

INTELLIGENT VIDEO: A Catalyst to Remote Aerodrome Control Services

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Introduction

The past few years have seen the introduction of several new surveillance technologies, some of these are cooperative such as ADS-B and Multilateration (MLAT) while others provide surveillance data of targets with or without transponders, such as radar and intelligent video. During this time, there has also been a massive increase in the range and capability of video/optical technology with a corresponding decrease in the cost of video-related components. Separately, these technologies can provide air traffic controllers in a tower a useful tool for improving situational awareness. However, the combined input of a cooperative system, along with an intelligent video type system provides a base level of surveillance technology and can meet or, in some cases, exceed the level of situational awareness that a physical control tower can provide.

Remote Aerodrome Control Services (RACS)

The ability to provide site-independent Air Traffic Control (ATC) services at an airport is currently a goal shared worldwide by many Airport Navigation Service Providers (ANSPs). NextGen for the FAA and SESAR for Europe have been postulating these as operational goals for implementation by 2020. RACS can be defined in many ways. Simply, RACS involves the provision of an air traffic control service, or an air traffic control 'like' service independent of controller (or other service provider) location. The benefits are significant: reduced capital expenditure requirements on new towers, greater staffing flexibil-

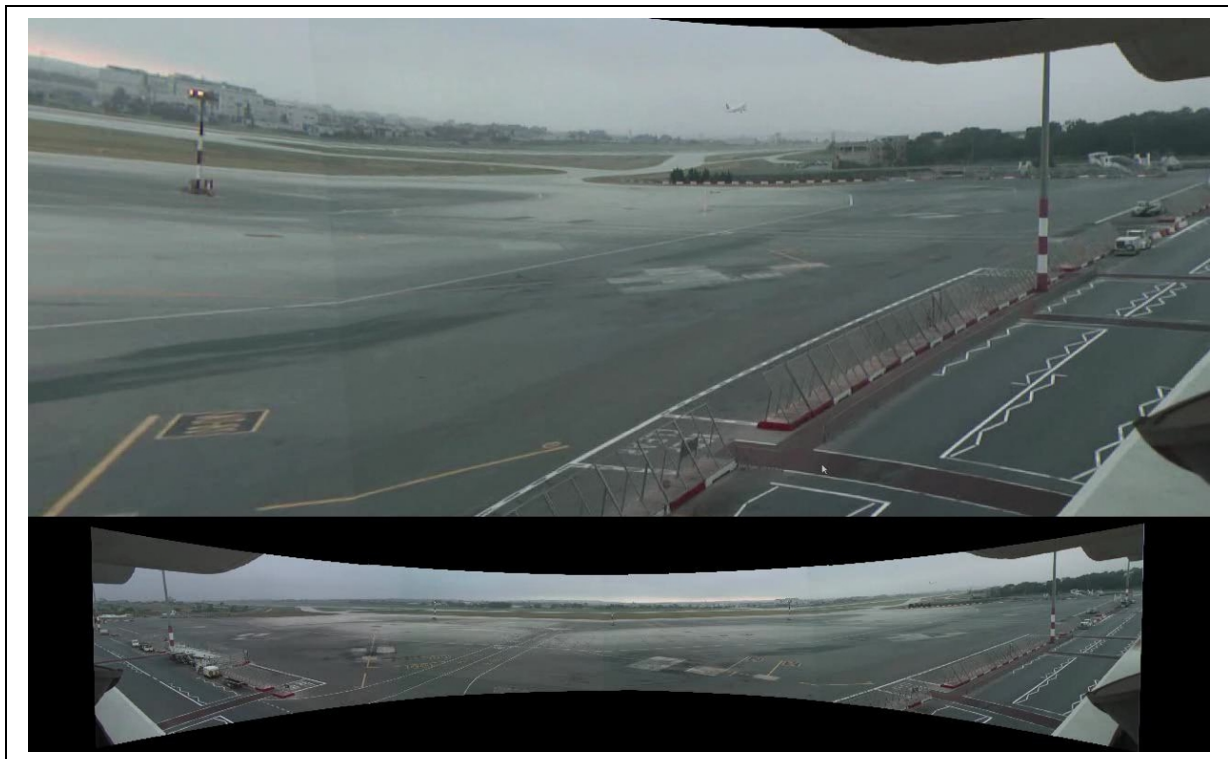


Figure 1 - Advanced video surveillance applied to remote apron control service - multiple camera 'stitched' view.

ity for existing towers, planning and growth flexibility at larger airports, enhanced safety/capacity where RACS can be deployed at airports that would otherwise not qualify for full ATC services. Any one of these benefits might be enough to justify the investment necessary to deploy and certify a RACS service.

Since adoption is one of the largest challenges, the primary driver in deploying RACS must be providing added capability to the controller, and ultimately an increased level of service to the aviation community. In addition to this, the service level requirements must also drive the deployment. Other than the potential cost savings, potential benefits relating to the service level requirements include:

- providing an air traffic service where the alternative may be reduced, or no service due to low traffic, or geographical remoteness
- allow for airport expansion thus providing increased service levels without the need for costly tower construction
- maintaining service levels regardless of fluctuations in traffic volumes or human resource shortages.

Challenges

There are numerous challenges that an ANSP must overcome in order to successfully deploy and operate RACS, including: developing operational concepts, procedural and system requirements, controller adoption and human-machine-interface constraints, and regulatory certification.

These challenges are significant, however using a model that leverages a required investment may be the best path towards creating adoption and ensuring concepts being developed meet operational requirements and goals. In other words, building a concept of operation (ConOps) based on already available data from an existing source will mitigate some of the challenges. Traditional surveillance systems may not allow for such a model; however the unique data attributes of intelligent video can be leveraged. Track information from intelligent video includes many of the same attributes as radar data, but also provides unique attributes such as target shape and heading, video streams, high update rates, and increased accuracy. Therefore, intelligent video can be applied to today's surveillance needs, but can also be leveraged to provide the necessary tools for RACS deployment.

Intelligent Video as a Catalyst to RACS

Intelligent video has been applied to many problems through out many industries. While security is the most widely used application, advanced intelligent video platforms have been gaining widespread adoption amongst the worlds top ANSPs. A contributing factor to this has been the ability to provide situational awareness using intelligent video, in a modular fashion. In other words, being able to provide localized surveillance allows an airport/ ANSP to provide situational awareness of only those areas that require it, either due to operational reasons or meeting a particular business case. As the requirement for situational awareness increases, the localized system can scale to provide the necessary coverage. It is this localized surveillance, coupled with providing the operator both track outputs from the intelligent video platform, along with visual line of sight surveillance using the video component, that allows an ANSP to progress its' adoption of RACS.

Traditional surveillance technologies such as radar and MLAT provide adequate situational awareness to co-located controllers. However, in situations where the controller is providing a service remotely, or independent of the site, additional information must be provided, such as video. Simply replicating the tower environment and sending the video from the site to the controller location is not a suitable approach. Many issues exist ranging from infrastructure cost, to controller adoption to communication requirements. The controller must be provided with increased capabilities to help them perform their tasks. These increased capabilities can be provided by extracting the unique attributes of the intelligent video data and presenting them to the controller or operator in a manner most conducive to supporting their operation.

The intelligent video platform must also be flexible enough to be applied to any operation. Being flexible allows the ANSP or airport to use the data for various needs today such as surface surveillance, runway incursion prevention and apron management, and also build upon this to progress towards RACS. This building-block approach will provide the necessary information to achieve the ultimate goal of an operational RACS.



Figure 2: Intelligent Video deployment for FAA Staffed Next Gen Towers Initiative

Building-Block Approach

Attempting to address all of the earlier-mentioned challenges as part of a single program carries significant risk with a potential all or nothing reward. While there is a significant financial risk, the main risk revolves around adoption of RACS in the relative short-term. In an industry where safety is paramount, providing new and innovative approaches must be coupled with sufficient analysis and feasibility testing.

In overcoming these challenges, adopting an evolutionary, building-block approach may be the best solution. This approach involves identifying a roadmap where the end goal is a full RACS operation, but with several intermediate objectives. Each objective would necessarily provide immediate benefit to the airport/ANSP, and would move baseline RACS capability closer to operation.

Consider for example some of the limitations of the physical tower: construction of new runways that require visual surveillance of greater distance

Particularly in low visibility conditions, line-of-sight limitations created by obstacles, visual phenomena such as the loss of contrast with white aircraft against snow embankments. Each of these can be overcome with a combination of electronic and video surveillance.

A building block approach to RACS relies on addressing existing physical tower limitations and providing immediate benefit, while laying a technological, procedural and regulatory foundation for a RACS.

Table 1: Building-blocks to full RACS

BLOCK	BENEFIT	RACS IMPACT
Phase I: Add ATC grade video to tower	Provide controllers with modular system for blind spot / line of sight coverage	Confidence in system to demonstrate camera/video capability - use data for ConOps.
Phase II: Intelligent Video providing full surface management	Provide airport/ ANSP with non-cooperative surveillance capability, meeting today's surveillance needs - gain controller buy-in and regulatory approval	Once operational, leverage data to develop requirements and determine interoperability needs on real data
Phase III: Integrate video systems with cooperative sensors	Intelligent video tracking data can provide gap fill to A-SMGCS	Interoperability requirements can be developed and tested for RACS operation
Phase IV: Fully integrated surveillance & tower automation system	Intelligent video tracking data enables tower automation features	Tower system including surveillance data can be remotored to a site for controller testing/ review and HMI development – ultimately resulting in a full RACS operation

Figure 3 – Early adoption through sample Phased approach.

Adoption

While the building-block approach is designed to leverage an investment, and will help in building a business case for at least analyzing the benefits of RACS, it remains a challenge to gain acceptance on many levels. From this point of view, it is worthwhile to mention operations today, which relate to RACS. These operations include: contingency operations; airport



operations centers; runway blind-spots; and use of surveillance data for line-of-sight requirements.

In all of these operations, some at the world's largest and busiest airports, operations are conducted without having full line-of-sight visibility of the airport surface. As an example, Malta ANS is currently using intelligent video to provide full situational awareness to its apron management unit allowing them to safely and expeditiously manage traffic throughout the apron area. This intelligent video system includes the full suite of safety features allowing the ANSP to use the system in an operational setting. In addition to this, Intelligent Video has been commissioned at Edmonton International Airport in Canada where the air traffic controllers will begin using the Intelligent Video data to provide them coverage of a gap area on the maneuvering area. This system was deployed in collaboration with MMM Group, Edmonton International Airport and NAV CANADA, and has met all necessary safety requirements required for use in the ATC tower.

Deutsche Flugsicherung (DFS), the German ANSP, decided not to build a new tower at Munich Airport, as they have done for Frankfurt and Berlin Airport expansions. Munich Airport plans to construct a new third runway at a distance of 4-5 km from current tower building. DFS intends to use RACS capability and operate in the form of a distant tower with a completely new ATC procedure called "instrumental control". Controllers in a RACS environment have the capability to control by visual rules using Intelligent Video as well as by instrumental rules using integrated Intelligent Video system with cooperative sensors.

Providing the right type of data and presenting it in the right way allows for these types of operations to occur. Simply replicating the tower environment is not sufficient and will not provide the tools necessary to address the sensitivities of adoption. Industry wide, innovation must provide additional capability to produce an operation above and beyond what is available in the tower environment today. Providing an increased level of service at a lower cost is achievable, however acceptance and insistence of innovative approaches are required.

Conclusion

RACS can be deployed in the short-term. While significant challenges remain, the business case is strong enough to support the rapid adoption of RACS. As an independent program, the cost benefit may not be positive, but through leveraging the unique attributes of intelligent video through a building-block approach, an ANSP can at least justify a review of the possible implication of RACS in its' own operation.

About Searidge Technologies (www.searidgetech.com)

Searidge Technologies provides intelligent video solutions to Air Navigation Service Providers and airports to help them cost effectively increase safety and efficiency of surface management operations. The company's intelligent video platform IntelliDAR(TM) is a robust Non-Cooperative Surface Surveillance (NCSS) system and the first operational system of its kind in an air traffic control tower to provide detection, positioning, and tracking of all targets on an airport surface. Searidge is helping its customers with ATC-grade video, gap filling/ A-SMGCS augmentation, apron management, and remote tower capabilities.

Working with industry leaders such as DFS, EUROCONTROL, FAA, and NAV CANADA, Searidge solutions are installed in sites throughout Europe, Middle East and North America. Founded in 2001, Searidge is a privately held company based in Canada's Capital region.