



KONGSBERG



360° CAMERA SYSTEMS

KONGSBERG 360° Camera Systems

Advanced Optical Situational Awareness for Remote and Virtual Towers

The KONGSBERG 360° Camera System provides advanced optical capabilities to detect, recognize, and identify targets of interest within the Area of Responsibility (AoR) of Air Traffic Controllers (ATCOs).

Specifically designed for remote and virtual tower operations, the system provides a superior Out-The-Window (OTW) view, reproducing the visual experience of a conventional control tower as closely as possible. It combines high visual acuity, excellent light sensitivity, accurate colour reproduction, and realistic scale and orientation to deliver comprehensive situational awareness.

The system is designed to optimise data bandwidth between the aerodrome and the remote control centre without compromising visual acuity. Its modular architecture also facilitates maintenance and servicing, minimising downtime.

The KONGSBERG 360° Camera System portfolio

comprises two complementary solutions:

Legacy 360° Camera System: An established, purpose-designed solution based on rotating camera technology, delivering a continuous panoramic view without image stitching.

Stitched 360° Camera Solution: An additional solution based on commercially available off-the-shelf (COTS) technology, combining multiple camera views to create a seamless 360° panoramic image, at 25 FPS.

Both solutions expand the options available to customers seeking high-performance optical capabilities for remote and virtual tower operations, with the flexibility to meet different operational and system requirements.

Key Capabilities

360° panoramic coverage: Comprehensive visual coverage of the designated Area of Responsibility.

High visual acuity: Visual resolution equivalent to human 20/20 vision in the legacy system.

Day and night operation: Integrated visible-light and infrared capabilities in the legacy system support situational awareness across a wide range of lighting conditions.

Seamless panoramic presentation: Continuous panoramic imagery without stitching in the legacy system and a stitched panoramic presentation in the additional COTS-based solution.

All-weather operation: Environmental protection features support reliable performance in demanding outdoor conditions.

Optimised data transmission: Efficient transmission of visual information between the aerodrome and the remote control centre.

Modular architecture: Supports efficient maintenance, servicing, and replacement.

Flexible product portfolio: Two complementary camera architectures provide additional options for customer requirements and system integration.

Legacy 360° Camera System

Functional Description

The legacy KONGSBERG 360° Camera Module is based on a rotating platform incorporating two line-scan cameras:

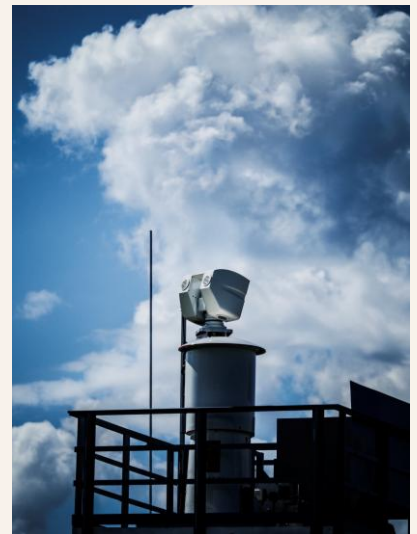
VIS 360°: A visible-light camera.

IR 360°: A long-wave infrared (LWIR) camera.

Both cameras use Time-Delayed Integration (TDI) technology to improve light sensitivity. The platform rotates at 5 FPS, providing five high-resolution 360° images per second.

The captured imagery is projected onto a native cylindrical format, providing a natural panoramic presentation for the operator compared with a collection of images from static cameras.

When presented on a curved video wall, the cylindrical projection delivers a continuous and uniform image across the horizontal plane.



The presentation maintains the angular relationships between objects, providing realistic spatial perception comparable to the view from a conventional control tower. The system incorporates a digital sunshade function that improves visibility around the sun, maintaining operator awareness under changing illumination conditions and in direct sunlight.

The 5 FPS image update rate, presented on 60 Hz flicker-free displays, highlights moving objects such as aircraft, vehicles, and animals. Combined with the associated display solution, the system provides situational awareness comparable to a conventional Out-The-Window view.

The relatively low transmission bandwidth is another key advantage for remote tower operations, enabling high-resolution panoramic imagery to be transmitted between the aerodrome and the control centre.

The system's Detection, Recognition, and Identification (DRI) range performance has been verified through field testing in accordance with STANAG 4347 and STANAG 4349.

Weather Protection

The legacy 360° Camera Module incorporates features to maintain visibility in adverse weather conditions.

All camera windows are equipped with wipers. Heated windows improve wiper effectiveness and prevent problems associated with ice and snow. The rotation of the camera platform further helps prevent rain, snow, salt, sand, and other debris from accumulating on the windows.

These features support reliable operation in demanding outdoor environments.

Infrared Capability

The legacy system incorporates a high-performance, cryogenically cooled thermal camera with excellent sensitivity and pixel resolution matching that of the visible-light camera.

The thermal camera has a vertical field of view of 17° and can be controlled by the operator to move upwards and downwards, covering the corresponding field of view of the visible-light camera.

The infrared capability provides enhanced situational awareness during night-time and low-light conditions, enabling operators to detect people, animals, birds, vehicles, and other objects on or near the runway.

Compared with uncooled infrared alternatives, the cooled IR system provides superior performance in demanding weather and low-light conditions.

The thermal camera delivers excellent DRI range performance during both daytime and night-time operations, contributing to enhanced situational awareness.

The infrared capability is also a key enabler for Air Navigation Service Providers (ANSPs) implementing Remote Aerodrome Meteorological Observation System (RAMOS) procedures.

Stitched 360° Camera Solution

Functional Description

The stitched 360° Camera Solution expands the KONGSBERG optical sensor portfolio with an alternative approach to providing comprehensive panoramic imagery for remote and virtual tower operations, providing a 25 FPS imagery. Based on commercially available off-the-shelf (COTS) technology, the solution combines images from multiple camera views to create a seamless 360° panoramic presentation.

Unlike the legacy system's rotating platform and line-scan camera architecture, the stitched solution uses a multi-camera configuration with image stitching to deliver panoramic coverage.

This alternative architecture expands the available options for system configuration and integration, enabling KONGSBERG to address a broader range of customer requirements.

The stitched 360° solution provides panoramic visual coverage within the remote tower environment, supporting the operator's need for comprehensive situational awareness.

Its COTS-based architecture offers an additional approach to delivering 360° imagery alongside the established legacy system.

The solution complements the legacy 360° Camera System, providing customers with greater flexibility when selecting an optical sensor configuration based on operational requirements, system architecture, integration needs, and overall system economics.

The legacy and stitched 360° Camera Systems are complementary products within the KONGSBERG optical sensor portfolio.

