SENSORTEC PANORAMIC TECHNOLOGY

This file provides a comprehensive overview of our various panoramic concepts including the high-end SensorTec Panoramic Cameras. You will have an exclusive insight on the hardware units, the embedded Artificial Intelligence and the advanced display technology, which together result in a complete solution that determine the future of video surveillance.

All Images in this File were Taken by SensorTec Panoramic Cameras.

SECURITY BEYOND LIMITS

In the few years since 2000, SensorTec has grown into an international company that it is today. We are among the most innovative technological companies in the world, manufacturing and developing intelligent security and surveillance solutions specifically for largescale projects for military, law enforcement, public authorities and private sectors.

We believe that serving the needs of our clients efficiently can only be achieved by delivering complete solutions. In order to achieve that, we design and manufacture all the critical components of our systems, including hardware, software and embedded computer vision. Our entire product range is manufactured and developed in accordance with the highest quality requirements.

SensorTec provides integrated solutions, which combine a wide range of devices, sensors, and software, such as surveillance cameras, surveillance radars, video analytic software and C3. All of our solutions are designed to work in harmony and provide a comprehensive multi-layer approach to deliver situation awareness and interactive intelligence.

KEY FIGURES

300+	TECHNICAL SUPPORT ENGINEER AND TECHNICIAN
4	BRANCHE OFFICES

HQ and Manufacturing Facilities:
Cambridgeshire, UK.
Budapest, Hungary.

Sales and Technical Support Offices:
Dubai, UAE.
Riyadh, KSA.

END-TO-END
SENSORTEC SOLUTIONS

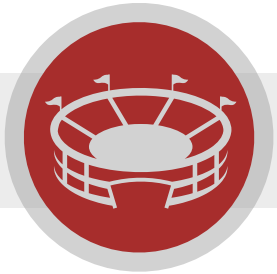
Borders
Video Surveillance

Airports
Video Surveillance

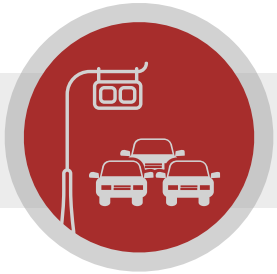
Seaports
Video Surveillance

Critical Infrastructure
Video Surveillance

Safe & Smart City
Video Surveillance

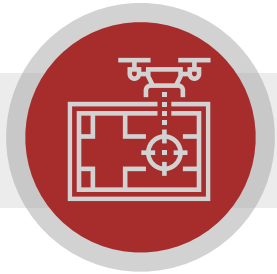


Stadiums & Crowds
Video Surveillance

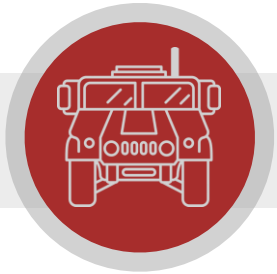


Traffic Management
& Violations Detection

Highway
Video Surveillance



Anti-Drone/UAV
Intelligent System



Mobile (In-Vehicle)
Video Surveillance

SELECTED INTERNATIONAL **REFERENCES**

BORDERS SURVEILLANCE AND SECURITY
Hungarian Land Borders - Hungary.
Egyptian Land and Sea Borders - Egypt.
Kuwaiti Land and Sea Borders - Kuwait.

AIRPORTS SURVEILLANCE AND SECURITY
LaGuardia Airport - New York.
Hungarian Airport - Hungary.
Mumbai Airport - India.
Turkish Airport - Turkey.
Alexandria Airport - Egypt.

SEAPORTS SURVEILLANCE AND SECURITY
Hungarian Waterway - Hungary.
Sea Ports - Kuwait.
Sea Port - UAE.

CRITICAL INFRASTRUCTURE SECURITY
Ministry of Defense - Egypt.
Egyptian Monument Authorities - Egypt.
Manarat Al Saadiat Cultural Museum - UAE.
Private Palace - Kuwait.
Saudi Arabia Embassy - Geneva.

CITY SURVEILLANCE AND SECURITY
Delhi City - India.
Luxor City - Egypt.
Sharm El Sheikh City - Egypt.
Cairo City - Egypt.
Port Saeed City - Egypt.

STADIUMS AND CROWDS SURVEILLANCE
Manchester City Stadium - UK.
Budapest Szusza Ferenc Stadium - Hungary.
Rijeka Stadium - Croatia.
Beşiktaş Stadium - Turkey.
Atatürk Olympic Stadium - Turkey.
Fenerbahçe Şükrü Saracoğlu Stadium - Turkey.
Luzhniki Stadium Moscow - Russia.
Spartak Moscow - Russia.
Mecca Religious Sites - KSA.
Dubai Festival Plaza - UAE.
Pyramids Touristic Area - Egypt.

TRAFFIC LAW ENFORCEMENT
Traffic Management And Violation Detection - Cairo, Egypt.
Traffic Management And Violation Detection - Kuwait.
Traffic Management - Armenia.
Traffic Management - Hungary.

CHALLENGES OF WIDE AREA SURVEILLANCE

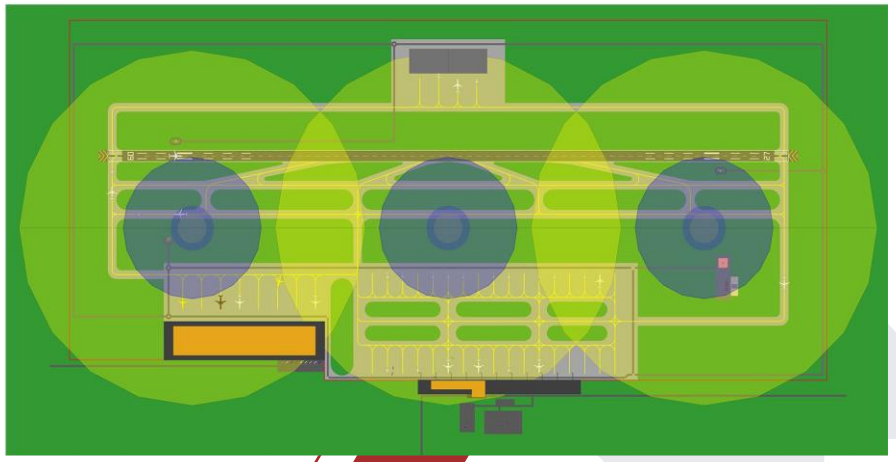
Efficient wide area surveillance is a significant challenge. A video surveillance system comprising hundreds of traditional IP cameras is not able to effectively cover a vast area.

If operators have to scan through a large number of camera images, important things might go unnoticed. Monitoring becomes exhausting really fast and accurate visual orientation is almost impossible. Archive playback can be also difficult from multiple cameras and in addition the individual image streams are not synchronized.

Furthermore those cameras deliver visual information of only a thin defense line. Installation and maintenance is also time-consuming and expensive with a traditional system.

SensorTec, however, has effective panoramic solutions that solve many issues of wide area video surveillance.

Full coverage by **361** of traditional **2MP** cameras.



Full coverage by **6** of **200MP** panoramic cameras.

OUR ANSWER FOR

WIDE AREA SURVEILLANCE

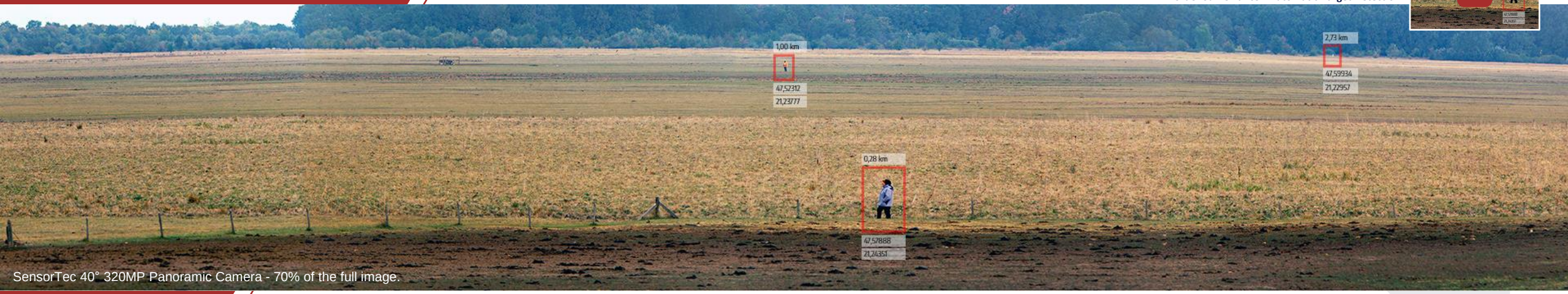
SensorTec engineered a leading-edge panoramic technology in order to make the video surveillance of vast areas more effective. The high-resolution panoramic images ensure better spatial awareness for operators, as the view is displayed contiguously, which helps visual orientation within immense areas.

The essence of this technology is the precise 3D geometric stitching of images taken by individual image sensors. This development allowed us to diversely design panoramic solutions. We provide multi-sensor panoramic cameras in various concepts and also freely structure virtual panoramas built from several individual high-resolution cameras.

Human Automatic Detection up to 3,000m.

Vehicle Automatic Detection up to 5,900m.

Click to watch the video
Border Surveillance - Automatic Target Detection.



SensorTec 40° 320MP Panoramic Camera - 70% of the full image.

SENSORTEC PANORAMIC
CAMERA SYSTEMS

	PANORAMIC CAMERAS								VIRTUAL PANORAMIC
CAMERA TYPE	40° 320MP Dual Vision	10° 100MP Dual Vision	40° 320MP	180° 300MP	180° 200MP	90° 100MP	20° 200MP	10° 100MP	20MP cameras Variable Structures
VISION	Visible Light and Thermal		Visible Light						
DESIGN	Industrial Grade | Military Grade | Marine Grade								Custom Housings
EMBEDDED INTELLIGENCE	Video Content Analysis								
RELATED NVR	SensorTec 4th Gen. Network Video Recorder (Rack-Mounted and Outdoor)								
INTEGRATION	Multi-Sensor System | Radar | Thermal Camera | LASER PTZ Camera | IR Flash								
VIDEO MANAGEMENT SOFTWARE	Control Center (Professional or Ultimate)								

180° 200MP
Panoramic Camera

90° 100MP
Panoramic Camera

40° 320MP Dual Vision
Panoramic Camera

40° 320MP
Panoramic Camera

20° 200MP
Panoramic Camera

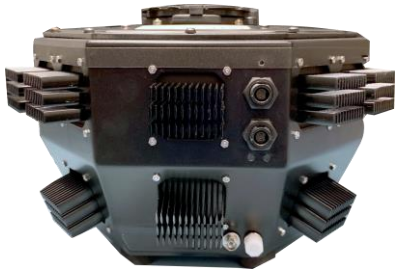
180° 300MP
Panoramic Camera

SENSORTEC DRONE-MOUNTED
PANORAMIC CAMERA

SensorTec Drone-mounted Tethered Panoramic Camera is developed to be mounted on different types of drones to monitor vast areas with wide angle panoramic view.

DRONE-MOUNTED TETHERED PANORAMIC CAMERA

- 120MP resolution and 120° horizontal Field of View.
- Day-night operation modes.
- AI for human and vehicle detection up to 1000m.
- Picture enhancement algorithms for foggy, rainy weather conditions.
- Real-time camera image stitching to create panoramic view and zoom.
- High Dynamic Range (HDR).
- Precisely stitched panoramic image with white balance and gradient compensation.
- Rugged housing.
- Small size and could be mounted on small drones.
- Light weight 1.5Kg.



120° 120MP
Drone-mounted Tethered Panoramic Camera

SensorTec 120° 120MP Drone-Mounted Panoramic Camera - 30% of the actual image size.

UNBEATABLE
RESOLUTION

SensorTec applies several specifically developed, high-quality sensor-lens combinations within massive, purpose-designed camera units. Their enormous resolution ensure the cameras deliver useful visual information from even kilometers away.

	AUTOMATIC DETECTION AND TRACKING BY COMPUTER VISION			
PANORAMIC CAMERA	**HUMAN** (23 PPM)	**LIGHT VEHICLE** (12 PPM)	**HEAVY VEHICLE** (8 PPM)	**AIRPLANE** (2 PPM)
40° 320MP*	3,000 m	5,900 m	8,860 m	35,400 m
180° 300MP	600 m	1,170 m	1,760 m	7,048 m
180° 200MP	600 m	1,170 m	1,760 m	7,048 m
90° 100MP	600 m	1,170 m	1,760 m	7,048 m
20° 200MP	3,000 m	5,900 m	8,860 m	35,400 m
10° 100MP*	3,000 m	5,900 m	8,860 m	35,400 m

* Also with Thermal Panoramic extension.

Distance of the Excavator: 380 m.

Click to watch the video
Panoramic Camera - Industrial Port Surveillance.

SensorTec 180° 200MP Panoramic Camera - 85% of the full image.

UNBEATABLE
RESOLUTION

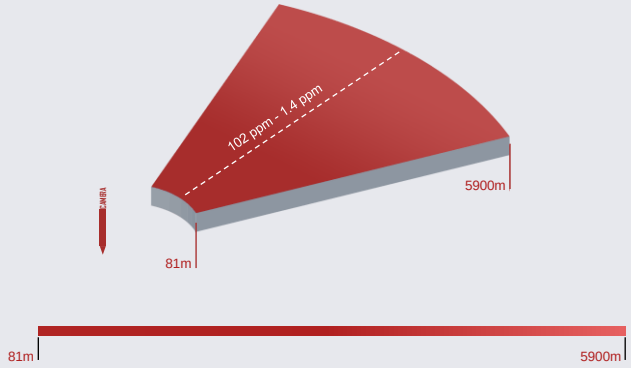
SensorTec provides panoramic cameras in different designs. All of them provide hundreds of megapixels and 20fps at full resolution to surveil vast areas from a single viewpoint with the highest resolution.

	THE CONCEPT OF SENSORTEC PANORAMIC CAMERAS		
PANORAMIC CAMERA	**EFFECTIVE COVERAGE AREA**	**PIXEL DENSITY**	**BLIND AREA**
40° 320MP Dual Vision	81 - 5900 m	102 - 1.4 ppm	0 - 81 m
40° 320MP	30 - 5900 m	486 - 12 ppm	0 - 30 m
180° 300MP	10 - 1170 m	583 - 12 ppm	0 - 10 m
180° 200MP	40 - 1170 m	365 - 12 ppm	0 - 40 m
90° 100MP	40 - 1170 m	365 - 12 ppm	0 - 40 m
20° 200MP	30 - 5900 m	486 - 12 ppm	0 - 30 m
10° 100MP*	30 - 5900 m	486 - 12 ppm	0 - 30 m

40° 320MP Dual Vision Panoramic Camera

Thermal Panoramic Extension

The thermal panoramic module, built inside the 320MP Dual Vision Panoramic Camera has an effective coverage area that is equal to the 320MP resolution visible-light module. A much lower resolution is sufficient for accurate automatic detection and classification during thermal surveillance.



SURVEILLANCE
IN THE LONG WAVELENGTH
IR ELECTROMAGNETIC RADIATION

WHAT DIFFERS OUR
PANORAMIC TECHNOLOGY

- SensorTec geometrically merges images at the image borders resulting in a contiguous panoramic image just as if it were taken by a single sensor camera.
- Synchronized imaging ensures that stitched panoramic images remains glitch free near the stitching borders too without object duplication or hidden object anomalies.
- SensorTec uses adaptable white balance and image tone correction algorithms to smooth gradient differences in the panoramic image.
- Thanks to the precise image synchronization and special stitching technology zooming and panning are seamless at the stitching borders as well.
- SensorTec delivers 20fps panoramic video streams with hundreds of megapixel resolution.
- SensorTec developed a special technology to handle large visual data and utilize the full resolution during monitoring.
- Intelligent Video Content Analysis (VCA) is performed on full resolution JPEG2000 image streams.
- SensorTec VCA is able to seamlessly track objects even if they move across stitching borders in the panoramic image.
- SensorTec Sensor Fusion technology makes it possible to fuse the data of image sensors, thermal imagers and external surveillance sensors, therefore realizing more accurate analyses and reliable computer vision.
- SensorTec provides automatic PTZ control, based on the tracking information of VCA algorithms that run on the stitched panoramic images.

Distance of Target: [2005418]: 1305m [2005419]: 1312m.

Distance of Target: [2005412]: 470m [2005417]: 1860m.

Click to watch the video
Border Surveillance - Automatic Target Detection at Dusk.

SensorTec 40° 320MP Panoramic Camera - 60% of the full image.

FINANCIAL **BENEFITS**

REDUCED INFRASTRUCTURE REQUIREMENTS
No need to install numerous poles or masts for individual cameras. The network infrastructure is far less complex and cabling is also fast and easy.

LONG LIFETIME
SensorTec technologies ensure the panoramic cameras are prevented from both physical and technological obsolescence for a long time.

UNINTERRUPTED OPERATION
SensorTec panoramic cameras are developed to operate with high MTBF.

DESIGNED TO LAST
SensorTec panoramic cameras can withstand intense weather conditions. They are full metal constructions with built-in heating and cooling systems, and they are also available made of marine grade materials.

NO NEED FOR FREQUENT MAINTENANCE
SensorTec panoramic cameras are capable of self-maintenance, thanks to their built-in self-cleaning and deicing systems.

LOW RUNNING COST, REMOTE MAINTENANCE
Beside standard maintenance, which is well-planned and organized for the panoramic cameras, SensorTec provides remote maintenance as well. The system constantly gives feedback on the condition of the cameras and other components. By exploring early warnings, failures can be prevented.

LESS MANPOWER
As vast areas can be monitored with much fewer cameras that provides far better spatial orientation for viewers and also VCA based Real-time Decision Making Support, far less operators are needed for efficient surveillance.

PIONEERING TECHNOLOGIES
TO PRODUCE HIGH-END QUALITY

MULTIPLE 1” SIZE CMOS SENSORS
Exceptional dynamic range, details in both dark and bright areas.

HIGH-QUALITY LENS
Sharp details in the image corners too, which further improve the quality of the stitched panoramic image.

CUSTOM-DESIGNED CHIPS
Full control over image processing, effective computing performance utilization.

EMBEDDED AI
High-performance environment for calculations and data processing on the full resolution raw video.

JPEG2000 IMAGE COMPRESSION
Dynamic resolution scalability for smart display of large panoramic videos.

HIGH-GRADE MATERIALS
Panoramic cameras are built to last. The metal housing with high quality glass windows and sunshields result in a massive, and reliable construction that can withstand extreme environments. Panoramic cameras are also available in marine grade materials.

ADVANCED THERMAL CONTROL
Panoramic cameras are equipped with a complex thermal control system to operate properly in intense temperatures, humid and dry conditions. Fans, heat pipes and glass heating make ensure that the inside temperature of the camera always remains within the operational value.

SELF-CLEANING SYSTEM
Panoramic cameras have a built-in water tank and wiper system. The high-quality rubber blades and the cleaning liquid ensure the wear-free cleaning of the windows. Even heavy dirt can be washed with this technique. The procedure can be scheduled and automatically started, so maintenance of the camera is easy, fast and effortless. The devices are able to send warnings if their water tank needs to be refilled, which is a one-man action, thanks to the smartly designed water pump system.

DE-ICING SYSTEM
In some environments the extreme cold may cause operational difficulties for video surveillance systems, but not for our panoramic cameras. Remote-controlled glass heating and zone-divided, contact-based house heating ensure to melt down ice, frost or accumulated snow from the surface of the device.

CROSS-MAPPED

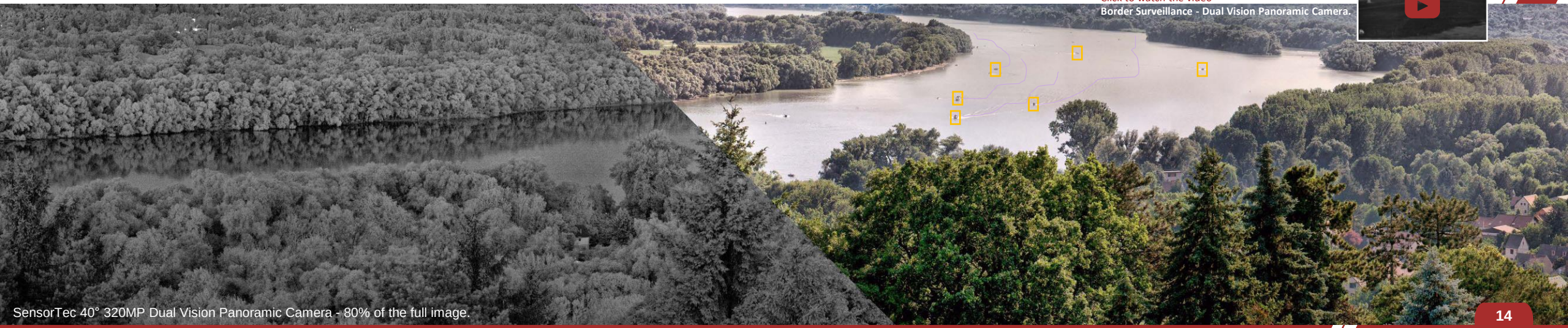
VISIBLE LIGHT AND THERMAL IMAGING

SensorTec Dual Vision Panoramic Camera takes images utilizing both the visible-light and the long wavelength IR electromagnetic radiation. The 320MP visible-light module is completed with a 6.6MP thermal panoramic extension. The thermal camera is designed to see the very same area that the visible-light module does. Covering this broad range of ER spectrum the camera can be used in all visibility conditions, including zero-lighting scenarios and thick foggy and hazy weather conditions.

The images of the two panoramic modules are cross-mapped. Each pixel of the thermal sensor is assigned to a group of pixels of the visible-light sensor. Therefore, these two types of sensors complete and strengthen each other, forming the most powerful camera for wide area surveillance. The AI-based VCA algorithms, which processes the image contents run on both types of images simultaneously. The outcomes of the analysis can be visualized on either images, no matter which one was the source of the detection.

120° 960MP
Dual Vision Panoramic Camera

Click to watch the video
Border Surveillance - Dual Vision Panoramic Camera.



SensorTec 40° 320MP Dual Vision Panoramic Camera - 80% of the full image.

EMBEDDED **INTELLIGENCE**

Having an extremely high-resolution video of a vast area is just the first step in making video surveillance more effective. We realized the potential in computer vision technologies, wherewith we were able to upgrade the security and video surveillance in many industries.

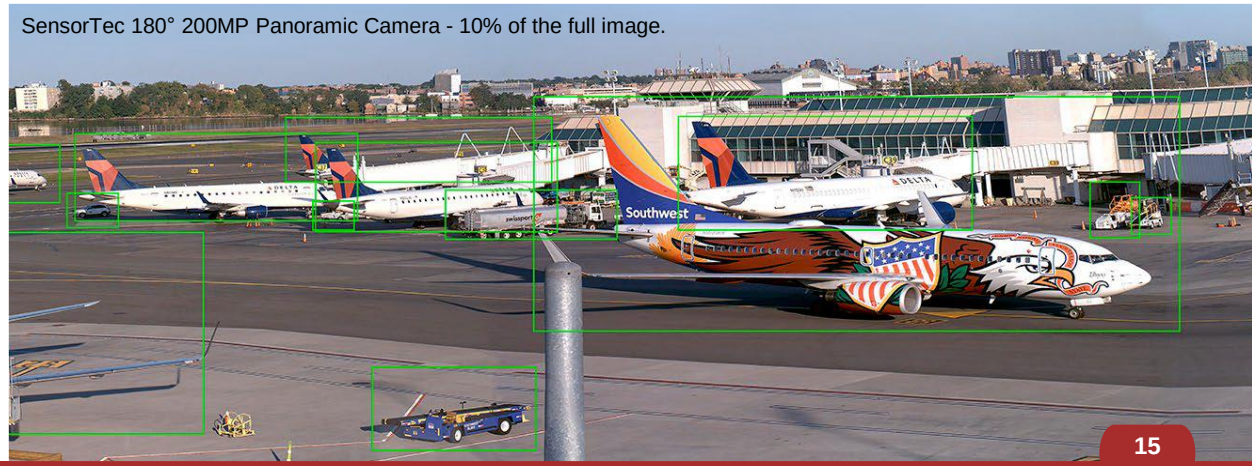
We developed embedded Video Content Analysis algorithms considering the specific tasks of different application areas. As the video content is analyzed as close to the image sensor as possible, resolution reduction or software-based visual enhancement algorithms do not disturb the calculations. High-resolution panoramic images and accurate VCA together create a powerful combination that provides reliable automatism in video technology.

	AIRPORT	BORDER	CRITICAL INFRASTRUCTURE	SAFE & SMART CITY
Object Detection	+	+	+	+
Object / Target Tracking	+	+	+	+
Object Classification	+	+	+	+
Geofencing	+	+	+	+
Virtual Fence	+	+	+	+
Collision Prediction	+	Not relevant	+	Not relevant
Proximity Alert	+	Not relevant	+	Not relevant
FOD Detection	+	Not relevant	+	Not relevant
Local Traffic Enforcement	+	Not relevant	+	Not relevant
Object History	+	+	+	+

OBJECT **HISTORY**

The specially developed VCA and advanced server applications make it possible to manage video history differently compared to conventional solutions. Our system allows for object based archive search. Operators can search for different types of objects, objects with registered IDs, status changes of objects, or objects that were staying in specific areas in specific time intervals. This method greatly facilitates search procedures, specially in areas where hundreds or even thousands of objects are moving 24/7.

SensorTec 180° 200MP Panoramic Camera - 10% of the full image.



SENSOR **FUSION**

SensorTec created a special technology wherewith the information of the sensors and external sensors can be fused. Sensor Fusion results in a more accurate analysis as algorithms can rely on a broader spectrum of reality. The extreme high-resolution visible-light and thermal image data can be augmented by radar data and other surveillance sensor data from sources, like seismic detectors or fiber optic sensors.

Thermal sensors are able to deliver useful visual information even when visible-light and short wavelength IR electromagnetic radiations are less informative. Surveillance radars see behind dense vegetation and can be also useful in pitch darkness. SensorTec analyzes the data of several sensors together for accurate detection, classification, geo-positioning and speed measurement. It is able to visualize layered images together and always highlight the most relevant objects with regard to the current monitoring task.

IMAGE **COMPRESSION**

Utilizing the full resolution of large panoramic images during live monitoring or archive playback is not a straightforward task. If we would transmit full panoramic images constantly, it would take an unmanageable load on the network infrastructure. Otherwise, as our panoramic cameras use the JPEG2000 image compression we were able to overcome this issue.

Utilizing the resolution scalability of this compression standard, the Video Management Software displays only the relevant pixels in the monitoring room. The resolution of the transmitted images always adapt to the screen resolution. This way full panoramic overviews are transmitted in lower resolution, but when users zoom in, the system sends the cropped image in higher resolution. The transmitted image resolution increases with the zoom value.

Operators can use multiple zoom windows on a single panoramic image. They can perform monitoring tasks just as if they were using multiple PTZ cameras, but at the same time they also get a large overview. Working with this technique, operators have better spatial awareness in the whole monitored area and they are able to surveil and understand situations in a more complete context.

Click to watch the video
City Surveillance in Crowds - Panoramic Camera.

SensorTec 40° 320MP Panoramic Camera - 25% of the full image.

ZOOM **FUNCTIONS**

Panoramic and PTZ Cameras Cross Mapping: This specially developed function allows the panoramic and PTZ cameras to be assigned by registering common spatial points that are visible to both cameras. The function allows for automatic PTZ control based on VCA algorithms that analyze the images of the panoramic camera.

ePTZ: ePTZ is an automatic zoom function wherewith operators get detailed visual information on situations in no time. In case the VCA or any configured external source triggers an alarm, a close-up appears immediately of the detected object in an individual zoom window. The system tracks the motion of the source object automatically. Both the panoramic camera itself and an assigned PTZ camera can deliver the tracking zoom image of the detected object.

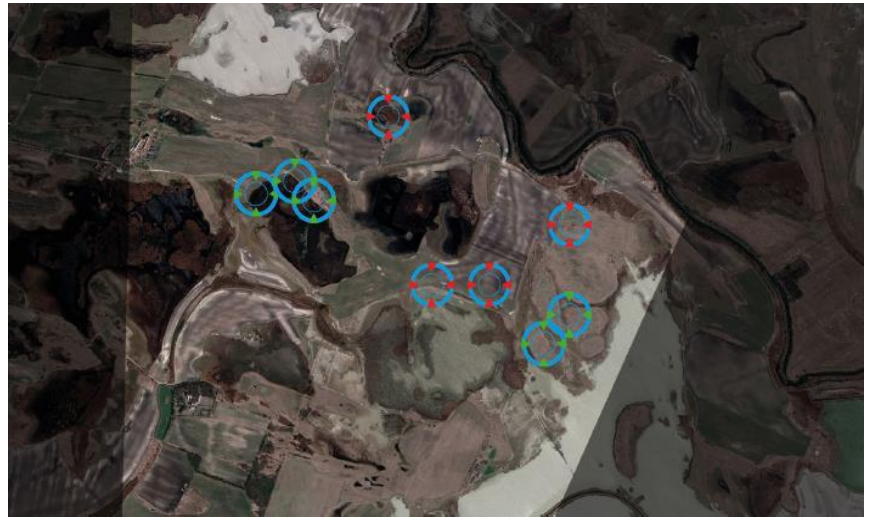
Zoom Tour: Several predefined zoom positions can be assigned to the panoramic view. Operators can step these presets and navigate the zoom position within the panoramic image and they can even step between several panoramic cameras. This way the entire covered area can be inspected easily. Automatic tours can be configured from these presets that scan through the desired area in a specified sequence.

Distance of the Boat: 1500m.

Distance of the License Plate: 35m.

INTERACTIVE **MAP**

SensorTec allows to associate interactive maps with the panoramic image. The map shows the objects that are visible in the panoramic view as real-time moving, color-coded icons. This way operators can monitor situations in a more extensive context and they can easily select objects to display close-ups of them in automatically tracking zoom windows.

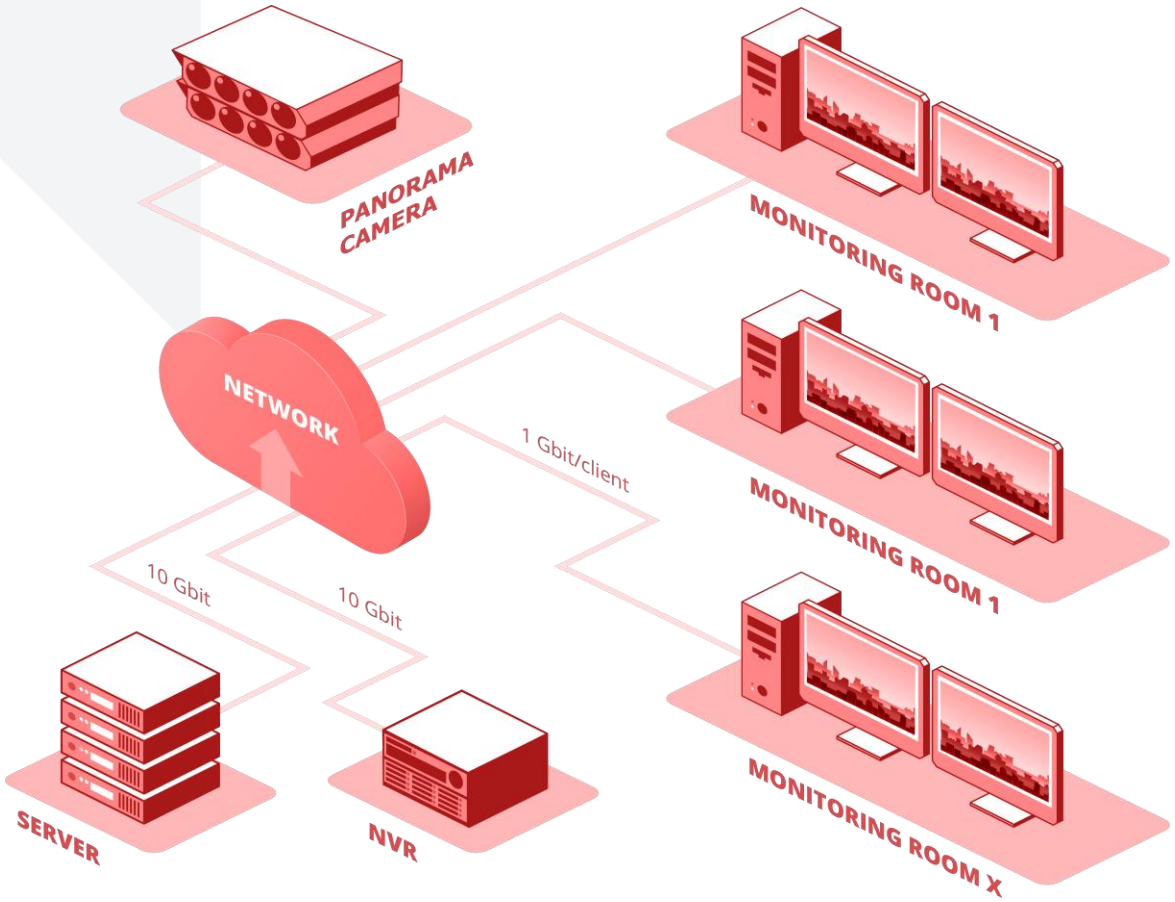


Click to watch the video
Airports Surveillance - PTZ Cross-Mapping.

SensorTec 180° 200MP Panoramic Camera - 75% of the full image.

MULTI-USER **ACCESS**

Multiple users can access the SensorTec panoramic cameras at the very same time. This allows synchronous work for operators in the same monitoring room or even simultaneous operation of different monitoring rooms, which are set up for different monitoring purposes.



ADVANCED **RECORDING**

Different models of the 4th generation SensorTec Network Video Recorders are specifically designed to handle the huge amount of data that the panoramic cameras produce. SensorTec NVRs have up to 256TB storage capacity and can be customized to individual needs. Some models of the 4th generation design can be further expanded with our specially-developed external storage units, reaching a total of 768TB capacity. SensorTec always considers the specific surveillance task and designs the most suitable storage system and storage management that helps keep costs at bay.

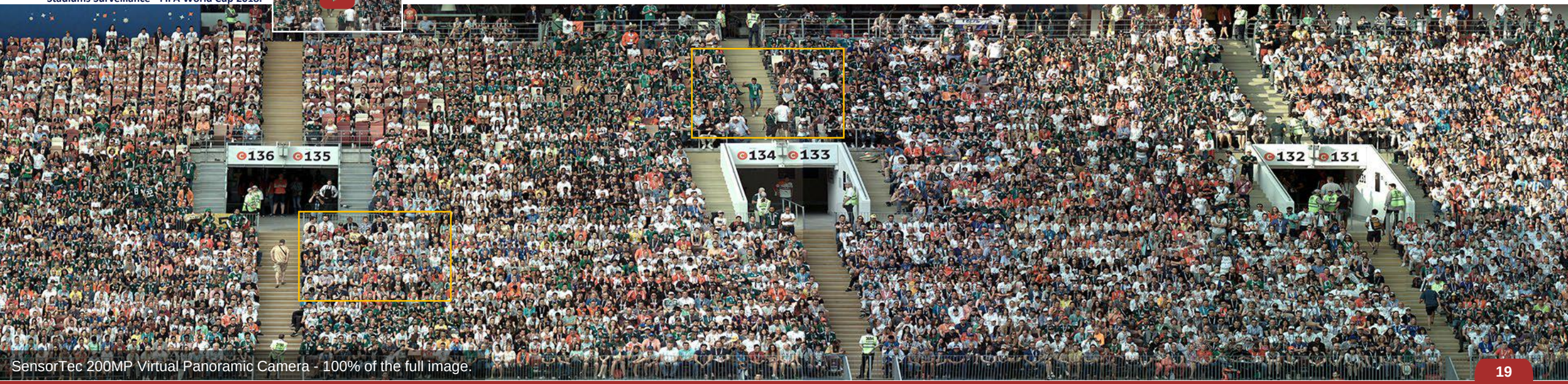
4th Generation SensorTec Network Video Recorder.

THE VIRTUAL PANORAMIC CAMERA

SensorTec recognized there are certain areas that can be covered more effectively if the number and also the position of the cameras can be freely customized. As our panoramic technology allows to stitch the images of individual SensorTec cameras, we created the Virtual Panoramic Camera.

The solution is based on several individual 20MP SensorTec camera images that are stitched together to create expanded panoramic views with resolutions up to hundreds of megapixels. There are neither hidden nor redundant areas in the stitched images. As the devices are installed individually, the structure of the camera system is easily tailored to newly emerging needs.

Click to watch the video
Stadiums Surveillance - FIFA World Cup 2018.

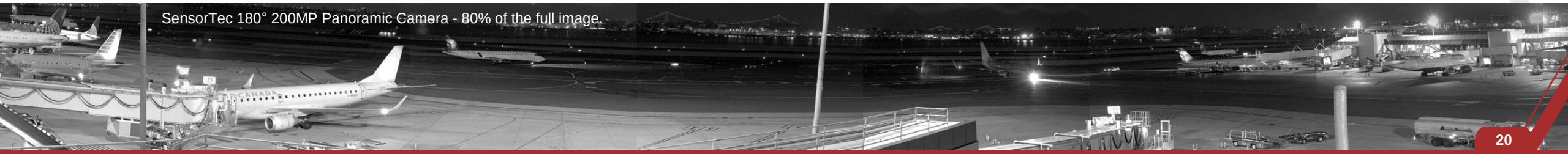


SensorTec 200MP Virtual Panoramic Camera - 100% of the full image.

STRENGTHS OF OUR
PANORAMIC CAMERAS

- Our specially-developed stitching technology provides a seamless panoramic view without object duplication or hidden objects and disturbing color gradient differences at image borders.
- Dual Vision Panoramic Cameras provide a thermal imaging module that covers the exact same area that the visible-light module does. The images of the two modules are cross-mapped pixels-by-pixels. Together, they ensure a broader range of spectrum for more effective surveillance.
- SensorTec panoramic cameras provide large panoramic images with a resolution high enough for face recognition and also for automatic detection of humans even from kilometers away.
- SensorTec uses the scalable JPEG2000 image compression standard, which makes it possible to utilize the full resolution of the panoramic cameras during monitoring.
- Panoramic images ensure better spatial awareness for operators within the monitored area, as the space is not split by individual cameras on a confusing monitor profile.
- Operators can use multiple zoom windows for the panoramic camera just as if they were using several PTZ cameras simultaneously. They can utilize the benefits of hundreds of megapixels during live monitoring and archive playback.
- Combining high-end panoramic technology with computer vision algorithms enables the effective video surveillance and accurate analyses of even compound situations within an immense area.
- SensorTec panoramic cameras and VCA makes it possible to accurately track hundreds of objects at the same time.
- Maintenance procedures are easy and cost-effective as less resources are needed.

Click to watch the video
Airports Surveillance - Night Vision.



SensorTec 180° 200MP Panoramic Camera - 80% of the full image.

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