

# AFRL

## SKYVISION: ENABLING BEYOND VISUAL LINE OF SIGHT FLIGHT BY UNMANNED AERIAL SYSTEMS

### Overview

The Air Force Research Laboratory (AFRL) has partnered with the State of Ohio Department of Transportation (ODOT) through its DriveOhio/Ohio Unmanned Aerial Systems Group to field and operate a Ground-Based Detect and Avoid (GBDAA) system at Springfield-Beckley Municipal Airport (KSGH). This system, known as **SkyVision**, will be used to meet R&D requirements for unmanned air vehicles (UAS) operating under Beyond Visual Line of Sight (BVLOS) control in the National Airspace System (NAS).

### Background

The **SkyVision** system enables UAS operations to meet the Federal Aviation Regulation (FAR) 91-113(b) to “see and avoid” other aircraft and other flight path obstacles while being remotely operated by the pilot in command (PIC). While the “see and avoid” requirement exists for both manned and unmanned aircraft, it becomes challenging when it is desired to fly UAS in the beyond visual line of sight (BVLOS) mode. Currently, most BVLOS operations employ visual observers (VO) placed under the flight path of the UAS or chase aircraft with some form of communications connectivity back to the PIC that enable the “see and avoid” requirement to be met. Such measures are logistically difficult and expensive making them impractical for many UAS flight activities.

The **SkyVision** design is based upon the Federal Aviation Administration’s (FAA) STARS ELITE system to fuse Air Traffic Control (ATC) data with UAS flight information to provide operators the situational awareness they need to avoid collisions while airborne. AFRL turned to the Air Force Life Cycle Management Center (AFLCMC) to manage the acquisition program that developed and procured **SkyVision** for AFRL and Ohio use. AFLCMC in turn partnered with MITRE (a federally-funded research and development center) and the Volpe Center (an

### SkyVision: Ground-Based Detect and Avoid

- *What is the impact for AFRL?* It enables the Lab to develop and field innovative UAS solutions to warfighter requirements faster and more cost-effectively.
- *What is the impact for Ohio?* It provides an unparalleled ability to conduct BVLOS flights in the National Airspace System making the state attractive for government and commercial entities to develop and demonstrate advanced UAS technologies.
- *What is the impact for the Nation?* It helps keep the United States at the forefront of efforts to safely and efficiently integrate UAS operations with those of manned flight.

agency under the Federal Department of Transportation) who contracted with Raytheon to acquire and field the **SkyVision** system. Program cost was equally shared by AFRL and ODOT for a total of \$5M.

### Description

**SkyVision** is fielded at Springfield-Beckley Municipal Airport (KSGH) where provision is made for the system to have connectivity with the FAA’s ATC network. Specifically, real-time data is provided from three local radars (the ASR-9 at Dayton International Airport, the ASR-9 at Columbus International Airport, and the CARSAR long-range radar at London) whose overlapping coverage provides high probability of detection ( $P_d$ ) of manned aircraft flying in the unrestricted airspace in the vicinity of and to the south of KSGH. This data includes both radar reflections and transponder emissions from aircraft so-equipped. Excellent  $P_d$  is maintained from high altitudes down to 500

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feet above ground level (AGL) affording a large airspace volume for BVLOS operations by UAS. Installation at KSGH also provides close proximity to AFRL at Wright-Patterson Air Force Base and ODOT's UAS Center in Springfield.

In addition to providing the ability to conduct BVLOS operations in unrestricted areas of the National Airspace System (NAS), a unique feature of **SkyVision** is its placement on a mobile platform.



This the first time that a STARS system has been modified and integrated into a vehicle which creates exciting possibilities for future applications. If combined with a transportable sensor (such as a radar on a telescoping mast), then a fully mobile **SkyVision** system could perform new missions such as drone support to:

- Emergency personnel responding to man-made and natural disasters
- Security forces monitoring sites where large crowds have gathered (such as sporting or political events)
- Provide overwatch of military convoys or forward operating base perimeter defenses

Alternately, a mobile **SkyVision** platform could serve as a gap-filler ATC node if an existing one is lost or damaged thereby allowing manned air operations to continue until repair or replacement is made.

## Operations

On 3 April 2019 the FAA issued Certificate of Waiver or Authorization (COA) 2019-CSA-3326 allowing AFRL to operate the **SkyVision** GBDAA system and conduct UAS BVLOS flights from KSGH. This COA provides for visual line of sight operations for launch and recovery of UAS from KSGH and BVLOS flights in an airspace volume extending from 1,000 feet AGL to 10,000 feet Mean Sea Level (MSL) and over 200 square miles of Ohio countryside. No restrictions exist on the type of UAS that can be flown. The COA is predicated on the exercise of AFRL's disciplined flight test review and approval process which involves airworthiness assessment, independent technical and safety reviews, validation of operator qualifications, risk assumption by appropriate authorities in the chain of command, and continuing oversight by a Flight Operations Authority (FOA). The COA affords AFRL the ability to conduct BVLOS UAS operations for activities with military relevance. Possession and operation of the **SkyVision** system platform will transfer to the Ohio UAS Center who will also administer its scheduling and user fee structure.

Going forward, AFRL will work with its ODOT partners to assist them in establishing mechanisms to facilitate civil and commercial use of **SkyVision** for non-military UAS customers. Such use will enable the ODOT-AFRL partnership to reach its full potential in advancing UAS technologies and fully integrating UAS into the NAS.

*"This is a critical milestone in the progression of unmanned aircraft operations and technologies. This waiver provides the latitude to test longer range UAS without the limitations of a visual observer. AFRL remains on the leading edge of world-class research, and with our Ohio collaborators, accelerates the delivery of ground-breaking technology that simultaneously enhances both the warfighter and our nation's industrial base."*

*- Maj Gen William Cooley,  
AFRL Commander*