

November 3, 2023

The Honorable Maria Cantwell Chair Committee on Commerce, Science, and Transportation United States Senate Washington, DC 20510

Dear Chair Cantwell:

Enclosed is the Federal Aviation Administration's (FAA) Report to Congress on the Study on Fire Department and Emergency Service Agency Use of Unmanned Aircraft Systems, as required by Section 359 of the FAA Reauthorization Act 2018 (Public Law 115-254).

Section 359 directs FAA to study Unmanned Aircraft Systems (UAS) use by fire departments and emergency service agencies. To complete this study, FAA collaborated with disaster preparedness and emergency response UAS operators from several federal, state, and local organizations. They generously shared insight into their successes, challenges, lessons learned, and best practices. As required by Section 359, this report documents the study's findings and makes recommendations to further the safe and efficient use of UAS during disasters and emergencies.

A similar letter has been sent to the Ranking Member of the Senate Committee on Commerce, Science and Transportation and the Chairman and Ranking Member of the House Committee on Transportation and Infrastructure.

Sincerely,

Mowhite

Michael G. Whitaker Administrator

Enclosure

Office of the Administrator



November 3, 2023

The Honorable Ted Cruz Ranking Member Committee on Commerce, Science, and Transportation United States Senate Washington, DC 20510

Dear Ranking Member Cruz:

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November 3, 2023

The Honorable Sam Graves Chairman Committee on Transportation and Infrastructure U.S. House of Representatives Washington, DC 20515

Dear Chairman Graves:

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November 3, 2023

The Honorable Rick Larsen Ranking Member Committee on Transportation and Infrastructure U.S. House of Representatives Washington, DC 20515

Dear Ranking Member Larsen:

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FAA Aviation Safety

REPORT TO CONGRESS:

Study on Fire Department and Emergency Service Agency Use of Unmanned Aircraft Systems

Federal Aviation Administration (FAA) Reauthorization Act of 2018 (Public Law 115-254) – Section 359

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Introduction

The Federal Aviation Administration (FAA) submits this report in response to Section 359 of the FAA Reauthorization Act of 2018:¹

SEC. 359. STUDY ON FIRE DEPARTMENT AND EMERGENCY SERVICE AGENCY USE OF UNMANNED AIRCRAFT SYSTEMS.

(a) STUDY.—

(1) IN GENERAL.—The Administrator shall conduct a study on the use of unmanned aircraft systems by fire departments and emergency service agencies. Such study shall include an analysis of—

(A) how fire departments and emergency service agencies currently use unmanned aircraft systems;

(B) obstacles to greater use of unmanned aircraft systems by fire departments and emergency service agencies;

(C) the best way to provide outreach to support greater use of unmanned aircraft systems by fire departments and emergency service agencies;

(D) laws or regulations that present barriers to career, combination, and volunteer fire departments' ability to use unmanned aircraft systems;

(E) training and certifications required for the use of unmanned aircraft systems by fire departments and emergency service agencies;

(*F*) airspace limitations and concerns in the use of unmanned aircraft systems by fire departments and emergency service agencies;

(G) roles of unmanned aircraft systems in the provision of fire and emergency services;

(*H*) technological challenges to greater adoption of unmanned aircraft systems by fire departments and emergency service agencies; and

(I) other issues determined appropriate by the Administrator.

(2) CONSULTATION.—In conducting the study under paragraph (1), the Administrator shall consult with national fire and emergency service organizations.

(b) REPORT.—Not later than 180 days after the date of enactment of this Act, the Administrator shall submit to the appropriate committees of Congress a report on the study conducted under (a), including the Administrator's findings, conclusions, and recommendations.

In accordance with Section 359(a)(1), the FAA conducted a study on the use of unmanned aircraft systems (UAS) by fire departments and emergency service agencies.² This report summarizes the findings, conclusions, and recommendations that resulted from that study.

¹ Public Law 115-254

² The FAA's Research, Engineering, & Analysis Division (AUS-300), which is part of the FAA UAS Integration Office, conducted a research study that included interviews of 35 stakeholders at 21 organizations including federal, state, and local public safety agencies, as well as industry associations. In accordance with Section 359(a)(2), the FAA included the National Fire Protection Association (NFPA) and the International Association of Fire Chiefs (IAFC) among the organizations it consulted as part of the study.

A. How Fire Departments and Emergency Services Use Unmanned Aircraft Systems

UAS enhance the way fire departments and emergency services agencies (collectively referred to in this report as "public safety agencies") respond to emergencies. Public safety agencies use UAS to obtain critical information through real-time surveillance, thermal imagery, and damage assessments. UAS can operate under circumstances and in conditions that may not be feasible or safe for traditional manned aircraft. Figure 1 below is a high-level summary of the various uses of UAS by fire departments and emergency service agencies across the United States.

Figure 1—UAS Uses by Fire Departments and Emergency Service Agencies. (Note: Not all activities listed in the figure below qualify as public aircraft operations.)



Fire Department Use of UAS

The International Association of Fire Chiefs (IAFC) reports that its membership is expanding its use of UAS and exploring new applications of UAS. Another membership organization, the National Fire Protection Association (NFPA), indicates that use cases include supporting fire departments in search

and rescue (SAR) operations, hazardous materials incidents, and infrastructure inspections. The NFPA also indicates that state and federal agencies are operating UAS to obtain high-quality images of fires and the impact of the fires on people and structures.

For example, a large fire department based in an urban area reports that it uses UAS mainly for support operations such as thermal imagery and surveying. In addition, this fire department also uses UAS for missing person cases, dropping packages, post-incident analysis, situations involving hazardous materials and dangerous items, damage assessments (including assessments for insurance companies), and technical rescues (i.e., cliffside or trench rescues that require specialized skills and equipment) as seen in Figure 2.

Another metropolitan fire department employs small UAS (sUAS) for brush fires, building collapses, emergency medical response, telemedicine, medical supplies deliveries, swift water responses, and mapping out firefighter locations. Furthermore, this fire department has tested a proof-of-concept use of UAS as "communication towers."³





Fire departments also use UAS to respond to emergencies such as hurricanes and tornadoes, as well as to aid law enforcement in situations involving suspicious packages, missing persons and SAR, traffic flow monitoring, damage assessments after aviation and boating incidents, and environmental incidents such as fuel spills.

In addition, fire departments increasingly use UAS to support wildland firefighting operations. In such instances, fire departments use UAS to monitor the spread of the wildfire and assist in the development of response efforts, warn residents that residents may be in the fire's projected path, identify hotspots, determine whether a fire has been extinguished or may be likely to flare up, and assist in SAR operations.

³ In metropolitan areas, drones can be used as radio repeaters in urban canyons or as portable cellular antennae to recreate a communications system in manmade or natural disasters.

Findings:

Fire departments continue to expand their use of UAS to support their operations as well as those of law enforcement. As discussed in Section C below, through the FAA's first responder outreach and tutorial sessions, the FAA continues to learn about new use cases and the fire department community's needs with respect to UAS operations. The FAA supports the fire department community by participating in interagency and interdepartmental meetings that bring firefighting community subject matter experts together. At these meetings, these experts share UAS use cases and advocate for collaborating on common operating procedures as well as on post-incident analysis processes and tools.

Emergency Service Agency Use of UAS

Emergency service agencies include, but are not limited to, law enforcement, emergency medical services and paramedic entities, and public safety departments.

The most common uses of UAS reported by law enforcement include responding to active shooters; conducting site surveys, SAR, mapping, damage assessments, prediction and modeling; monitoring suspects barricaded in a room; accessing difficult locations; and photographing crime scenes. As an example, one police department based in an urban area successfully used UAS to detect explosives, assess hazardous materials incidents, and assist with hostage rescues.

For law enforcement use cases where personnel are exposed to risks from suspects, UAS may improve situational awareness before officers arrive on the scene. Moreover, UAS can minimize the amount of risk exposure to personnel in non-emergency cases. For example, using UAS to map the scene of, and reconstruct an automobile accident reduces the amount of time investigators spend on the roadways.

Emergency service agencies also use UAS for damage assessment after hurricanes and tornadoes, and for special border (including anti-terrorism) operations, as well as non-emergency purposes such as communications tower inspections, public affairs events, and maintenance and training.

A specialized outreach team within a suburban police department utilized UAS during the COVID-19 pandemic to provide public health education and hygiene kits to homeless persons who live in areas that are not easily accessible. The team also used UAS to communicate public health messages about services available for the homeless and to provide directions to help people find these services. By using UAS and this strategy, this emergency service agency accomplished in three hours what otherwise would have required two days.

Findings:

For emergency service agencies, UAS use cases are evolving. The most common and significant benefits of this evolution are the increased situational awareness for emergency responders and the ability to mitigate safety risks.

B. Obstacles to Greater Use of UAS by Fire Departments and Emergency Service Agencies

Despite the numerous benefits that UAS provide, there also are challenges and obstacles to operating UAS that limit their use by fire departments and emergency service agencies.

For example, for fire departments and emergency service agencies alike, UAS can be difficult to operate near fires due to limitations with the UAS and payloads. If the UAS battery encounters extreme heat, the battery may overheat, which triggers the return to home feature, ending the operation.

For fire departments, there is an additional obstacle in that severe updrafts during fires may affect the operator's ability to maintain control. There also are challenges in using UAS to provide images during fires, as images may be affected by poor visibility due to smoke. In addition, some infrared cameras cannot withstand the extreme environments associated with some firefighting situations.

In addition, some local fire departments report challenges with acquiring secure and affordable sUAS models that meet the performance requirements of their operations. With the increasing demand for UAS applications for emergency response, Beyond Visual Line of Sight (BVLOS) operations will allow UAS to operate without the need for a maintained visual line of sight (VLOS) of the UAS by operators or observers along the route of flight. BVLOS capabilities would enable unmanned aircraft operators, such as public safety agencies, to cover far greater distances, improving accessibility and feasibility during critical emergency response operations.

Findings:

Public safety agencies experience a variety of obstacles to greater use of UAS. These obstacles include system limitations, both within the UAS and the payload, that may inhibit or degrade the ability to respond in certain situations. Additionally, these teams have identified operational challenges that constrain the adoption of UAS by additional emergency response organizations.

C. Outreach Supporting Greater Use of UAS by Fire Departments and Emergency Service Agencies

Many fire departments and emergency service agencies are not traditional aviation stakeholders and are unfamiliar with the FAA and its rules for operating safely in the National Airspace System (NAS). As a result, the FAA regularly works with its public safety partners to support public safety agencies' use of UAS for public safety missions. These outreach efforts include twice-monthly webinars to discuss current public safety UAS issues and to provide an opportunity for these organizations to ask questions and obtain resources to support their programs. The FAA also works with public safety associations to conduct webinars and presentations that address FAA rules, lessons learned from other public safety programs, and how to start a UAS program.

In addition to producing these webinars and presentations, the FAA produces guides, magazine articles, and videos to support public safety programs. FAA staff present and display at public safety conferences around the United States. The FAA also works with public safety agencies on a daily basis, answering questions and assisting with their current UAS programs. The FAA also provides a public safety resource web page at https://www.faa.gov/uas/public_safety_gov/.

Findings:

Most fire departments and emergency service agencies seeking to use UAS in support of their public safety mission do not have the familiarity with or knowledge about aviation that would allow for the seamless launch of a UAS program. The FAA recognizes that public safety agencies are not typical users of the NAS. The Agency continues to assist and provide resources, helping them conduct safe and legal UAS operations to support their missions.

D. Laws and Regulations Presenting Barriers to Career, Combination, and Volunteer Fire Departments' Use of UAS

There are different pathways available to fire departments and emergency service agencies seeking to operate UAS during critical response missions. Government entities that qualify to conduct public aircraft operations (PAO) under the PAO statute (Title 49 of the United States Code [49 U.S.C.] §§ 40102(a)(41), 40125) and FAA Advisory Circular 00-1.1B may fly a UAS without restriction by weight. Regulations permit any emergency responder to operate a UAS weighing less than 55 pounds as a civil aircraft under Title 14 of the Code of Federal Regulations (14 CFR) part 107. Aircraft weighing more than 55 pounds may be operated as civil aircraft under 14 CFR part 91 by obtaining an exemption issued by the FAA in accordance with the Special Authority for Certain Unmanned Systems provided in 49 U.S.C. § 44807.

The limitations associated with UAS PAO are:

- Limited to qualified government entities described in the statute
- PAO entities self-certify their aircraft and pilots
- Operators must apply for a Certificate of Authorization (COA) application describing their operations; COAs expire and must be renewed
- Operation under a COA is limited to the applicant
 - Use by another part of the same government likely will require other operational authority
- Each flight must have a valid governmental function as described in the statute
- Operators may not be compensated or charged for the operations
- UAS PAO are not eligible to use Low Altitude Authorization and Notification Capability (LAANC), the FAA's tool for airspace access.

If an operation fails to qualify as PAO, the operation is considered a civil operation and 14 CFR applies to the aircraft, pilot, and operations.

Entities or operations that do not qualify for PAO status include, but are not limited to, volunteer fire departments, universities, private schools, the Civil Air Patrol, charitable and nonprofit/non-governmental organizations such as the Red Cross, operations outside the NAS, and government entities that seek

compensation. These organizations, and any government entity that chooses to conduct civil operations under part 107, are eligible to conduct civil operations under part 107.

UAS operations under part 107 have a number of restrictions. Among other things, a UAS operated under part 107 must remain:

- Either below 400 feet above ground level (AGL) or below 400 feet above a structure's immediate uppermost limit when operating near a structure
- Within visual line of sight of the operator or visual observer
- In uncontrolled Class G airspace unless they have received FAA authorization to operate in controlled airspace.

UAS operations under part 107:

- Do not have the governmental function limitations of PAO
- Do not have reimbursement restrictions
- May use LAANC.

Every government entity qualifies as a civil operator when it operates within the limits of civil authority. However, the same operation cannot be considered a civil operation and a PAO. Some entities may need to conduct UAS operations as a PAO because their aircraft each weigh more than 55 pounds or there is a routine need for altitude or airspace above and beyond part 107 limitations. The following table describes and compares the applicable pathways for agencies seeking to operate UAS.

Under 49 U.S.C. §§ 40102(a)(41), 40125, government entities may qualify to operate UAS as a public aircraft when the operating entity and the flight meets certain qualifications. The FAA's Air Traffic Organization then issues a PAO COA or waiver to that government entity for a specific UAS activity.

Some fire departments report that they are not qualified to operate as a public aircraft operator since the majority of fire agencies in the U.S. are volunteer-based and are not recognized as political subdivisions of their respective states. Instead, these fire departments conduct civil operations in accordance with part 107.

Section 107.205 lists the regulations within part 107 that are subject to waiver. Part 107 waivers are approved on a case-by-case basis. The FAA may grant a waiver if the applicant has shown that the individual operation meets an acceptable level of safety. The decision whether to grant a waiver includes the evaluation of factors such as the concept of operations, reliability of the UAS, location of the operation, and qualifications of the pilots. As a result, two operations may have different approvals and significantly different operating limitations.

Given the unpredictable and urgent nature of their work, fire departments and emergency response organizations often need rapid approval to operate. As described earlier in this report, the FAA has in place an effective Special Government Interest (SGI) process for emergency operations that allows for amendments to COAs and waivers. Agencies often receive approval in a very short timeframe.

During the course of this study, fire departments and emergency service agencies suggested that the FAA develop special exemptions for fire departments and emergency response organizations in order to support their life-saving response efforts. One proposal entailed the development and approval of a standard authorization in advance or less restrictive regulations predicated on higher standards for training that would permit these organizations to operate UAS in an emergency, provided they meet certain conditions.

Findings:

While public safety agencies have several paths to consider in order to conduct operations, it is not always apparent which approval process is the most expedient for a given operation. Fire departments and emergency service agencies would benefit from continued education, community outreach, and the sharing of best practices in the area of operational approvals so that they may understand approval processes and how to select the path that may be best suited for their operation.

E. Required Training and Certifications for the Use of UAS by Fire Departments and Emergency Service Agencies

Training and certification requirements differ depending on the nature of the operation. For public aircraft operations, the government entity conducting the operation, and the pilots executing the operation, need not comply with FAA airman certification requirements. Instead, for such public aircraft operations, the government entity may implement its own pilot training requirements. For civil operations under part 107, pilots first must pass an aeronautical knowledge exam and obtain a Remote Pilot Certificate (RPC) with sUAS rating. For operations conducted in accordance with 14 CFR parts 91 and 61, the operator must comply with the conditions and limitations of any exemption setting forth standards for airman certification.

In 2018, NFPA released *NFPA 2400, Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations.* NFPA developed this standard for all public safety agencies that operate sUAS, and details minimum requirements that NFPA determined are necessary for the safe operation, deployment, and implementation of sUAS. This standard also covers organization program criteria and considerations, professional qualifications for safety personnel, and elements of a maintenance program. Among the professional qualifications that this standard addresses are minimum job requirements for both a remote pilot and a visual observer, allowing public safety agencies to develop a curriculum and train crewmembers accordingly.

ASTM International, formerly known as the American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services. The ASTM International "Committee F38 on Unmanned Aircraft Systems" has a subcommittee dedicated to the development of standards for personnel training, qualification, and required certification. Standards developed by this subcommittee include training standards for public safety agency piloting of UAS. These training standards establish the minimum knowledge, skills, and abilities that ASTM has determined are appropriate for public safety agency piloting of UAS, and can be used to develop a training guide or program for these agencies.

Several local fire departments reported that they established UAS training programs for their personnel. One local fire department requires that, at a minimum, their operators are FAA-certified part 107 remote pilots. This fire department organizes exercises and demonstrations several times per month, and possesses a 14 CFR part 107.29 waiver to conduct nighttime training. It also provides presentations at national aviation and public safety conferences, and works with standards organizations to help standardize public safety training and operations.

Findings:

There are efforts to develop standards for minimum training and certification standards that may be used by fire departments and emergency service agencies operating UAS. Fire departments and emergency service agencies may use these standards as a basis in developing their own testing methods, qualification requirements, and training procedures for their UAS teams.

Regarding education, there are a few two- and four-year colleges that offer certificates in UAS use cases for public safety agency team members. While there are standalone classes for first responders who use UAS, there is no established first responder UAS curriculum. The establishment of a standardized high school or university curriculum on UAS operations for first responders would facilitate the development of a qualified workforce for emergency response organizations.

F. Airspace Limitations and Concerns in the Use of UAS by Fire Departments and Emergency Service Agencies

There are different operating areas and airspace requirements for operating UAS. For PAO, there are two types of COAs; one restricts operations to Class G (uncontrolled) airspace, the other is a jurisdictional COA that allows for operations in controlled airspace. For civil operations under part 107, operators that obtain authorization may operate in controlled airspace. With an exemption for operations in accordance with Section 44807, an operator could receive a standard COA (referred to as a "blanket" COA) only for operations below 400 feet, or a more specific COA for operations outside the parameters of a "blanket" COA.

When responding to emergencies, fire departments and emergency service agencies may be eligible for expedited operational approval through the FAA's SGI process, provided that they have an existing COA and use a pilot who holds an existing part 107 RPC.⁴ The FAA System Operations Support Center (SOSC) works with the local Air Traffic Control facility to evaluate the potential impacts of the requested operations. If the FAA determines that the requested operations are safe, SOSC will issue the approval.

Pursuant to 14 CFR § 91.137, the FAA may issue a Temporary Flight Restriction (TFR) to "[p]rovide a safe environment for the operation of disaster relief aircraft." However, there are exceptions to the use of a TFR for operators participating in hazard relief or carrying law enforcement officials.

⁴ The FAA's SGI process for emergency operations allows for expedited amendments to COAs and waivers.

One local fire department reported that it has flown its UAS under a TFR in order to avoid concerns about other traffic. Another local fire department discussed airspace limitations resulting from the fact that its region has little Class G (uncontrolled) airspace due to the surrounding military bases and international airports. Given its location, this fire department's UAS team has both a blanket COA for Class G airspace and a jurisdictional COA to cover the controlled airspace within the region.

Findings:

There are mechanisms in place to allow fire department and emergency service agency UAS access to the airspace. These operations are subject to limitations, restrictions, and requirements just like any other airspace operation. The FAA has processes in place to expedite approval of requests to access airspace in the event of an emergency.

G. Roles of UAS in the Provision of Fire and Emergency Services

Earlier sections of this report, particularly Section A, detail the role of UAS in the provision of fire and emergency services.

H. Technological Challenges to Greater Adoption of UAS by Fire Departments and Emergency Service Agencies

Fire departments and emergency service agencies have faced limitations with communications systems and infrastructure; some of these challenges are compounded by the UAS operating environment. For example, due to communications range limitations, one organization reported that it must conduct line of sight operations using 900 MHz or 2.4 GHz radio frequencies for most of its UAS operations. These frequencies commonly are used by many household devices (such as garage door openers, cordless phones, baby monitors, microwave ovens, and even some Wi-Fi and Bluetooth channels) and are less desirable to public safety agencies that would prefer a dedicated band in order to reduce potential feedback or interference.

A metropolitan fire department reported similar limitations caused by a saturated frequency spectrum. These problems are exacerbated by the environment in which the fire department operates (for example, as discussed above, because 2.4 GHz commonly is used for household items, it could cause interference). In urban settings, tall buildings, concrete, and density of wireless and radio communications cause interference and signal blocking that can make UAS operations difficult. The fire department noted that these circumstances degrade Global Positioning System (GPS) availability in metropolitan areas, making navigation in those cities a challenge. The fire department added that it can be difficult to maintain line of sight and communications when navigating around buildings.

Another urban fire department identified challenges associated with flying UAS near a diesel-electric engine on a locomotive. The fire department reported that doing so caused the UAS to experience magnetic interference from the engine and a subsequent loss of signal.

While urban environments pose certain challenges related to interference, there also are challenges with operations in more remote areas. These areas may have limited or no communications coverage or internet connectivity leading to problems communicating with aircraft and impacting the ability to share data.

Challenges related to infrastructure also come into play in the aftermath of a disaster. UAS operations may depend on the availability of infrastructure including electrical power and communications. If these systems are lost during a disaster, UAS may not be able to operate safely according to the approved plan of the fire department or emergency services agency.

Equipment durability challenges also exist. One challenge for public safety agencies is the lack of durable equipment that can operate in adverse weather conditions. For instance, certain inexpensive platforms can handle only moderate rain. Extreme weather requires a more durable, and more expensive, platform.

Findings:

Technological challenges can affect the UAS operations of public safety agencies. These challenges may be limitations with the UAS itself or challenges related to the communications infrastructure. The operational parameters and technology constraints also can determine which kind of operation a fire department or emergency service agency chooses.

I. Other Issues Determined Appropriate by the Administrator

The previous sections of this report address the relevant issues for public safety agencies that use UAS as well as the opportunities and challenges they face.

Recommendations

Based on the findings of this study, the FAA makes the following recommendations to facilitate the expansion of the adoption of UAS by more fire departments and emergency service agencies and to improve operations by those organizations already using UAS.

- Federal, state, local, and tribal public safety agencies should continue to engage collaboratively on best practices, lessons learned, operational use cases, and procedures for using UAS.
- The FAA should continue its outreach to, and education efforts for, public safety agency operators.
- Public safety agencies should continue to mature UAS use cases developed during the COVID-19 pandemic so that UAS can be used to support emergency responders during any future public health emergency.
- Standards bodies, such as ASTM and the National Institute of Standards and Technology, should be encouraged to develop or enhance curricula and training to facilitate the creation of a public safety workforce that is well-qualified to use UAS.

• Existing national and international UAS forums for discussions and collaboration should continue to explore the use of UAS for emergency response.

Conclusion

The key findings outlined in this report indicate that there is no "one size fits all" approach for UAS operations by fire departments and emergency service agencies. A public safety agency must determine if it is eligible to operate PAO, or if it is required or preferable for that organization to conduct activities as a civil operator under part 107. That decision will impact the requirements to which each agency must adhere and the limitations of the agency's proposed operation.

There is a range of factors that influence response operations, including the specific type of emergency event, the location, the agencies responding, and the types of UAS assets used in the response. Other factors to consider include the technological limitations of the aircraft and local supporting infrastructure. While certain challenges remain, UAS have proven effective in helping public safety agencies respond to a number of emergency situations, and have been directly responsible for saving the lives of first responders and civilians. Public safety agencies likely will realize additional benefits as use cases for UAS evolve.