

UAS for First Responders in Complex Urban Environments Assessment QuickLook

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UNMANNED AIRCRAFT SYSTEMS FOR FIRST RESPONDERS

Over the past decade, first responders have integrated small, unmanned aircraft systems (UAS) as a resource for their operational needs. UAS provide first responders with an aerial view of their environment and can be outfitted with various sensors tailored to address different applications. UAS, often referred to as drones, are used by first responders in support of public safety activities such as search and rescue, firefighting, and post-incident reconstruction or recovery. This equipment falls under the Authorized Equipment List (AEL) reference number 030E-07-SUAS titled “System, Small Unmanned Aircraft.”

Assessment Overview

In July 2025, the National Urban Security Technology Laboratory’s (NUSTL) System Assessment and Validation for Emergency Responders (SAVER®) program conducted an assessment of UAS for first responder use in a complex urban environment. The assessment was conducted in New York City, with support from the Fire Department of the City of New York (FDNY) and the New York City Police Department. This effort included comparative evaluations of select “Blue UAS” systems that have undergone cybersecurity testing by the Department of Defense, alongside platforms from covered nations. Platforms on the “Blue List” are cyber-secure and compliant with Section 848 of the National Defense Authorization Act (NDAA) for Fiscal Year 2020, which prohibits the use of UAS or related services or equipment from certain foreign entities. Response agencies still rely on UAS from covered nations to achieve their mission of ensuring public safety based on reliability and overall performance.

UAS used by state and local first responders may be espionage targets due to their presence in areas where UAS are not otherwise permitted to fly, such as critical infrastructure and mass gatherings. While “Blue List” drones are deemed cybersecure and NDAA compliant, the Blue designation does not address whether they can perform the functions needed for public safety. Therefore, a key objective of the assessment was evaluating the effectiveness of the selected Blue List drones for said missions. SAVER examined the operator experience of the tested drones noted below but did not evaluate or determine risk to national security based on relevant [statute\(s\)](#).

Assessment activities and evaluation criteria were based on recommendations from a [focus group](#) of responders with UAS expertise. Nine remote pilots – subject matter experts on UAS response operations from Connecticut, Florida, New York, and Texas – assessed the UAS in operational scenarios in both full and low light conditions. This included preparing drones for deployment, flying them to collect information, changing batteries, and redeploying. Within the SAVER categories of capability, deployability, and usability, the evaluators assessed the UAS against nine evaluation criteria (listed in order of relative weight): control link quality, latency, electro-optical (EO) camera visual acuity, infrared (IR) camera visual acuity, flight duration, command and time to redeploy, deployability, ease of use and ground control station (GCS) interface.

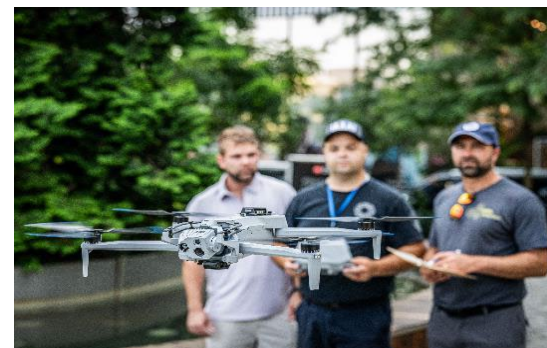


Figure 1. An evaluator flies the Skydio X10D alongside NUSTL staff members



Figure 2. A Parrot ANAFI USA GOV flies in Hudson Yards

Products Assessed

The seven UAS below were assessed. The pricing, rounded to the nearest whole dollar, is based on General Services Administration (GSA) pricing as applicable in their stated configuration without additional accessories, or from quotes received for procurement in their stated configuration.



Ascent AeroSystems Spirit
GSA Price \$56,195



Freefly Systems Astro
Price: \$47,018



Parrot Drones ANAFI USA GOV
GSA Price: \$13,964



Skydio X10D
GSA Price: \$28,382



Teal Drones Teal 2
GSA Price: \$15,073



DJI Matrice 30T
Price: \$18,608



DJI Matrice 4T
Price: \$12,958

Assessment Activities

Evaluators began the assessment with a familiarization session on the seven UAS at the FDNY's training facility at Fort Totten – an open field environment. Hands-on training was conducted with all platforms; evaluators flew each UAS through a predetermined course, which allowed them to get a sense of the aircrafts, controls, and cameras before moving to a more challenging operational area.

Operational activities occurred in the Hudson Yards neighborhood of Manhattan, a dense urban environment with features that add complexity to UAS operations. Prior to formal evaluation, test flights were conducted by a proficient remote pilot. Four of the seven platforms – DJI Matrice 4T, DJI Matrice 30T, Parrot ANAFI USA GOV and the Skydio X10D – were able to maintain a position hold with sufficient accuracy and little drift such that they were deemed safe to fly. The remaining platforms – Ascent AeroSystems Spirit, Freefly Systems Astro, and Teal Drones Teal 2 – were tested at multiple locations and found unable to maintain their positions, which is insufficient for first responder use cases where operators are primarily focusing on the live feed and not maintaining the position of the aircraft. A combination of factors that typify a complex urban operational environment contributed to this issue: global navigation satellite system (GNSS) multipath and obstruction of the satellites by buildings, urban canyon wind shear, and the lack of additional sensors to assist the aircraft in maintaining its position (e.g., obstacle avoidance sensors). As a result, three platforms could not be operationally evaluated and scored.

Overall Results

Overall scores for the two Blue UAS that were fully evaluated at Hudson Yards ranged from 3.7 to 2.4 out of a maximum achievable score of 5.0. The table below presents the overall assessment score and SAVER category scores for both products, which are listed from highest to lowest overall score. Results related to the covered nation platforms is available to public safety agencies upon request. Please contact NUSTL@hq.dhs.gov to request this information.

Manufacturer	Model	Overall Score	Capability	Deployability	Usability
Skydio	X10D w/ VT300-Z and NightSense	3.7	3.7	3.5	4.0
Parrot Drones	ANAFI USA GOV	2.4	2.3	2.4	2.9

Key Takeaways

An overall finding of this test was that in a dense urban environment, UAS that rely on GNSS for holding their position are challenging to fly. While not the only alternate positioning option, the Skydio X10D features a camera-based obstacle avoidance system that allowed it to remain stable in the air even with degraded GNSS signals. In some cases, the obstacle avoidance helped provide stability at lower altitudes until the operators were able to climb to an altitude with better GNSS reception.

Table 1 summarizes the advantages and disadvantages of the Skydio X10D and Parrot ANAFI USA GOV as identified by the evaluators. Products are listed in order from highest to lowest overall score.

Table 1. Advantages and Disadvantages

Manufacturer/Product	Advantages	Disadvantages
Skydio, X10D¹ 	• Easy to set up and deploy • Intuitive to use • Limited latency • Autonomous navigation modes increased stability • “NightSense” accessory for enhanced collision avoidance during night operations	• Latency in transition from analog to digital zoom • Lack of basemaps by default • Inconsistent tracking feature (e.g. would drop off when the subject of interest was visible on the GCS) • Non-ergonomic GCS • Lack of payload options • Latency when shifting between EO and IR cameras
GSA Price: \$28,382	Overall Score: 3.7	

¹ The Skydio X10D is a quadrotor UAS that offers two integrated EO/IR payload options; the VT300-Z and VT300-L. During the assessment, the X10D was equipped with the VT300-Z payload that contains two EO cameras and a 640x 512-pixel radiometric thermal camera. The two EO cameras are a 48 MP telephoto camera and a 64 MP camera with 50° field of view that produce a zoom of up to 128x. The X10D uses an 18.55V lithium ion (Li-ion) polymer battery rated at 150 Watt-hours (Wh).

Manufacturer/Product		Advantages	Disadvantages
Parrot Drones, ANAFI USA GOV¹ 		• Easy to set up and deploy • IR fusion with EO helped with image resolution and clarity • High fidelity optical zoom	• Latency when switching cameras • Connectivity issues as near as 50 feet from launch point • Poor visual acuity of low resolution (320 x 256) IR camera • Gimbal control slow to react, slower with IR • Lack of numeric satellite count shown on GCS main screen
GSA Price: \$13,964	Overall Score: 2.4		

System Specifications and Qualitative Feedback at Familiarization

Qualitative feedback was also collected from the evaluators for the Spirit, Astro and Teal 2 based on their experience during familiarization flights at Fort Totten (a less dense urban area). That feedback, along with product configuration and insight into the factors limiting their flight operations, is outlined below. Products are listed in alphabetical order by manufacturer.

Ascent AeroSystems Spirit

The Ascent AeroSystems Spirit (Figure 3) is a coaxial unmanned aircraft. The Spirit can be flown with one or two 12S 44.4 volt (V) lithium ion (Li-ion) batteries; for the assessment it was flown with one battery. The Spirit was equipped with a NextVision Nighthawk2-UZ EO/IR camera that features 40x EO zoom (20x optical, 2x digital) and 4x digital IR zoom. Both cameras have a resolution of 1280 x 720 pixels. The Spirit could not be fully assessed at Hudson Yards because it lacked sufficient GNSS reception to reliably hold position.

During the familiarization session held before the assessment activities, evaluators highlighted the camera and zoom quality of the NextVision Nighthawk2. They also noted the coaxial design of the Spirit made it challenging to fly as there is no physical indication of the aircraft's orientation. Its 360° camera also contributed to disorientation during flight. Additionally, the platform was slow to respond to pilot inputs.



Figure 1. Spirit about to take off at Fort Totten

¹ The Parrot ANAFI USA GOV is a quadrotor UAS with an integrated EO/IR payload containing two EO cameras (21 MP telephoto and 21 MP wide angle), and 320 x 256-pixel IR camera. The telephoto lens provides 5x zoom from the wide angle, with all other zooms being digital. The IR, a FLIR Boson LWIR micro-bolometer sensor, is rated at 20 Hz and a thermal sensitivity of 0.05°C. The ANAFI USA GOV uses a Li-Po battery.

Freefly Systems Astro

The Freefly Systems Astro (Figure 4) is a quadrotor vertical take-off and landing platform with dual hot swappable SL-8 Air batteries rated at 157 Wh and a swappable payload via the Freefly Smart Dovetail adapter. It was controlled by the Freefly Pilot Pro and was equipped with a Sony LR1 EO camera with an integrated laser range finder and FLIR Boson 640x512 IR radiometric sensor. This UAS could not be fully assessed in Hudson Yards as evaluators attempted to fly the Astro at Hudson Yards and found that the Astro would not enter position mode, causing the aircraft to drift constantly. A safety pilot from the test team took over control of the aircraft and attempted to switch into position hold at a higher altitude, to no avail.

During familiarization flights at Fort Totten, evaluators gave mixed feedback on the size and deployability of the aircraft with some appreciating its size for applications with sufficient deployment space and others noting it would not be an ideal size for emergency operations with reduced time and footprint. Evaluators found value in the ability to swap payloads, and hot swap the batteries on the aircraft, making it the easiest of all assessed platforms to redeploy. While using the camera, evaluators noted the lack of optical zoom on the RGB camera made it insufficient for their operations. They reported that switching the camera into video mode improved visual acuity, however that did not change their overall impressions. Regarding the IR camera, evaluators said it provided industry standard resolution and clarity, but they would have liked it to include an optical zoom.

Teal Drones Teal 2

The Teal 2 (Figure 5) is a quadrotor UAS with an integrated EO/IR payload, an integrated dual axis EO/IR gimbal with a Hadron 16MP EO camera and 640x512 IR sensor. Teal 2 operates on one Teal Performance Battery Pack, a 22,2 V Li-ion battery pack rated at 60 Wh.

Evaluators could not safely launch the Teal 2 without sufficient GPS lock, which was challenging to obtain during familiarization flights at Fort Totten and Hudson Yards.

During the training at Fort Totten, some evaluators experienced RemoteID failures that prevented the Teal 2 from taking off. After approximately 10 minutes of troubleshooting, the error was resolved for a successful launch. Evaluators reported experiencing lag even at short distances as well as a shaky, pixelated video feed. They noted the quality of the camera zoom was insufficient for capturing license plates and large text. They also expressed that the thermal camera lacked resolution sufficient for response operations. Evaluators also observed controller gimbals that felt unsteady and expressed alarm that the kill switch was readily accessible, worrying that they could accidentally activate it during flight. They appreciated the controller's large screen and course setting capabilities. Regarding deployability, evaluators appreciated the soft, foldable antennas. However, the GCS cannot be connected to Wi-Fi and the drone at the same time, which could add several steps of disconnecting and connecting different components in situations when quick deployment is needed. Additionally, evaluators liked that the batteries had an audible click and felt secure as well as the shared batteries between the platform and the GCS, they noticed rapid battery loss during shorter flights.



Figure 4. Astro during a test flight at Hudson Yards

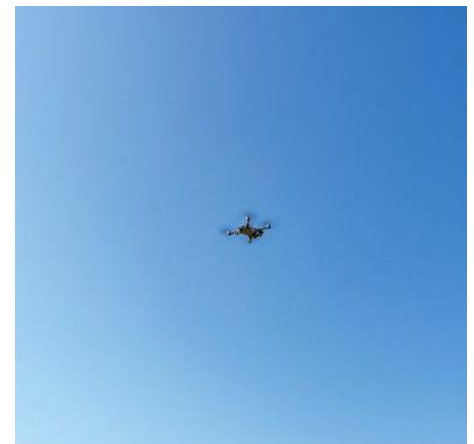


Figure 5. Teal 2 in flight at Fort Totten

For More Information

This document provides high-level information on the operational assessment methodology, systems selected for testing, and overall scores for the Blue UAS platforms assessed. For more information on the rural, urban, and complex urban assessments, full assessment reports with evaluator feedback and comparative results will be published on the SAVER website, specifically on the “Blue UAS for First Responders” page at www.dhs.gov/science-and-technology/saver/blue-uas-first-responders. Results related to the covered nation platforms from the complex urban assessment are available to public safety agencies upon request. Please contact NUSTL@hq.dhs.gov to request this information.

More than 1,200 publications can be found on the SAVER website at www.dhs.gov/science-and-technology/saver. For more information on the National Urban Security Technology Laboratory please visit our [website](http://www.dhs.gov/science-and-technology/saver) or contact us at NUSTL@hq.dhs.gov.

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