End Visualization

LAARS was developed to simplify airside monitoring, increase operational efficiency, and enhance overall safety. It transforms complex monitoring tasks into intuitive workflows within a single, unified platform. By fusing multiple ultra-high-resolution video streams with object information generated by Video Content Analysis and data from integrated airport systems, LAARS enables faster, more informed decision-making. Operators and controllers are provided with contextual visual and textual information directly within the user interface. This intelligent front-end visualization guides attention to the most relevant situations in real time, helping users detect hazards earlier, respond more effectively, and reduce the risk of incidents. As a result, LAARS not only improves operational performance but also significantly increases safety across airside operations.


User Interface

The front end interface is responsible to display and structure the information generated by all LAARS functions.

Operators use different forms for real-time monitoring, searching in video history, investigating violations and reviewing registered landings and takeoffs.

The real-time monitoring form displays the most versatile functions but it still delivers clarity and usability. Its modular design ensures flexible interface customization even on multiple screens. All interface modules are interconnected with each other, all information are displayed in a synchronized fashion.

The interface contains a large overview video stream with informative AR visualization. Separate zoom windows provide detailed close-ups of the area of interest. An interactive map provides additional information on object positions. A detailed object list contains all detected objects with all their current and previous statuses, which are recorded in an in-memory database. Operators can load previous object statuses in no time and watch archive on the fly if needed.

LAARS generates informational labels with collected data and associates these with the detected objects. Clicking on the desired label, the related object is highlighted in the panoramic video. Operators can select an object on the displayed image and in the object list as well. This way they get information on airplanes quickly and they can easily track all their movements throughout the airside. Also non-cooperative objects get labels but with moderate information. The zoom window can be locked to automatically track any selected object.
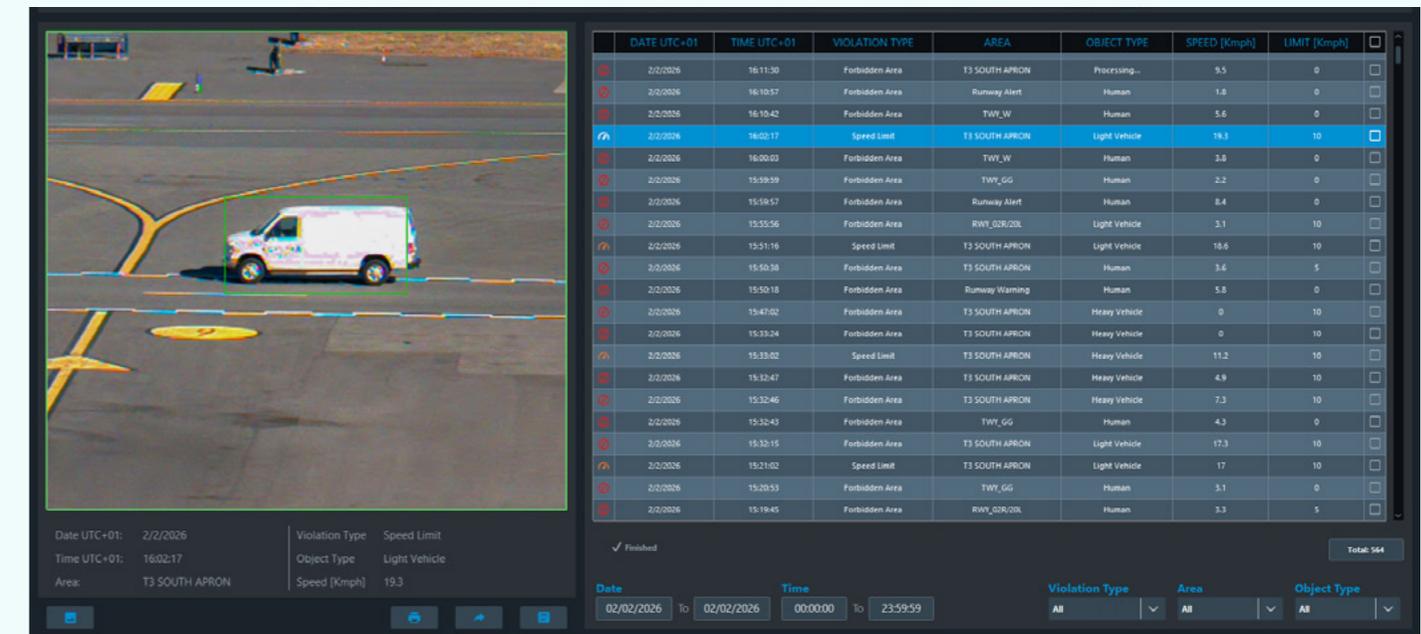
Perimeter Security

LAARS supports perimeter protection through two different approaches, ensuring flexible solutions for advanced airport security requirements and seamless integration with existing infrastructure.

Integrated PIDS-based Detection

LAARS can be seamlessly integrated with existing Perimeter Intrusion Detection Systems (PIDS), such as fence sensors, microwave barriers, or ground sensors. Alarm signals generated by these external systems are ingested by LAARS and used as triggers for Logipix Panorama Cameras and associated PTZ units. Upon alarm, the system automatically directs cameras to the affected zone, initiates intelligent zooming, and provides immediate visual confirmation.

VCA-based Perimeter Protection

As an independent or complementary solution, Logipix Video Content Analysis performs perimeter intrusion detection directly using dedicated camera deployments. The VCA continuously analyzes movement patterns and object behavior to identify unauthorized entries within protected zones. Once an intrusion is detected, LAARS automatically tracks the intruder, generates real-time alerts, and presents relevant visual context to operators. Advanced classification and filtering logic significantly reduce false alarms, ensuring reliable and efficient perimeter security operations.

ZOOM AREA

Technologies Behind Logipix Functions

Panoramic Technology

Logipix panoramic technology makes it possible to geometrically stitch images of Logipix visible light and thermal sensors. The images are taken in a synchronized fashion which precludes the possibility of duplicated or hidden objects at the stitching borders. White balance and tone correction algorithms smoothen the color gradient between the images.

AI-powered Video Content Analysis

Logipix provides the most reliable VCA possible, as the algorithms run on full resolution, uncompressed image streams. This approach ensures accurate detection and tracking even at far distances. The VCA relies on several advanced method. One of them is the Multidimensional Gaussian Background Model that always adapts to the background and differentiates every moving object from the learnt environment. Our built-in neural network ensures that the system does not loose the relevant non-moving objects. The VCA also applies Object Feature Extraction, Motion Behavior Analysis and Motion Path Estimation algorithms in order to realize an intelligent, self-learning virtual environment.

Augmented Reality

Sensor Fusion Technology

FOD Cameras

Logipix Augmented Reality enhances live video streams by layering color-coded object indicators directly onto camera images while presenting detailed informational labels beneath the panoramic view. These context-aware visual elements move in synchrony with detected objects, providing immediate operational insight without obstructing image content. This carefully structured visualization improves situational awareness, supports faster decision-making, and enables operators to interpret complex airside situations with greater clarity and confidence.

Logipix developed specific raw data level and GPS level sensor fusion technologies. Raw data analysis works with uncompressed data. This technique provides data fusion at the lowest level of abstraction, therefore it provides the highest level of accuracy. It was developed for Logipix sensors, but the system is able to fuse the data of external sensors as well. Complex data analysis means, the algorithms fuse the data of different sensors, which results in more accurate object detection and geopositioning.

Logipix FOD Panorama Cameras are specifically engineered for the reliable detection of foreign object debris across large airside movement areas. Unlike conventional color sensors, these cameras use high-sensitivity black-and-white imaging that captures the full intensity of incoming light without color filter arrays. As a result, each pixel records pure luminance information, enabling finer detail resolution, higher dynamic range, and a significantly improved signal-to-noise ratio.

By operating beyond the standard visible spectrum and leveraging additional infrared sensitivity, the cameras deliver high-contrast imagery optimized for identifying small objects against complex runway and apron surfaces. Combined with ultra-high resolution and wide-area panoramic coverage, this imaging approach ensures fast, accurate, and automated FOD detection under both daytime and nighttime conditions.

PTZ cameras in the system

High-end Logipix PTZ cameras efficiently complement the system. A special function allows the PTZ cameras to be assigned with the Logipix Panoramas by registering common spatial points that are visible to both cameras. This function allows operators to control the PTZ cameras by selecting the area of interest in the panoramic image.

Smart Storage Management

The system continuously records the videos. Thanks to the Logipix Ageing Technology, storage period of video streams can be greatly prolonged. The system intelligently drops frames from the video stream according to a configured period. As the JPEG2000 stream consists only intra-frame images, the footage will be still available after video stream ageing, but with reduced fps.

Monitoring in Full Resolution

Displaying 400-160 MP panoramic images during live monitoring or archive playback is not an easy task. This amount of data can impose excessive burdens on the network infrastructure and also on client computers.

Logipix developed a special technology to overcome this issue. The system stores the panoramic images in full resolution on the NVR, but always transmits and displays only relevant pixels. When a panoramic overview is on screen, its horizontal resolution is equal to the screen resolution. When an operator zooms in, the system sends the cropped image in higher resolution. As the zoom value increases, so does the transmitted image resolution.

Virtual PTZ

Logipix VPTZ enables LAARS video streams and high-level functions to appear seamlessly in third-party Video Management Systems (VMS). Since Augmented Reality information is not part of native video streams, LAARS fuses ultra-high-resolution video with cross-correlated object data and AR visual elements, generating a standard ONVIF-compatible stream. To overcome bandwidth and compatibility limits of conventional VMS platforms, LAARS converts panoramic streams of up to 400 MP into an interactive Full HD ONVIF stream. Operators can navigate the full-resolution panorama as if controlling a physical PTZ camera, using joystick movements and keypad shortcuts to access LAARS functions smoothly and intuitively.
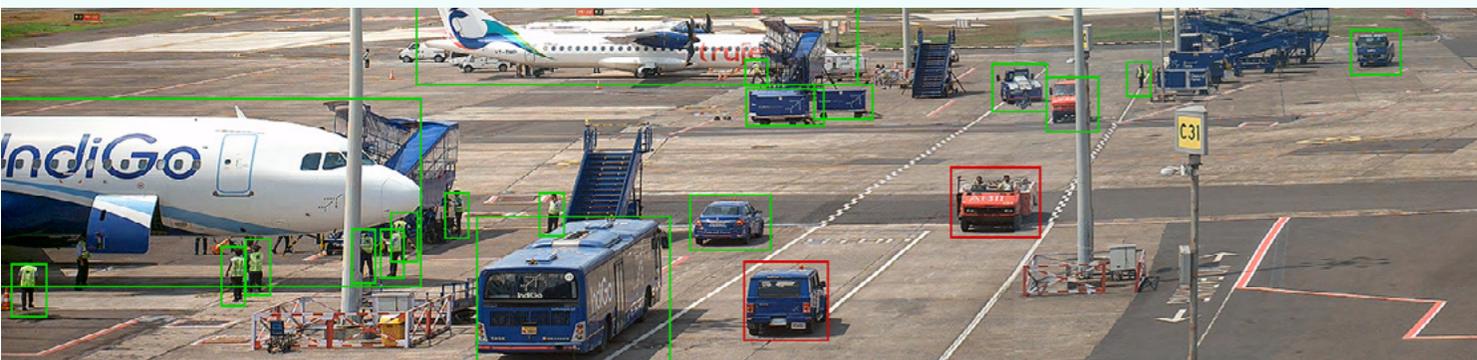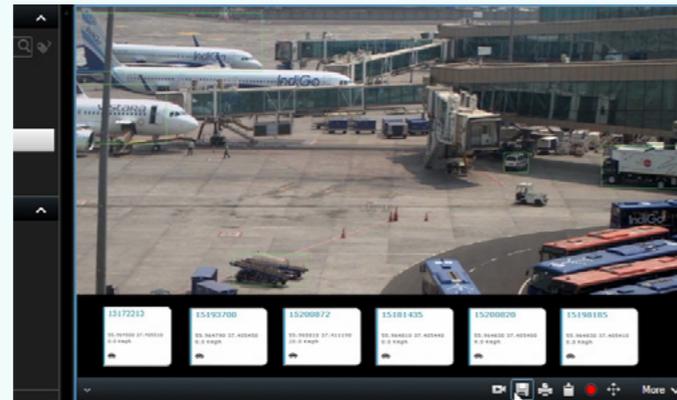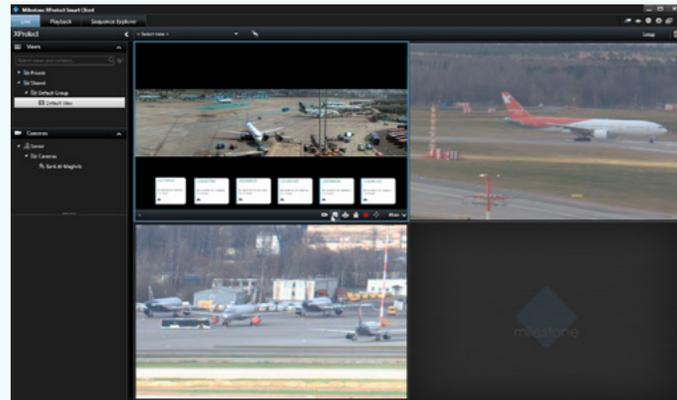

Cybersecurity

Logipix cybersecurity is designed to meet the strict security requirements of airport environments. The system protects sensitive operational and video data through proprietary encrypted communication, strict access control, and tamper-resistant storage. Full encryption of raw video streams and cryptographic signing of exported recordings ensure data integrity and traceability. Regular vulnerability assessments, penetration testing, daily database backups, and device binding mechanisms provide resilience against evolving cyber threats while supporting secure, uninterrupted airside operations.

System Health Monitoring

Logipix provides continuous remote monitoring of system health through automated health reports, SNMP traps, and a centralized notification center that delivers real-time feedback on hardware and network status. This enables early detection of anomalies and proactive maintenance before issues escalate. Physical maintenance requirements are minimized through built-in self-cleaning and deicing systems, ensuring reliable operation in harsh weather conditions while reducing on-site intervention and maintenance costs.
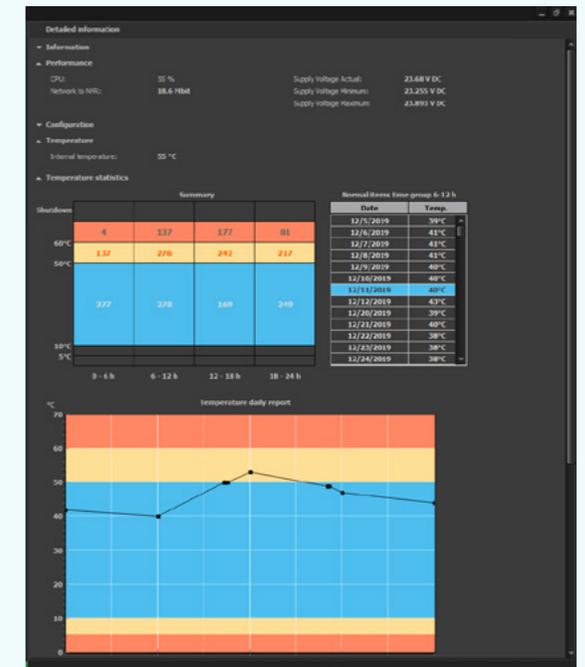
Main Features and Functions

Monitoring

- 400-200 MP Panoramic Video Stream for Airside Monitoring with 20 fps / cam
- 20+1.3 MP Dual Vision for Glide Path Monitoring with 20 fps / cam
- 160 MP Extended Spectrum B&W Panoramic Stream for FOD Detection
- Real-Time Monitoring in Full Resolution
- PTZ Control on Panoramic Images
- Interactive Map
- Interactive Object List
- In-Memory Object Database
- Video History

AI-Powered VCA

- Glide Path Monitoring
- Object Tracking
  - Detection ǀ Classification ǀ Tracking
  - Merging Motion Information with Images
    - Object Indicators ǀ Path History ǀ Heading
  - Object Labeling
- Geofencing
- Virtual Fence
- Access Control
- Situational Awareness
  - Proximity Alert
  - Collision Prediction
- Automatic Traffic Enforcement
  - Overspeed ǀ Line Violation ǀ Traffic Light
- Automatic FOD Detection

Transponder System

- Cost-Effective Upgrade to Transform Non-Cooperative Objects into Cooperative Ones
- IoT-Based Transponder-Assisted Object Identification
- Resolution-Independent Object Identification
- Fusion of Transponder Data with Video Content Analysis
- Reliable Identification at Long Distances
- Seamless Integration with Existing Airport Systems
- Centralized Management of Transponder-Equipped Objects

Integration

- Positioning Systems: ADS-B, MLAT, A-SMGCS
- Radar Systems and Rangefinders
- AODB (Airport Operational Database)

Perimeter Security

- PIDS Triggered Intrusion Detection
- VCA-Based Intrusion Detection
- Highest Detection Accuracy Possible
- Automatic Zoom in on Alarmed Area
  - ePTZ (Automatic Zoom on Panoramic Images)
  - Automatic PTZ Zoom

Maintenance

- Remote Maintenance
  - Health Report ǀ Notification Center ǀ SNMP Notification
- Hardware Maintenance
  - Self-Cleaning ǀ Deicing

Key System Components

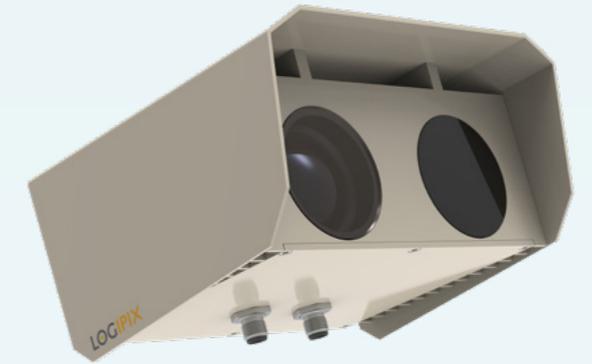
Logipix 300 MP Panorama Camera

Logipix 200 MP Panorama Camera

Logipix 6 MP PTZ Camera

Logipix 20+1.3 MP Dual Vision Glide Path Camera

Logipix 160 MP Panorama Camera

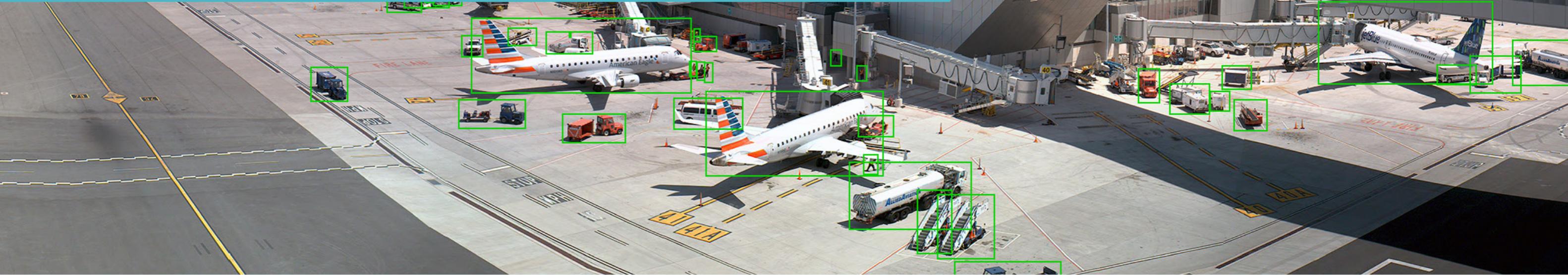LAARS Software Package

Logipix Network Video Recorder 5th Gen

Technological Strengths of the Solution

- Logipix employs purpose-built camera and sensor technologies optimized for specific airside tasks, including visible-light, thermal, and high-sensitivity black-and-white imaging. Each sensor is engineered to deliver ultra-high resolution and exceptional image quality.

- The solution uses the scalable JPEG2000 image compression, which is the only standard that allows for real-time monitoring with hundreds of megapixels in a bandwidth effective manner.

- Logipix AI-powered Video Content Analysis is embedded directly within the cameras and Network Video Recorders, operating on full-resolution JPEG2000 image streams to ensure accurate detection and analysis without compromising image detail.

- Based on advanced Video Content Analysis the solution detects, tracks and classifies both cooperative and non-cooperative objects at the airside.

- Logipix Transponder System provides resolution-independent object identification by fusing IoT-based transponder data with ultra-high-resolution video analytics.

- A dedicated software function provides informative, dynamic labels that are linked to both cooperative and non-cooperative objects. These labels move in synchrony with detected objects and can display contextual information such as object type, aircraft registration number, and flight number directly alongside the object.

- Logipix makes it possible to cover the monitored area with virtual layers both temporary and permanent and assign specific rules to them.

- Logipix automatically detects traffic related violations, proximity situations, predicts possible collisions and detects FOD throughout the movement area and the apron.

- Using Real-time Decision Making Support, operators can effectively filter numerous objects, incidents and situations and highlights only the most relevant ones on screen.

- The solution integrates Airport Systems like Airport Operational Database, Radar Systems, Range Finders, ADS-B, MLAT and A-SMGCS and fuse these data with the VCA data flow.

- Logipix system is able to ensure redundancy for all types of hardware elements.

Conclusion – Proven Excellence

Logipix engineers developed the best-in-class airside video monitoring solution that comprises high-end visual sensors, intelligent data processing units and a complete software package. It aids airside services by Computer Vision Technologies and supplement the scene for operators with informational augmented reality elements.

The solution facilitates airside operations and prepares airports to conveniently face pressing new directives. It ensures smooth and secure ground processes and plays a key role in preventing incidents and also in investigation. As a result, it enhances airport efficiency, reduces the number of costly delays, and even shortens the system's payback period.

LAARS is a trusted system that has been chosen already by some of the largest airports around the globe, preparing their airsides for the difficulties of our new challenging era.