Attachment A

Mutual Aid Box Alarm Systems
Unmanned Aircraft Systems Program (UAS)

UAS Program Planning

OVERVIEW

This document provides information required for MABAS Divisions and member agencies to plan and implement safe, legal and effective UAS operations. MABAS has identified that the primary cause of UAS program failures is the lack of planning. This in turn lead to agencies procuring equipment or training incompatible with the mission, or omitting requisite equipment or training. The following document intends to provide guidance agencies should follow when researching or establishing UAS programs in the fire service.

A. IDENTIFY OPERATIONAL NEEDS

The first step when conducting research to implement a UAS program is to understand the needs of the sponsoring agency as well as any other agencies, divisions or municipalities that may request the UAS to respond via mutual aid. The following areas should be taken into consideration by the implementing authorities having jurisdiction (AHJ).

1. Geography, population, and weather

The population density and geographic area for which the AHJ is responsible should be a primary factor of consideration for how the UAS program should be specified, and what types of UAS responses may be called for.

For example:

- An agency with an extensive rail network in their jurisdiction should consider developing a UAS program able to assist with derailments and associated HAZMAT incidents.
- An agency in an urban area near a Level 1 or Level 2 trauma center should expect medical helicopter traffic regardless of class of airspace and should consider coordinating with helicopter services in advance by means of standardized operating procedures, and memoranda of understanding.
- An agency in an area that receives extensive precipitation and condensing moisture during long periods of the year should consider launching their UAS program with an aircraft that is ingress protected.

2. Frequent deployments

The deployments to which the AHJ expects to be directed should be a primary indication of how the UAS program should be initially specified.

For example:

- An agency who expects to receive frequent water rescue calls should consider a UAS with effective payload capability to carry and release a personal flotation device, and requisite crew training so as to operate the UAS with external loading.
- An agency who expects to use the UAS to support post-control efforts on structure or wildland fires should consider a UAS with thermal imaging capabilities, and the requisite crewmember training so to operate and interpret thermal payloads.
- An agency that intends to provide mutual aid support to law enforcement should train flight crew.

3. Airspace

The overlying airspace of the AHJ's local and mutual aid response area (if applicable) should also influence the procedures and training required for safe and effective deployment.

For example:

- An agency In MABAS division 1, 3, 8, 9, 10, 21, 24, 28, or 48 should consider pre-arranging authorization with local Air Traffic Control (ATC) facilities for the controlled airports in their response area and have requisite authorizations in place before deployment.

- An agency with uncontrolled airports in its response area should consider equipping the UAS team with airband radios and the requisite training for the flight crew or Tactical Group Supervisor to separate air traffic without the support of Air Traffic Control (ATC). Consider an aircraft with a system similar to DJI AirSense which gives instant real-time positioning alerts on nearby manned aircraft.
- An agency who intends to respond by mutual aid should ensure any airspace authorization, waiver or COA extends beyond their municipality boundaries to include mutual aid areas.

4. Mutual aid availability and capability

Finally, each agency choosing to build a mutual-aid capable drone program should consider whether they intend to deploy assets from their program, in whole or in part, to support nearby agencies via mutual aid. This decision should be determined by the level of need and capability.

For example:

- Neighboring agencies with UAS programs who expect to deploy on mutual aid assignments together should consider standardizing on aircraft platform, training, and SOPs.
- Agencies who intend to deploy beyond the local scale, whether as part of a MABAS or FEMA team should ensure their program is compliant with the requirements of MABAS or FEMA team membership.
- Agencies that are early adopters of UAS technology in their region should expect to receive UAS mutual aid requests from neighboring agencies.

B. COST JUSTIFICATION AND BUDGETARY CALCULATIONS

Protecting firefighters from unnecessary exposure to harm is the primary cost justification for a UAS program. Budgetary calculations should take into account the operating cost of personnel and equipment as well as unforeseen liabilities like injuries, damage to equipment, and workman's compensation claims. The speed and efficiency with which an agency can respond to an incident have a direct relationship with the reduction of fixed costs and potential liabilities. Less time on scene means less payroll and overtime and less wear on equipment. Reduced direct, physical involvement in the incident means equally reduced liability of injury and loss. Additionally, the improved situational awareness provided to an incident commander by a drone allows the incident commander to allocate resources in the manner most efficient to meet the needs of the emergency, reducing unnecessary material expenditure.

An injury report published by NFPA in 2017 ("U.S. Firefighter Injuries in 2016"), indicates that on average 1% of a department's personnel will sustain an injury that will require around 3 weeks of recovery per year [1]. The National Fire Incident Reporting System (2016) statistics indicate that between 2012 and 2014 over 43% of recorded firefighter injuries were of moderate severity which included at least some degree of lost time, including overtime costs incurred to cover the injured individual [2]. Full reports are available online. In addition, opportunity costs, lost productivity, workman's comp, administrative functions and medical costs are incurred by the agency. The actionable intelligence provided by an effective drone program empowers safety officers to make more informed decisions to ensure the safety of personnel, and achieve objectives efficiently.

1. Startup costs

When developing a UAS program, there are some factors that need to be calculated including both fixed costs and development time.

a. Research time

On average, agencies should expect to spend between 80 and 120 man-hours conducting the necessary preliminary research to specify the scope of their drone program and beginning budget. This estimate of hours includes preliminary administrative tasks such as requesting competitive quotes for equipment and training. MABAS expects this time investment to decrease significantly as drone adoption becomes more mainstream and industry best practices are adopted.

b. Policy writing

Agencies that choose not to adopt the MABAS UAS Policy, or agencies that choose to operate beyond the MABAS UAS Policy, should expect to spend additional time defining and documenting the policies for their internal program. Typically, defining policies and guidelines, incorporating local, state, and federal policies and regulations may require up to an additional 120 man-hours of effort. MABAS strongly recommends that MABAS member agencies adopt

the MABAS UAS Policy to eliminate this development burden and promote interoperability between agencies implementing program.

2. Initial equipment cost

Agencies implementing drone programs should estimate initial equipment expenditures to range from $8,000 to $75,000. The upper limit of this range takes into account agencies who intend to operate multiple airframes of different capabilities, maintain redundant capacity with multiple aircraft, and dedicate a support vehicle to the UAS program. However, the majority of operational needs of an average agency can generally be met by an aircraft package including UAS, support equipment, payloads and accessories with an approximate cost of $30,000 to $35,000. Training costs will also be incurred, and it will be more than likely to include internal and external costs. The external costs over time will go down as fire service members over time will be able to train others. Typically, agencies can expect to spend around $1,200 to $1,500 per pilot on initial training, plus potential additional costs for position backfill that will depend on agency needs and available resources.

3. Program recurring costs

Once a UAS program is established, it will require recurrent training, equipment maintenance and replacement. These costs should be accounted for in the UAS program operating budget. Typically, attrition rates for roles within an organization are roughly 6% to 7% annually. This means that 6% to 7% of the initial funds spent on training would need to be budgeted. Also, as skills develop and become standardized, agencies may want to train their UAS teams in specialties such as UAS response to Search and Rescue, UAS response to HazMat, and others.

Additionally, all UAS equipment will require routine maintenance to remain in a deployable configuration. Typically, an agency should allocate 10% to 15% of their initial equipment cost for maintenance, as well as budget for equipment replacements. The average UAS has a lifespan (dependent on nature of use) of approximately 5 years. Thus, it is recommended that agencies allocate approximately 20% of their equipment cost per year to prepare for the eventuality of airframe replacement.

4. Amortized costs

Determining the value and understanding the return on investment that a tool provides will be different for each agency. This variance will be based on agency size, available resources, types of responses, number of annual responses, and local hazards.

The included MABAS UAS program budget calculator allows an agency to project the expense of making the UAS available for a particular incident, over the expected lifespan of the UAS, based on their fixed implementation costs and number of yearly expected deployments.

5. Examples of determining the value of a UAS Program

Understanding the value is one of the critical factors in starting any kind of program. With a UAS Program, there are a number of startup costs associated with equipment purchases and initial training. Additionally, there are recurring maintenance and training costs. Determining how a UAS program will allow an agency to operate more safely and efficiently are they key components to understanding the program's value.

For the examples below, we use a highly conservative estimate of $300 per incident based on real-world examples.

- **Example # 1** (Suburban Wildland Fire)

  This fire covered over 43 acres of 10ft cat-tails. The inability to maintain situational awareness based on the density of the foliage made allocating resources difficult. Incident command had predicted, extinguishment would take up to 4 hours with 3 agencies and roughly 15 personnel on site. Utilizing the UAS, the actual incident only took about 2 hours with the 15 personnel. Accounting only for personnel costs utilizing the UAS saved $675, not including wear and tear on equipment and vehicles as well as the potential for injuries in an uneven, rough terrain.

- **Example # 2** (Law Enforcement Mutual Aid, Barricaded Subject)

  In this scenario, over 20 fire personnel were on scene for support purposes. Managing the incident, there were approximately 125 law enforcement personnel including about 40 from Special Tactics teams. The incident was predicted to require at least 18 hours of on scene time utilizing a UAS.

The actual incident was concluded in 12 hours, a 33% decrease in time from the initial estimate. In this scenario, the UAS was used to deliver a cell phone to the armed and barricaded suspect which allowed negotiators to arrange a peaceful surrender. With the 6 hours of savings in time multiplied by the approximately 150 personnel on scene, the estimated cost savings was well in excess of $20,000. The drone assisted in preventing injuries to the suspect, personnel on scene, and the community. For some UAS programs, this one incident alone may justify a 4-year expenditure.

- **Example # 3** (Large Downtown Structure Fire)

  This scene covered a large structure fire in a dense downtown area. The fire caused extensive damage, rendering even adjacent buildings unsafe to enter. This was determined to be an arson fire. With the size and scale of this fire, almost every department in the city government was involved. The Fire Department deployed a drone during firefighting operations to aid the Incident Commander with situational awareness. The drone was also deployed after the incident to document the scene and map the city block. The orthomosaic map and 3D model were used by investigators to document the scene. The 3D model was also used create a virtual tour, which allowed officers from the Police Department, Building Department, Public Works, Finance Department, Mayor's Office, and City Council, to safely assess the scene. Information was spread more rapidly, services were restored more expediently and exposure to hazards were minimized.

  The day after the incident, the drone was used again with the fire investigation unit to enter the unstable structure and document the area of origin without undue risk to personnel. Currently, the documents, maps, and photos are being used by prosecutors with hopes of bringing the arsonist to justice.

6. Potential sources of funding

Drones are an emerging technology and adoption in the fire service is just beginning; as a result, many agencies have not made allowances in their general operating budget for the UAS Program and may have difficulty justifying an increase in budget without the tangible track record of success of an operational drone program. While MABAS strongly recommends that all member agencies interested in utilizing UAS assets budget accordingly, agencies that do not have a UAS Program in the budget can find resources to fund equipment acquisition and training through other sources. Below is a general, though not an exhaustive list of funding sources MABAS members have found to be useful. MABAS recommends prospective grant recipients familiarize themselves with the grant requirements before application.

Related information:

- Foreign Fire Tax (2% Fund)
- Fire Grants Help (Fire Rescue 1). *Search for Grants.* Retrieve from firegrantshelp.com
- EMS Grants Help. Retrieve from emsgrantshelp.com
- FEMA: *Assistance to Firefighters Grants Programs*. Retrieve from fema.gov
- Fire Grants. Retrieve from firegrants.info
- Firehouse Subs Public Safety Foundation. Retrieve from grants.firehousesubs.com
- Firefighters Support Foundation. Retrieve from ffsupport.org
- First Responder Grants. Retrieve from firstrespondergrants.com
- Urban Areas Security Initiative (UASI) Program. Retrieve from homelandsecuritygrants.info
- Walmart Community Grant Program. Retrieve from walmart.org
- Port Security Grants

C. CREW TRAINING AND CURRENCY

The specific requirements for training crewmembers may be found in *MABAS UAS Policy*, Chapter B Crewmember Roles and Responsibilities.

1. Initial training required

- Operations personnel who will be tasked with the role of UAS crewmember on a MABAS deployment shall have completed requisite training for their position to which they will be tasked, as specified in the MABAS UAS Policy, Attachment B Crewmember Roles and Responsibilities.

- Operations personnel who will not be tasked with the role of MABAS UAS crewmember on a MABAS deployment may receive initial training as specified by the AHJ or agency responsible for the UAS program.
- Regardless of operation, compliance structure, or MABAS affiliation operations personnel acting in the capacity of Remote Pilot in Command shall hold a current Part 107 Remote Pilot Certificate, and shall have received an applicable course and practical training to exercise the authority associated in any situation the Remote Pilot in Command is reasonably expected to encounter.

2. MABAS team requirements

It is the eventual goal of MABAS to assemble statewide and interstate deployable FEMA compliant UAS teams to provide statewide response capabilities to regions unable to support the establishment of local UAS programs. To maintain team status and membership, crewmembers shall obtain and maintain the training qualifications specified for team membership. These specifications will be distributed as teams are established.

3. Sources of compatible training

MABAS recommends agencies preparing to launch UAS programs carefully research the training vendors before selecting a source. MABAS UAS crewmembers will be expected to fly in situations and environments significantly beyond the capability of most civilian drone pilots. As such, MABAS expects that UAS crewmembers receive more specialized training from vendors with expertise in public safety.

Training vendor should meet the following guideline:

- Vendor should be intimately familiar with the MABAS UAS program, and associated compliance strategies.
- Vendor should provide a student-instructor ratio no greater than 1-6 during flight training to provide the most practical experience possible.
- Vendor should maintain a local presence and availability for recurrent training and service if necessary
- Vendor should be, or maintain an affiliation with a college, university, or public safety academy.
- Vendor should offer a public-safety focused curriculum, or track.
- Vendor's instructors tasked to train MABAS crewmembers should have comparable experience to the UAS Instructor Endorsement described in Chapter B, Crewmember Roles and Responsibilities (MABAS UAS Policy*).*

4. Maintenance of currency

Once initial training is completed, MABAS member agencies should prepare to maintain the proficiency of UAS operations personnel.

a. Yearly practical test

Agencies implementing UAS programs should consider instituting a yearly practical test for each crewmember to be tasked with the role of Remote Pilot in Command during a UAS operation. This practical test should be recorded and graded, against a criterion referenced standard to assess and document the performance of each pilot, and determine if additional recurrent training is needed.

b. Currency minimums (organized training)

In addition to the yearly practical test, agencies implementing UAS programs should ensure that each crewmember qualified to serve as Remote Pilot log at least 5 hours acting as Remote Pilot in Command every 90 days during dedicated training sessions.

D. EQUIPMENT ACQUISITION

Determining the right equipment must take into account a number of variables. Below is a list of the more common items for consideration, but it is not exhaustive.

- Types of incidents that a UAS would be utilized for.
- Types of UAS neighboring agencies are using (to support mutual aid interoperability).

- Initial UAS costs, including sensors and payloads.
- Manufacture support/warranty.
- Support equipment.
  - Transport vehicle (existing or new)
  - Aviation radio
  - Battery chargers
  - Inverter / generator
  - landing pad
  - Spare parts (propellers, screws, etc.)
  - Anti-collision lights

Cost is one of the most prominent factors for an agency acquiring new equipment. Agencies should consider not only the initial expenses but also recurring maintenance and equipment replacement. On average, an industrial UAS should have a life expectancy of 5 years, depending on severity of service. Accounting for an agency's startup cost, it should plan to budget 20% of the aircraft cost annually for equipment replacement and maintenance.

A key factor in determining equipment needs is interoperability with other UAS teams. Standardizing equipment helps to ensure that another agency responding to a mutual aid request can support continuous operations (by having interchangeable components such as batteries, air frames, sensors and controllers). Recommended equipment configurations may be found in the UAS equipment guide attachment.

E. FAA COMPLIANCE

Agencies that intend to implement a UAS Program should familiarize themselves with the federal aviation regulations pertinent for their intended operations, and their responsibility for compliance. Agencies may choose to launch their own drone programs, but access to MABAS UAS resources including insurance and regulatory support will only be granted to agencies that are compliant with MABAS's UAS policy.

1. Overview of the MABAS COA

MABAS-IL is currently in the process of finalizing a Certificate of Authorization (COA) with the Federal Aviation Administration to authorize specialized MABAS UAS responses anywhere within the state and beyond under a unified command and compliance structure once approved. This Certificate of Authorization (COA) is an agreement between the Federal Aviation Administration (FAA) and MABAS-Illinois, it allows MABAS Illinois to authorize any MABAS Agencies' pilots and aircrafts that meet the training and airworthiness requirements specified in the Certificate of Authorization (COA) to conduct UAS operations without the requirement of oversight or compliance management by the AHJ. The MABAS COA is designed to provide maximum flexibility and interoperability to UAS flight crews operating on MABAS deployments anywhere in the state.

NOTE: Statewide and interstate deployable MABAS UAS teams will be required to operate under the MABAS COA and MABAS UAS Policy.

To utilize the MABAS COA, the following criteria shall be met:

- Intended operation
  - Shall be a governmental function, as defined by the *United States Code*, 49 U.S.C § 40125: Qualifications for public aircraft status [3].

    NOTE: Not all functions conducted by a MABAS member agency qualify as "governmental functions" per statute. In *FAA Advisory Circular (ACs)*, 00-1.1B - Public Aircraft Operations [4].

  - Shall be in support of a MABAS mobilization or approved on a case-by-case basis by the UAS Section Chief.

- Flight crew
  - Shall meet minimum crew roles as defined in the MABAS COA.
  - Shall meet minimum training and certification levels for crewmember position as defined in the MABAS COA.
  - Shall not be a contractor or commercial flight service provider under contract with the AHJ. In FAA Advisory Circular (ACs), 00-1.1B – Public Aircraft Operations, section 9.
- Aircraft
  - Shall be a make and model approved for use under the MABAS COA.
  - Shall be maintained in accordance with manufacturers maintenance schedule or directives.

2. Agency compliance

Agencies implementing drone programs to conduct operations independently of MABAS may choose to develop their own methodology of compliance with federal aviation regulations. It is strongly recommended that agencies that intend to build localized drone programs do so in an interoperable manner with the MABAS UAS Program, even if they do not frequently intend to use MABAS resources or compliance protocols. Agencies that do not meet the requirements outlined in the MABAS UAS Policy may be ineligible to participate in MABAS deployments.

Agencies implementing UAS programs have two options for localized or agency specific compliance:

a. Civil operations under 14 CFR Part 107

Often cited as the quickest and most expedient method for authorization, UAS pilots who hold a Remote Pilot's Certificate can legally operate under that Part 107 regulations during the day, in reasonably good weather and visibility, and in uncontrolled airspace. Originally designed for commercial operations, Part 107 does not distinguish or apply scrutiny to type and nature of mission. For specialized operations, such as flying at night, in controlled airspace near a major airport, flying over people or moving vehicles, or flying beyond the pilot's line of sight, individual waivers are available. More information on the Part 107 regulations can be found in FAA Advisory Circular (ACs), 107-2 – Small Unmanned Aircraft Systems (sUAS) [5].

- Part 107 Pros
  - Not mission specific.
  - May not require any additional paperwork.
  - No FAA reporting burden.
  - Fly any drone you want, less than 55lbs.
  - Well understood regulatory program with extensive caselaw and support.
- Part 107 Cons
  - Restrictive operating rules (can't fly at night, beyond line of sight, over persons or vehicles, etc. without a waiver).
  - Must request authorization to fly in controlled airspace.
  - No exceptions for public safety mission types.

b. Public operations under a certificate of authorization pursuant by The Office of the Law Revision Counsel United States House of Representative.

See the United States Code, 49 U.S.C § 40125: Qualifications for public aircraft status, for more information [3].

The Public Certificate of Authorization process (Public COA) was designed by the Federal Aviation Administration (FAA) to support both manned and unmanned public aircraft operations and provides agencies a great deal of flexibility in justifying special operating circumstances.

To begin the Public COA process:

1) Your agency first needs to be declared in conformity with the statutes governing public operation of aircraft. This declaration should be provided to the Federal Aviation Administration (FAA) by the appropriate attorney (city, village, county, state attorney general).

2) Once approved, you'll be authorized to write your COA request. In this request, you'll be expected to demonstrate your operating, training, inspection, maintenance, emergency and other procedures, as well as make a safety case based on the procedures you develop.

For many exigent operations, Public COA provides the greatest amount of operational freedom. These include allowances to overfly persons, fly at night, request Temporary Flight Restrictions (TFRs) for manned and unmanned traffic, and call the FAA's System Operations Support Center (SOSC) in Washington, DC, for immediate amendments to the COA for emergency circumstances (see SGI Addendum, section C).

It is worth noting that the Public COA may only be used for "governmental operations" which may preclude certain non-exigent operations such as preplanning, and demonstrations for the public. MABAS recommends working with your agency's attorney to determine what if any operations that you intend to conduct fall outside of the bounds of "governmental functions" for missions undertaken using your agencies COA.

- Public COA Pros
  - Much greater flexibility than Part 107.
  - More access to controlled airspace.
  - Night operations approved by default.
  - Overflight of people approved by default.
- Public COA Cons
  - Limit to "governmental operations" pursuant to 49 U.S.C §40125: Qualifications for public aircraft status.
  - Monthly reporting requirements.
  - Greater upfront program development burden.

3. Special Governmental Interest Addendum (SGI Process, Formerly E COA)

The Special Governmental Interest (SGI) Addendum (formerly Emergency Certificate of Authorization) is a process by which the Federal Aviation Administration (FAA) may provide emergency authorization on a case-by-case basis to allow public safety agencies to operate UAS assets expediently in situations that would normally require a lengthy waiver or COA addendum process. Agencies should use the Special Governmental Interest (SGI) addendum process for emergency needs, where unforeseen circumstances require the UAS to be operated outside the bounds of the federal aviation regulations, or current authorizations. Agencies should be aware that the Special Governmental Interest (SGI) addendum is granted at the discretion of the FAA System Operations Support Center based on the specifics of the intended mission, and associated interest of safety of the NAS and the general public.

Example circumstances for SGI authorization:

- Emergency access to controlled airspace for overwatch on an active structure fire.
- Emergency need to operate over nonparticipating persons during search and rescue operations.
- Emergency need to operate in decreased visibility during water rescue operations
- Emergency need to access an area covered by a Temporary Flight Restrictions (TFR).
- Emergency need to establish a Temporary Flight Restrictions (TFR).to prevent incursion by nonparticipating aircraft.

The complete, step-by-step process of requesting a Special Governmental Interest (SGI) addendum may be found in the Air Traffic Organization Policy. MABAS member agencies or flight crews requesting a Special Governmental Interest (SGI) addendum should familiarize themselves with JO7200.23 before requesting.

See Air Traffic Organization Policy (UAS), Order JO 7200.23, section 7, for more information [6].

F. COMMUNITY AWARENESS AND ENGAGEMENT

Historically, drones have been met with skepticism from the public. The rapid emergence of this technology has led to privacy and safety concerns from many. It is incumbent on the public safety agencies adopting this technology to actively work to allay the concerns of their communities through education, transparency, and the active promotion of the safe, responsible and ethical use of drone technology.

Agencies can inform and engage the community by sharing the successes of the drone program through:

1. Official Department Social Media Accounts.
2. Official Fire Department press releases to the media.
3. Public Service Announcements to inform the general public about safe drone use.
4. Community demonstrations and presentations during planned events.
5. Other events when the department has a presence in the community.
    - Job Fairs
    - Fire Station Open Houses
    - Neighborhood Meetings / Block Parties
    - Fire Safety Presentations

As an emerging technology, drones inspire attention from local media. Agencies can take advantage of increased media attention by inviting media outlets to a demonstration of the capabilities of the drone program and describing its successes and intent. This full transparency allows the agency to alleviate the concerns of the community, promote the usefulness of the program, and out its direct impact on the safety and wellbeing of the community.

In addition to educating the community, it's vital to ensure all members of the department are educated on the value drones can provide in public safety. While not all department members will be active flight crew, all should understand the practical deployment considerations of the UAS relevant safety procedures. MABAS strongly recommends all department personnel complete at least awareness level training so as to be adequately informed about, and advocate for, the use of UAS by public safety agencies.

References:

[1] Hylton Haynes. (2017). U.S. Firefighter Injuries in 2016. National Fire Protection Association (NFPA). Retrieve from NFPA.org.

[2] Fire-Related Firefighter Injuries Reported (2012-2014). PDF. FEMA. Retrieve from usfa.fema.gov.

[3] 49 U.S.C § 40125: Qualifications for public aircraft status. The United States Code. Retrieve from uscode.house.gov.

[4] FAA Advisory Circular (ACs). 00-1.1B - Public Aircraft Operations. PDF. Retrieve from faa.gov.

[5] FAA Advisory Circular (ACs). 107-2 - Small Unmanned Aircraft Systems (sUAS). PDF. Retrieve from faa.gov.

[6] Air Traffic Organization Policy (UAS). Order JO 7200.23, section 7. PDF. Retrieve from faa.gov.