ADVANCED RAMP CONTROL SOLUTION

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OPERATIONAL CHALLENGES

The surge in air travel, combined with unforeseen disruptions, poses dual challenges for airports. Meeting escalating demand while preparing for reduced operations requires strategic planning. Expanding airport size or assets isn't viable, instead, optimizing existing infrastructure is crucial. Adaptability is key in this dynamic area. It requires efficient operations while maintaining high-level of safety, even with fewer personnel.

To overcome this, airports must shift towards innovative, advanced solutions. Implementing AI-powered monitoring, technology-driven data analysis, and integrated systems is vital. These advancements can refine processes, minimize delays, and ensure seamless turnaround operations while upholding safety standards.

THE LOGIPIX ADVANCED RAMP CONTROL SOLUTION

Efficient coordination of all tasks surrounding airplanes during their turnarounds is paramount for the seamless functioning of an airport. Logipix airside-specific solutions have been meticulously designed and implemented to not only enhance airside safety and visibility but also to optimize overall airport efficiency across various critical areas, encompassing the airport stands.

To make turnaround processes more traceable and more effective, airports can deploy the Logipix Advanced Ramp Control Solution. It is an intelligent video-based system that assists ground handling process registration, and it also provides valuable data to create statistics, which help better organize tasks around airplanes.

YOU NEED OUR SYSTEM, IF YOU WOULD LIKE TO...

- optimize ground process management and explore operational bottlenecks
- make all airplane stands visible for ground operators in high-resolution, both in real-time and historical mode
- shorten turnaround times and create useful statistics on ground handling efficiency
- have relevant information for KPI calculations to make effective plans and decisions
- create statistics on stand occupancy based on precisely recorded and organized data
- improve overall airside efficiency by monitoring and analyzing turnaround processes
- facilitate incident investigation and get irrefutable visual evidence in already occurred cases
- increase the safety of passengers, employees and assets at the airside
- optionally bring Artificial Intelligence and Computer Vision Technologies into turnaround monitoring
- clarify billing procedures based on accurately registered and traceable service times
- Track important turnaround milestones and assist ACDM

FINANCIAL BENEFITS

- **Supporting strategical decisions**
  The system supports KPI calculations by providing accurate data on actual turnaround times and delays

- **Optimizing stand occupancy**
  Various airside statistics and calculations can be created on stand occupancy, which helps realize explicit business benefits.

- **The system increases operator's efficiency**
  Far less personnel is needed to manage multiple turnarounds simultaneously and keep all services on track.

- **No need for frequent maintenance using human resources**
  Logipix hardware components are capable of self-maintenance, thanks to their built-in self-cleaning and deicing systems.

- **Optimizing manpower**
  Operators can manage several stands simultaneously, therefore less manpower is needed to manage all stands at the apron.

- **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 apron developments.

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

- **Maximized system uptime**
  Logipix provides uninterrupted system availability as all their components are developed to operate with high MTBF.

OPERATIONAL EFFICIENCY BENEFITS

- **Enhanced vision at the aircraft stands**
  The Logipix system allows to cover all aircraft stands and their surrounding areas from multiple angles. This way operators have real-time visual information on all stands at the apron and they can check the progress of the turnaround processes.

- **Real-time stand allocation management support**
  The system calculates the end of turnaround services, alerts delays and time conflicts, which make stand allocations and re-allocations easier for operators.

- **Convenient turnaround registration**
  Operators have a user-friendly interface to register turnaround processes real time, or use the historical mode to search the exact time when the processes have started.

- **Increased operational efficiency**
  The solution makes it possible to register turnaround processes at a higher level, assisted by Video Content Analysis (VCA), and therefore increase ground handling management efficiency at the apron.

- **Real-time Decision Making Support**
  ARCS functions an RTDMS system that always highlights the most relevant information on screen.

- **Undoubted visual evidence in questionable situations**
  Any situation can be thoroughly investigated with Logipix, down to the smallest details. For instance, in cases when it is unclear whether an airplane has been damaged at the airport or prior to landing. Logipix sensors provide undoubted visual evidence upon request.

WHAT DIFFERS US FROM OTHERS

- Logipix Advanced Ramp Control is a high-end image sensor based system. Logipix sensors provide clear visibility of all stands and the extended surrounding areas at the apron.
- High-resolution visual feedback is delivered of each turnaround processes.
- Operators can confidently manage multiple turnarounds simultaneously. They can switch between stand views immediately whenever they have to.
- Using advanced historical operation mode, turnaround registration can be performed with accurate time stamp even after the processes have finished.
- The system allows browsing among the captured turnarounds. Operators can recall the high-resolution footage of any turnaround process if needed.
- Logipix delivers the full component line of the complex system, from hardware to software.
- Optionally, our system provides AI-based features, developed to track and register some of the turnaround processes automatically.
- Logipix Advanced Ramp Control Solution makes it possible to create useful statistics based on the registered turnaround data.
- Our system provides irrefutable visual evidence of any incidents that occur during turnarounds, and it can also prove that a damage occurred prior to the investigated turnaround.
- ARCS provides long storage periods, thanks to its intelligent storage management technology.

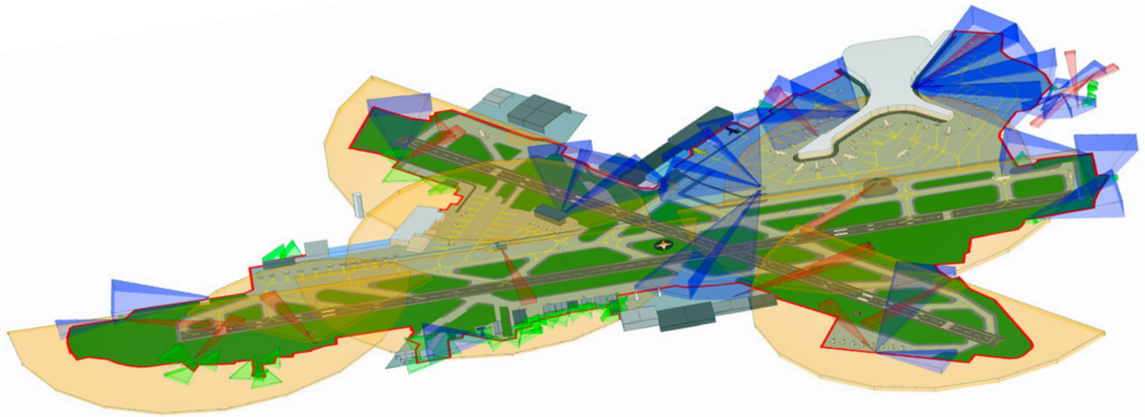
DESIGNING YOUR PROJECT

3D model of visual coverage

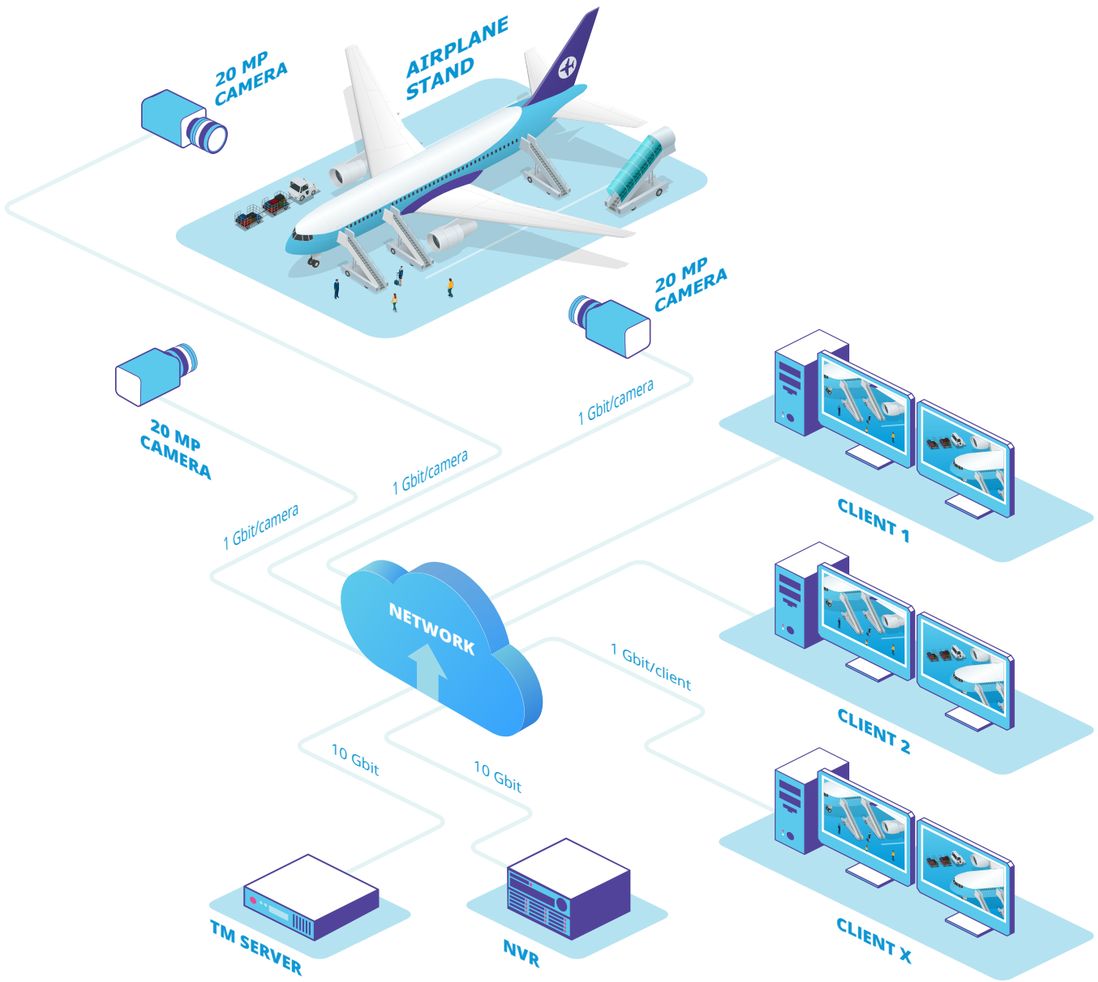
Logipix starts each project with a customized 3D plan that shows camera installation points and Filed of Views. It helps optimize camera arrangement, the necessary resolution and coverage at the airplane stands, according to customer needs. The best result can be achieved if a stand is visible from multiple angles. Both panorama cameras and single sensor cameras can be used for optimal coverage.

System extension

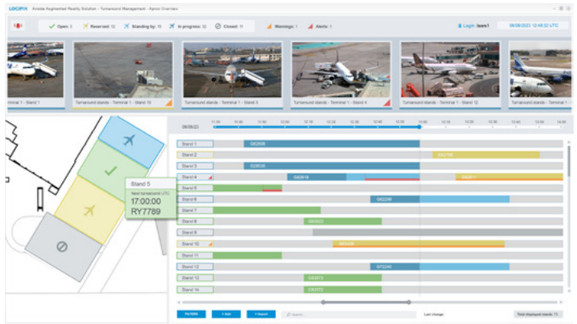
Logipix solution is designed to be flexible for future developments. Both the covered areas and also system functionality can be extended easily on demand.



SYSTEM ARCHITECTURE



TECHNOLOGICAL DESCRIPTION



MAIN FUNCTIONS

Apron Overview

Operators and supervisors can overview all aircraft stands on the apron and monitor the progress of the daily turnarounds. They receive warnings and alerts on service delays, therefore they can rearrange plans easily and avoid time conflicts.

Turnaround Registration

Operators can choose a single stand to visually track and register each turnaround and save detailed reports about the whole process in real time or afterwards.

Turnaround History

In Turnaround History previously saved work-sheets can be reviewed with automatically saved reference images.

Turnaround Statistics

Valuable statistics can be created based on the registered operations, which help improve the efficiency of turnarounds.

MANUAL AND VCA ASSISTED OPERATION MODES

The Advanced Ramp Control Solution is available in two versions. The first one essentially relies on full manual operator activity. The second one is an extended version, where AI-based Video Content Analysis assists in registering some of the operations.

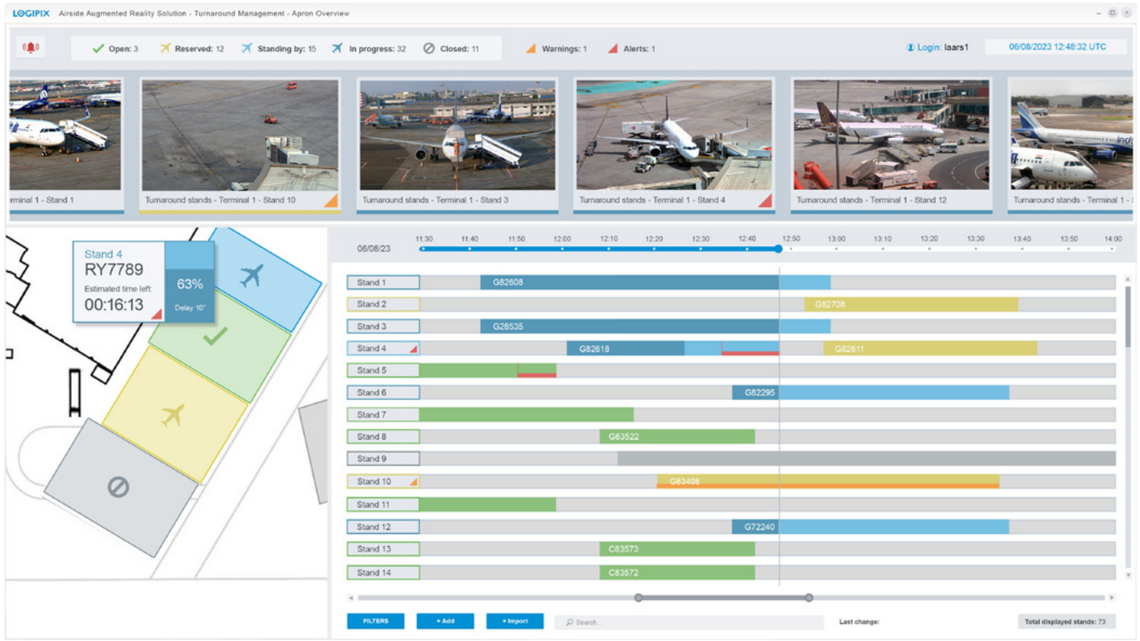
The Logipix VCA can detect the presence and classify different objects. It can accurately track the motion of airplanes and various ground equipments. Depending on the applied resolution and chosen point of view the algorithms can detect even complex processes.

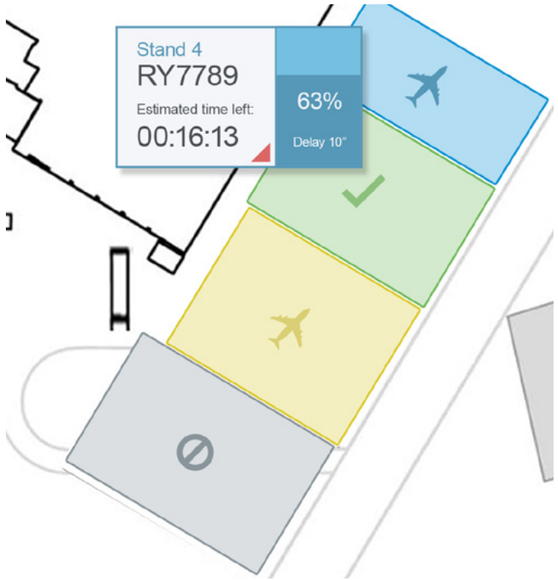
Apron Overview

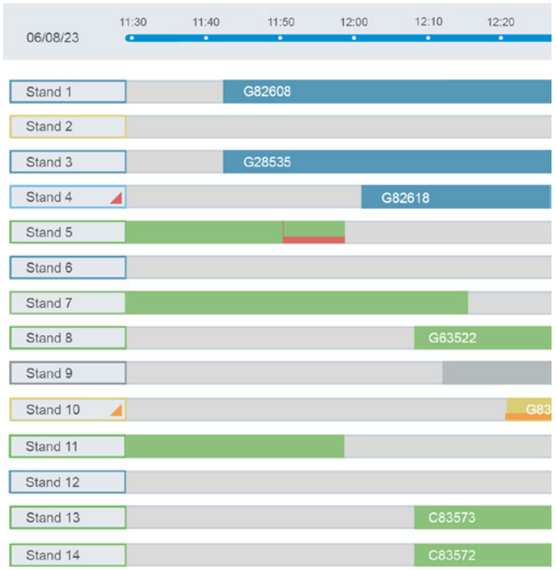
Apron overview was developed to provide a summary on all aircraft stands at the apron. Operators receive real-time information quickly watching the images of the stand cameras and also the daily flights, which can contain even hundreds of stands with daily schedules. The visualized stands and turnaround statuses are all color-coded in order to provide clear, instant feedback on their statuses. Operators can easily filter for stand groups or simply for their assigned stands.

The whole interface is intended to deliver turnaround information as quick as possible. An interactive map displays aircraft movements and stand statuses. Operators can zoom in and pan on the map in order to find and enlarge areas of interest. Hovering on a stand, an informative label pops up, showing airplane allocation or current turnaround progress.

In case any delay or change that occurs in the daily plan, operators can instantly understand the situation and they can provide information to Airport Operation and Ground Handling Agents. This way they can easily re-schedule the aircraft stand allocation.







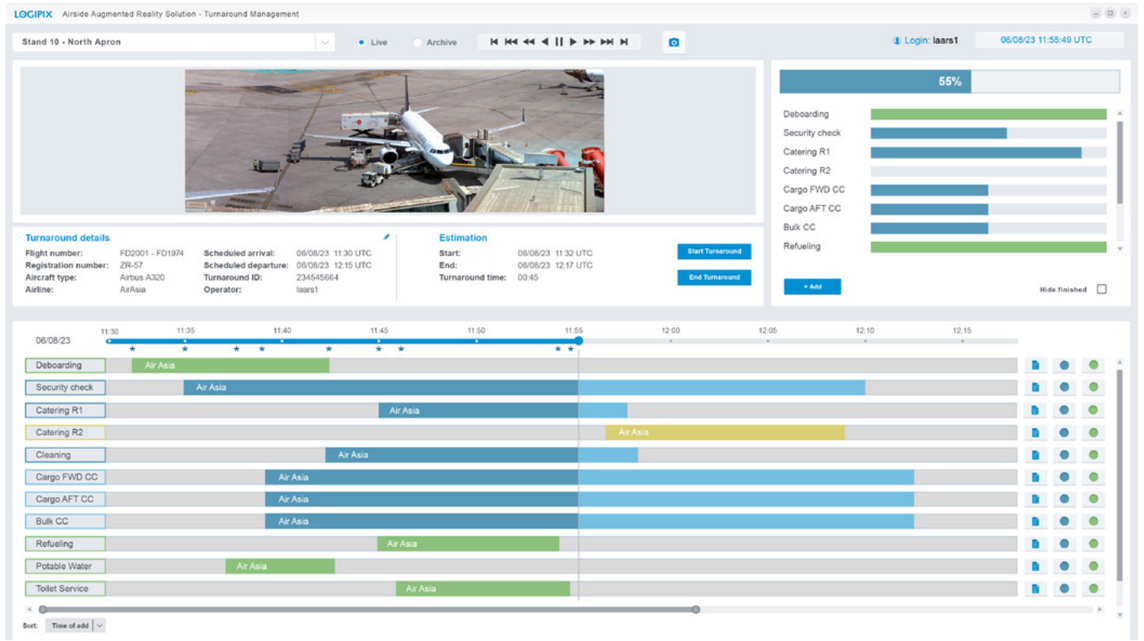
In case the Logipix system receives transponder information, or information from the vehicle management system or monitoring is supported by the Logipix VCA, the map can display the real-time positions of airplanes on the apron. Clicking on airplane icons, the software displays labels, which inform about airplane IDs and allocated stands.

One of the main information sources of the interface is the daily flights schedule. Each stand has its own timeline that shows the color-coded time frames according to the imported schedule data. In case a turnaround lasts too long, the system automatically displays warnings or alerts for the operator.

Turnaround Registration

The Turnaround Registration interface enables operators to monitor and register the progress of turnaround processes on any stand, starting from parking until push-back. Operators can easily navigate through turnarounds on the overview interface and choose one for a more detailed view.
Once an individual turnaround is selected, the registration interface appears, allowing operators to verify whether turnaround tasks are being executed within the scheduled operational parameters.

They can create a comprehensive turnaround report by registering the processes with precise time stamps. Since the stands are continuously monitored from multiple angles, operators have constant access to high-resolution visual feedback on the activities surrounding the airplanes. Additionally, they receive turnaround details in text format, including an estimated turnaround time based on predefined time frames.



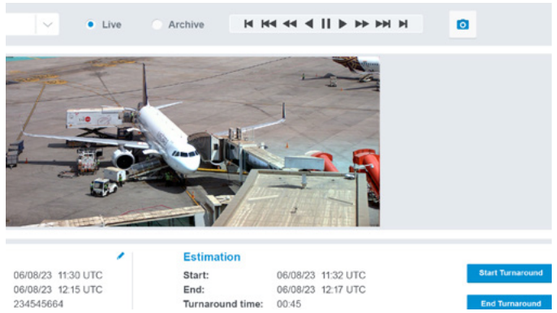
The schedule is filled automatically with the optimal time frames based on an imported list or template, that contains the ordered services. The system constantly refresh the estimated time of this schedule according to real-time information about the progress. The time frames vary automatically based on airplane types and stand types.

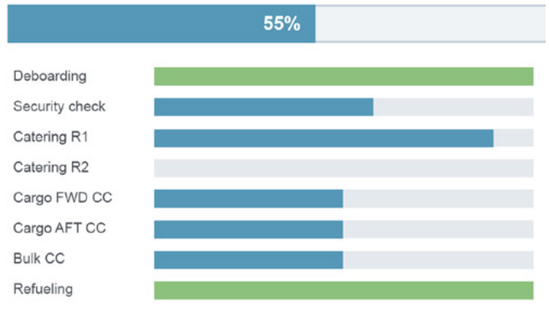
In case of manual operation, operators have the opportunity to register every services in real-time, but they also have the opportunity to register already ended services using the archive mode. They can rewind or fast forward the whole process, search within the timeline and register services within minutes.

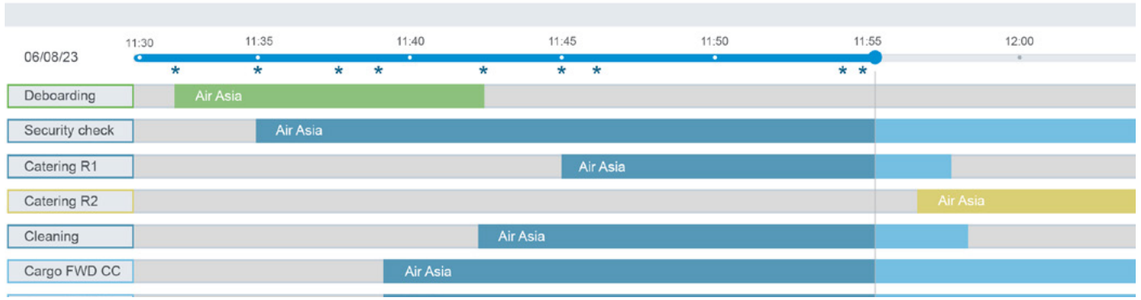
This feature allows operators to manage several turnarounds and stands simultaneously.

VCA assisted operation mode increases system efficiency and takes some of the burden off of operators. In this case computer vision algorithms monitor the progress of the turnaround processes and register them. The type of the recognizable processes are just the matter of applied resolution and the right camera angle.

Whenever operators or the VCA start or end the registration of a service the module automatically saves reference images, but operators can save extra images any time. These can be watched back any time until the end of the storage period.







Turnaround History

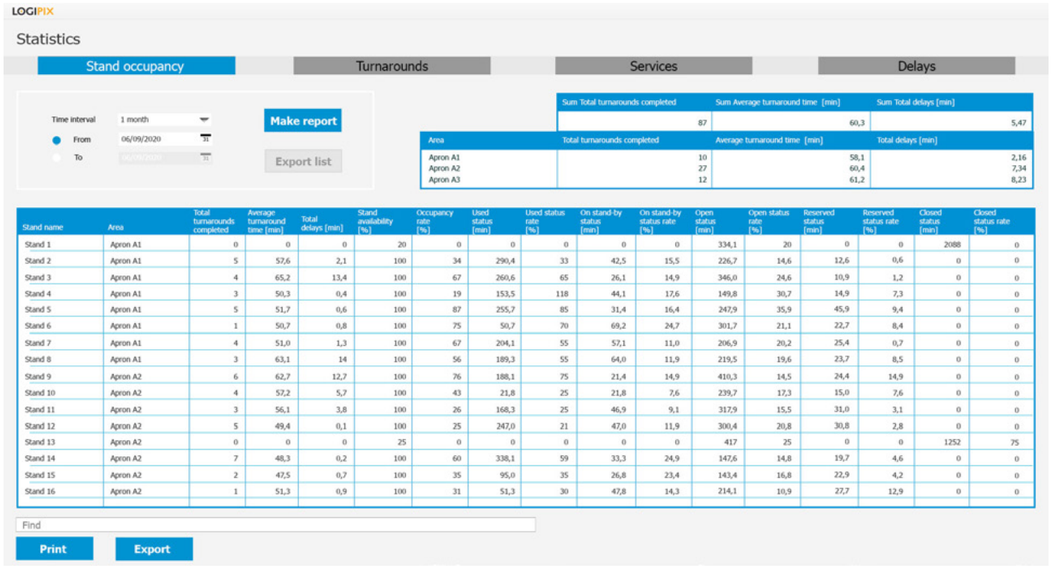
Using the Turnaround History form, operators can search in the registered turnarounds and recall them within the storage period whenever necessary.

The interface is similar to the turnaround registration form in archive mode, except it has an extra search bar for browsing the registered turnarounds. The displayed schedule facilitates the search process. This way operators can find the reference image of interest within seconds. They can use this for any type of evidence search.

Turnaround Statistics

Valuable Turnaround Statistics can be created from the registered data. This function allows to analyze turnaround times and every services in details. Automatic calculations can be made to identify critical bottlenecks and improve turnaround times.

These can be performed separately for every type of aircraft and flights serviced on the airport, and also for each stand individually, if needed. The performance of different Ground Handling Agents can also be measured.



TECHNOLOGIES BEHIND LOGIPIX FUNCTIONS

Synchronized Imaging

All Logipix system components are synchronized to each other and all the cameras take their images in sync to guarantee that the moving objects are visible at their correct location. The system records time stamps in all image headers, which allows the system to provide appropriate visual evidences during investigation.

Logipix 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. 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.

Logipix Intelligent Storage Management Technology

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, and therefore it frees up space on the HDDs. 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 the extreme high-resolution image streams at high fps 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 full-size images on the NVR, but always transmits and displays only relevant pixels. When a full frame image is on screen, its horizontal resolution is equal to the display 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.

Full resolution image detail

MAIN FEATURES AND FUNCTIONS

Monitoring

- 20 MP video stream with 20 fps / cam
- Crops from 300 MP panoramic video streams with 20 fps
- Real-time monitoring in full resolution
- Interactive map
- Daily flights per stands
- Turnaround History
- Turnaround Statistics

Turnaround registration

- Manual registration
  - Live operation
  - Historical operation
- AI assisted registration

Integration

- Positioning systems: ADS-B, MLAT, A-SMGCS, Vehicle Management System
- Data import and export: Airport Information Systems, AIXM

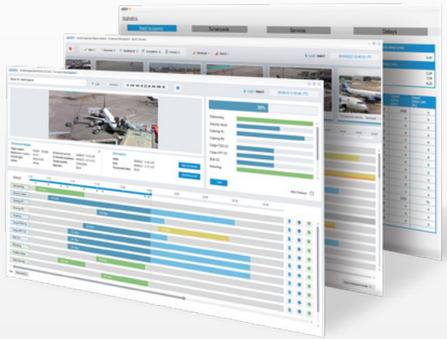
KEY SYSTEM COMPONENTS

Logipix ONE 20 MP Camera

Logipix 320 MP 40° Panorama Camera

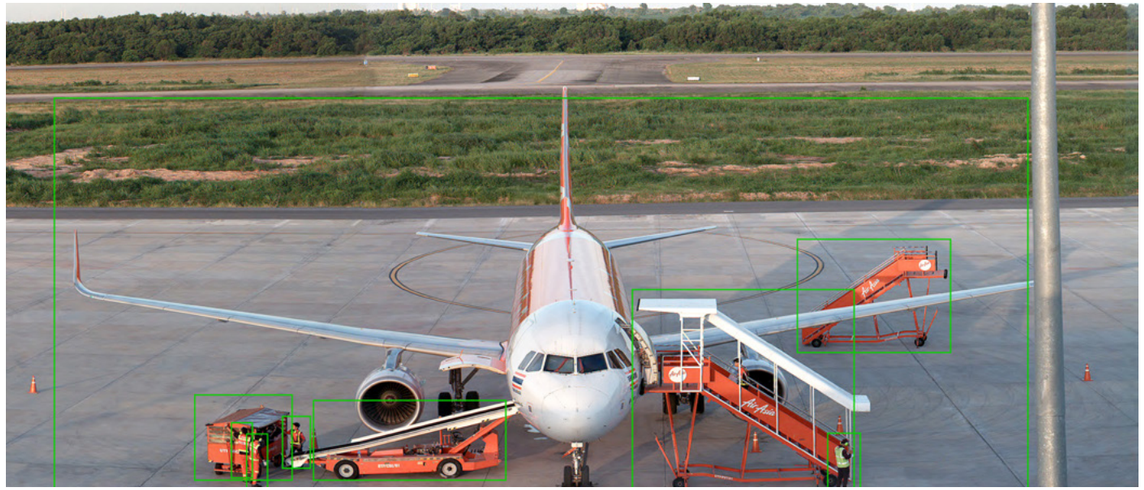
Logipix 200 MP 180° Panorama Camera

Logipix 300 MP 180° Panorama Camera



ARCS Client and Server components

Logipix Network Video Recorder 4th gen

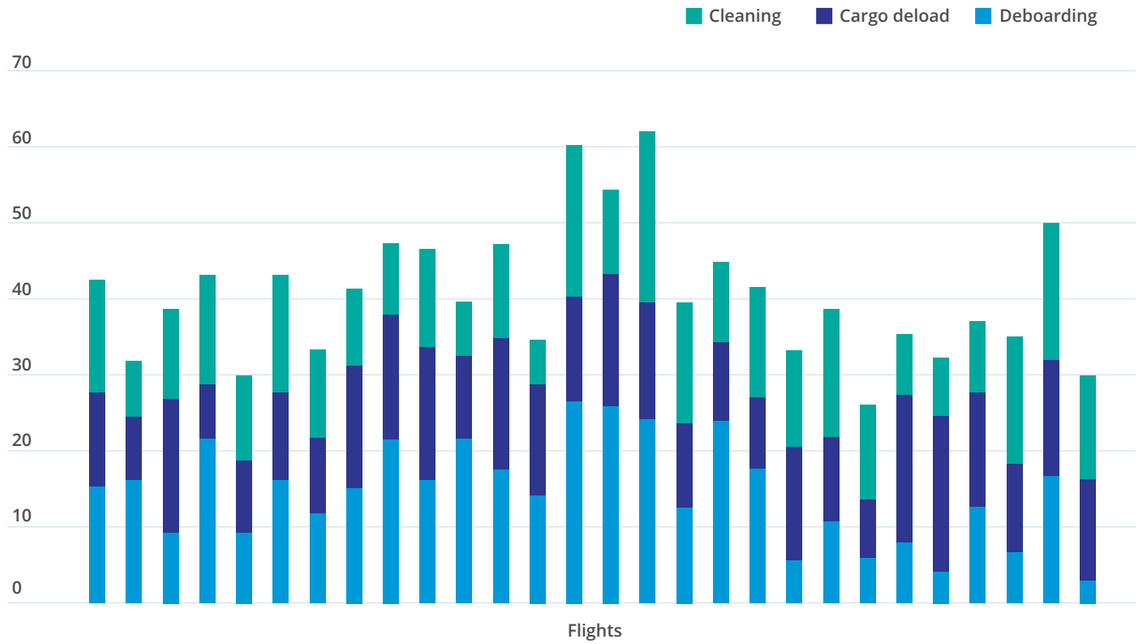


TECHNOLOGICAL STRENGTHS OF THE SOLUTION

- The system provides high-resolution video coverage of all stands on the apron.
- Operators can visually track and register the status and the progress of multiple turnarounds simultaneously using a designated user interface.
- The system visualizes stand allocation and service schedules on interactive maps and timelines.
- Using specially developed software functions, operators can easily register services real-time, or they can postpone and quickly perform the whole turnaround registration later. This allows them to handle several stands concurrently.
- Logipix AI-powered Video Content Analysis brings automatism in turnaround service registration. It is able to detect and register the start and finish of various services automatically.
- All recorded data can be summarized and prepared for post-analyzes. This function helps calculate KPIs and optimize turnaround processes, which eventually avoids queuing and reduces the number of delays on the apron.
- The high-resolution footage also helps the investigation of any negligence or incident.

CONCLUSION

Average process times



The Advanced Ramp Control Solution has been created to improve turnaround management at airplane stands. Its high-resolution imagery sensors capture all stands and their surrounding areas on the apron. The system allows ground controllers to detect any potential issues quickly, whether they are time conflicts or negligence during turnaround processes and take the necessary measures to resolve them. The system also provides analytics about the turnaround processes, such as the time it takes for the aircraft to be ready for takeoff. This helps identify any areas of improvement that could further reduce turnaround times.

ABOUT LOGIPIX

Logipix Technical Development Ltd. is a privately held company established in 1996 in Budapest, Hungary. Since then, Logipix has grown into the international company that it is today – one of the most innovative, end-to-end video surveillance solution developers and manufacturers. Today the main profile of the company is to provide specially designed, high-end video surveillance solutions considering the various characteristics of different application areas.

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