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UNMANNED AIRCRAFT SYSTEM FOR MEDIA PRODUCTION: AN EXTENSION OF DEFENSE TECHNOLOGY

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Abstract

The defense industry has played a major impact in enhancing global economy. S-curve 11th is the target industry which promotes Eastern Economic Corridor (ECC) in Thailand. The state-of-the-art in defense technology is increasing all the time including Unmanned Aircraft System (UAS) which can be used for the media production in defense technology. UAS pilots for media production in defense technology are different from other UAS pilots. They require hard and soft skills such as management, decision, planning and knowledge for controller and cinematography including ability to choose and operate the right equipment for filming aerial movies properly and creative talent to film movies. The UAS knowledge and controller can be learned from a remoted pilot license course but the soft skills can be partly developed from experiences. The

purpose of this study is to lay guideline for using the UAS media production in defense technology with the expectation of providing specific views and multiple domains in research area. It is a combination of engineering, science, art and management. The content in this article is based on experiences from UAS operation.

Keywords

Unmanned Aircraft System, Cinematography, Media Production, Defense Technology

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1. Introduction

Unmanned Aircraft System (UAS) or Unmanned Aerial Vehicle (UAV), commonly known as a drone, is an aircraft system without pilots on board. It can be operated manually and autonomously for take-off, landing, holding the position, orbiting and moving with waypoint by remote control or command and control station (Tsach et al., 2010). UAS is very popular for applying in many fields for examples; spreading the water or fertilizer and sowing the seeds for agriculture, searching and rescue, surveillance and reconnaissance, terrain mapping with 3D model and cartography, military mission and army, transport infrastructure planning, delivery service, virtual tourism, sports or events monitoring, wildlife tracking, enjoyment and media production (Šulyová & Vodák, 2020). The UAS is one kind of director tool for autonomous media production. It performs on production perspective with bird eye view, multi-view and concurrent shots which are different from the simple production (Romero et al., 2020).

Defence Technology Institute (DTI) under Ministry of Defence of Thailand is responsible for research and development on defense technology which requires approval from Defence Council. The output prototypes and innovations have impacted not only on the military but also civilian purposes (Defence Technology Institute, 2009).

Recent innovative and developed output of DTI includes explosive ordnance disposal robot (EOD Robot), amphibious armored personnel carrier (AAPC), armored personnel carrier (APC), ground to ground multi-purposed launcher, multi-purposed craft (MPC) and UAS. For the UAS, DTI has developed several sizes of aircraft such as mini (see Figure 1), small and medium in accordance with various usage purposes.

The UAS can be a major tool for defense technology media production. There are a lot of media types such as photos, videos, newspapers, posters, presentations and websites. The UAS technology can support experimental research and development processes and show usability,

performance and efficiency. Therefore, the UAS for media production can offer the degree of freedom superior to specific physical constraints in camera crane, dollies, steadicams and camera track (Galvane et al., 2017). The main purpose of UAS media production is to create a unique scene which costs less than shooting on a helicopter or an airplane.

Figure 1: *The mini UAS (D-Eyes 02) by DTI*
(Source: Tantawutho, T. on January 2019)

2. Literature Review

The UAS standard operating procedure (SOP) is a guideline or recommendation for UAS flight operation planning and execution which included the best practices and processes for safety and effective flight operations such as the UAS pilot roles and responsibilities, mission phases, and emergency procedures (North Carolina Department of Transportation, 2022). There might be some differences on the SOP according to the local laws, local regulations, missions and objectives of UAS flight authorities. For examples in the Air Navigation ACT B.E. 2497 (A.D. 1954) and Announcement of the Ministry of Transport on Rules to Apply for Permission and Conditions to Control and Launch Unmanned Aircraft in the Category of Remotely Piloted Aircraft B.E. 2558 (A.D. 2015) for Thailand, section 24 stated that “No person shall control or release a pilotless aircraft or release a parachute unless written permission has been obtain from the minister and the conditions specified by the minister are complied with.”, section 5 stated that “This act shall not apply to air navigation in the military service, police service and other government services as specified in the ministerial regulations.” (Civil Aviation Authority of

Thailand, 2016) and article 4 stated that "Remotely piloted aircraft is divided into two categories which are for the purpose of hobby, entertainment, or sport (recreation) and other purposes where its weight does not exceed 25 kg such as reporting incidents or traffic-related matters, photographing, filming or TV programs, research and development of aircraft and other purposes." (Civil Aviation Authority of Thailand, 2017).

There are no different on the main phases for operation including pre-flight, during flight (in-flight) and post flight (see Table 1). However, there are some deviations on sub phases according to the purposes of mission.

Table 1: *The three main phases for UAS operation*

Citation	Title
Shinnamon & Cowell, 2014	Building and Managing a Successful Public Safety UAS Program: Practical Guidance and Lessons Learned from the Early Adopters
Valdovinos, Specht, & Zeunik, 2016	Community Policing & Unmanned Aircraft Systems (UAS): Guidelines to Enhance Community Trust
Civil Aviation Authority of Thailand, 2017	Remotely Piloted Aircraft (RPA) Regulation
Connecticut Department of Transportation, 2019	CTDOT Unmanned Aircraft Systems (UAS) Standard Operating Procedures
Weldon, Hupy, Lercel, & Gould, 2021	The Use of Aviation Safety Practices in UAS Operations: A Review
Cromwell, Giampaolo, Hupy, Miller, & Chandrasekran, 2021	A Systematic Review of Best Practices for UAS Data Collection in Forestry-Related Applications
New England Departments of Transportation, 2021	Develop Implementation Procedures for UAS Applications

(Source: Tantawutho, T. on May 2022)

The UAS media production in defense technology has the processes or phases in editing customizing and analyzing the media production with the engineering or experimental results after completing the post flight phase. There are some problems or issues on combining the UAS flight for defense technology and media production because there is no standard and

recommended guideline. This study might provide some suggestions in applying the UAS media production to defense technology development.

3. UAS Media Production Challenges

UAS photography has many advantages in creating maps, sightseeing, recording evidence, searching and rescue, and cinematographic media production. The UAS or drone media production is used for reporting and capturing news or events by taking footage and pictures of breaking news. It assists the reporters and journalism to work easily and safety in difficult situations such as floods, drought, earthquake, landslide and fire (Tilak, 2020). The visual reporting and entertainment are the other advantages in UAS media production by presenting the new perspectives and wide frame on media (Harvard et al., 2020). The UAS media production creates a fascinated perspective of pictures and videos as well as captivates the audiences, more exciting than common media from a bird eye view. The aerial cinematography must give a special attention to both the aesthetics of the frame captured and the dynamic motion. The essential of UAS cinematography competencies are included knowledge, skill and attitude on flight controlling, filming and photography. However, there are many limitations for operating UAS such as limited operation range of distance, flight ceiling, flight time, wind direction and velocity, weather, visibility, no-fly zone and permission requirements. There are several rules and regulations to follow such as Notice to Airmen (NOTAM) and flight regulations which are related to The International Civil Aviation Organization (ICAO) and The Civil Aviation Authority of Thailand (CAAT) regulations (Phrommas, 2016).

3.1. Non-Technical Issues

These are issues related to the laws and regulations.

3.1.1. Flight Regulations

The flight regulations in Thailand are released by CAAT. These regulations cover various topics such as UAS types, weight, flight height and radius, flight time, restricted area and distance between object and person. The UAS must operate in daytime from sunrise to sunset. Operating UAS in 9 kilometers near any airports or temporary airfields is prohibited. Additionally, UASs are not allowed to fly close to any hospital, government places and some restricted areas without permission (Civil Aviation Authority of Thailand, 2017). However, the remoted pilot license has not been requiring by the law at present in Thailand.

3.1.2. Data Privacy and Laws

The data privacy for UAS photos and videos is controlled by the legal restrictions in many countries. The privacy concerns human faces or facial images and videos if it is not agreed upon (Mademlis et al., 2018).

3.1.3. Coordination

The UAS has been used in numerous missions. However, it is confronted with communication misunderstanding which is caused by poor collaboration among stakeholders such as UAS staffs (mission commander, internal pilot, external pilot, payload operator and technician), media production director and staffs, air traffic controller or flight rule operator etc. (Headquarters Department of the Army, n.d.).

3.2. Technical Issues

These are issues related directly to the operation of UAS.

3.2.1. Pilot Skill and Competency

The UAS accident rate has been increasing rapidly and the cause of this error includes skill-based error, poor decision making and perception error. The skill-based errors occurred when the UAS controllers have insufficient skill, competency and experiences. If the controllers have insufficient knowledge, they might perform poor subsequent decision making. Perception error is caused by misconception or misjudgment (Oncu & Yildiz, 2014). Basic knowledge requirement for the UAS pilot are UAS regulations, airspace classification and operation, weather, loading and performance and operations such as radio communications procedures, airport operations, emergency procedures, aeronautical decision making, physiology and maintenance and inspection procedures (The Federal Aviation Administration, 2018).

3.2.2. Mission and Scenario Planning

The UAS usage in public and military environments is well known. In the public sectors, UAS has been used in forestry, agriculture and searching and rescue but the military has more specific missions. Therefore, mission requirements are important because they are related to management, planning, safety and communication (Eaton et al., 2016).

3.2.3. UAS Classification

The UAS classification is based on different aspects which are not complicated. They may be classified by weights, operation altitude, mission radius, endurance and typical use. The categories of UAS can be grouped as High Altitude Long Endurance (HALE), Medium

Altitude Long Endurance (MALE), Medium Range or Tactical UAV (TUAV), Mini UAV (MUAV), Micro UAV (MAV) and Nano Air Vehicles (NAV) according to the flight missions (Gupta et al., 2013).

3.2.4. **Environment**

The effectiveness of completion of mission in UAS depends on the environment conditions. The impacts of environment include visibility, safety and completion of a mission. The UAS pilots should be concerned with sun-angle, illumination, cloudiness, wind velocity and direction, weather, humidity, location and geo-referencing or ground point (Tmusic et al., 2020)

3.2.5. UAS System

The issue on the UAS systems is related to limited payload, limited battery life or flight time, disturbing sound from engines and propellers, autonomous UAS software, line of sight between the UAS pilots and aircraft and unplanned missions (Mademlis et al., 2019). Path planning (waypoint) and targeted navigation (tracking) are basic functions in commercial UAS which are easily to use; however, the reliability and agility are involved with the software algorithms and equipment (Zhou et al., 2020).

3.2.6. Communication System

The UAS communication system capabilities and efficiencies are the major factors in all missions. There are many network architectures suitable for UAS specific functions, services and requirements. The common UAS network architecture is ad-hoc, consisting of the remote control and drone. It is always used in the commercial drones also for the performance operations. There are several architectures such as relay nodes, network gateways, satellite, UAS to UAS (U2U), UAS to Infrastructure (U2I), distributed control, centralize control, pre-programmed control and UAS based data storage which could be used. The techniques and architectures can be applied only to appropriate environment applications and missions (Jawhara et al., 2017).

3.2.7. UAS Cinematography

The various shot types in UAS cinematography can be described in two criteria. The first type is Framing Shot Type (FST). The FST is based on visual inspections or scene perspectives such as Extreme Long Shot (ELS), Very Long Shot (VLS), Long Shot (LS), Medium Shot (MS), Medium Close-Up (MCU), Close-Up (CU), Two-Shot/Three-Shot (2S/3S) and Over The-Shoulder (OTS). The second type is UAS/Camera Motion Trajectory (CMT). The CMT is related to the motion of UAS and camera such as Static Shot (SS), Static Shot of Still Target

(SSST), Static Shot of Moving Target (SSMT), Static Aerial Pan (SAP), Static Aerial Tilt (SAT), Fly-Over (FLYOVER), Fly-By (FLYBY), Chase/Follow Shot (CHASE) and Descent (DESCENT). These techniques are flexible. The UAS pilot can apply different techniques in one scene but the pilot must be aware of complicated contents (Mademlis et al., 2019). The media production skill is one of the creating media skills.

4. UAS Media Production in Defensive Missions

In the military and defensive missions, the combat camera has the responsibility to service support in graphic, multimedia, photographic and videography service (Marine corps combat service support schools, 2022). The UAS media production in defense technology will support the aerial media to complete the media production in defense technology. As a result, the competency of the UAS media production in defense technology pilot includes not only basic flight maneuver and aerial filming but also tactical flight operation and beyond visual line of sight (BVLOS) operation which offered only for military and some government officers.

The data and information in this study are based on four year experiences on UAS media production in defense technology of the authors which covered AAPC sea operation, MPC maneuver experiment, ground to ground multi-purposed launcher ranging test and APC controlled test. In addition, several reports and literatures were reviewed. Qualitative techniques such as narrative, descriptive, illustrative, comparing and summarizing had been used in order to get the results.

There are many studies and practices in this area which provide some recommendations and guidelines for the UAS media production pilots as follow (Unmanned Aircraft Systems Training Centre, 2021).

4.1 Pre-Flight (Preparation)

There are 5 steps in preparation process which are gathering the mission information and planning, choose the appropriate aircraft, comply with the standard and regulation, select the operating area and dry run and test flight (see Figure 2).

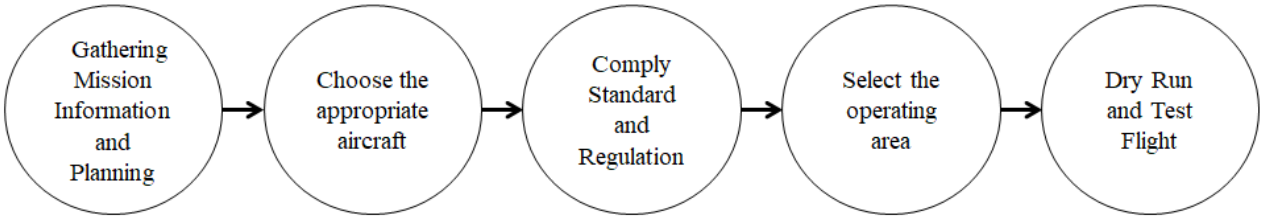

Figure 2: *The UAS mission preparation steps*

(Source: Tantawutho, T. on May 2022)

- The UAS pilots must complete the flight regulations and laws before operating any UAS. There are 3 types of controlled area namely danger area, prohibited area and restricted area. The danger area is the area which activities dangerous to the flight of aircraft. The operators or pilots of aircraft that are necessary to assess this area must relate to responsibility for the safety of aircraft. The prohibited area is the area which is prohibited the flight of aircraft. The operators or pilots of aircraft must require the authorization from the appropriate organization. The restricted area is the area which is specified conditions. The operator or pilots of aircraft must require the authorization from the appropriate organization and comply with specified entry criteria (Civil Aviation Authority of Thailand, 2020). There are some commercial UASs which are complying with the international flight regulations. They are not allowed to takeoff, calibrate or operate the system in or nearby No-Fly Zone such as airports, palaces, military zones and other restricted areas. For military operations, they use their own system for the mission.

- The UAS pilots must clearly understand the overall of missions and create the storyboards such as the flight path, UAS movement and camera motion.

- The UAS pilots must have a clear perception of the mission area. Each mission areas need some specific considerations. Firstly, obstacles such as mountain, building, tree etc. which affect to UAS line-of-sight communication, visibility and safety must be considered. Secondly, the UAS operation areas including takeoff/landing areas, emergency landing areas (ditching points), ground points or reference points and flight paths must be carefully specified. Thirdly, signal usage which is important to the communication system and datalink must be reviewed. Engineers/technicians must use a spectrum analyzer or equipment to analyze the frequency, transmission power and direction of signal in mission areas.

- The UAS pilots must plan and choose the compatible UAS for government missions and areas. Military missions are different from the private ones such as recording the missile launchers testing in Army, monitoring the AAPC sea operations in Navy, tracking the drug trafficking for policemen and searching the wildfire for foresters.
- The UAS pilots must concentrate on the weather forecast including Meteorological Report (METAR), Terminal Aerodrome Forecast (TAF), weather radar information, weather satellite radar information or the related weather data and NOTAM. The NOTAM is the information notice for an aviation authority to alert aircraft pilots.
- Dry run and test flight in the real environment should be administered before the mission starts. UAV does not always conduct takeoff and landing on the ground or land. However, it sometimes does go on the naval ship deck, craft, boat, truck, high building, wild, beach and mountain or by pilot hand UAS (see Figure 3).

Figure 3: *The UAS pilots test flight in preparation process*
(Source: Tantawutho, T. on October 2020)

4.2. In Flight (Operation)

- The UAS sometimes cannot perform takeoff or landing on the ground. Sometimes, the pilot has to use his hands as an alternative.
- Ground points are very important for the UAS pilots because all flying missions are based on pilot visualization. The selected ground point must be identified for easy to notice.
- There are unreceived Global Positioning System (GPS) signal problems sometimes, which may be caused by magnetic field, obstacles and signal reflection. The magnetic field may

occur when UAS takeoffs on the metal ground such as heliport, ship dock and craft. This material effects the GPS signal receiver and creates poor GPS signals. The obstacles and signal reflection occur while UAS takeoffs in the wild or tall building area. The UAS altitude measurement may get some errors. As a result, UAS pilots must carefully control the UAS according to his visual and gimbal (UAS camera). Moreover, the offline map can be applied to support some additional information.

- The UAS pilots for media production must be aware of the effects from the military missions. Examples are pressure reflection from artilleries or launchers after firing and communication interferences from other signal operations. The pressure reflection may cause damages to the UAS. The communication interferences are created by radar, high voltage poles and telephone poles. This equipment use similar frequency, high transmission power and similar operated direction. Therefore, these situations may interfere with UAS communication and datalink. The operating team and UAS pilots should have a backup plan and reserved operating area to avoid the interferences or use the other controlled radio frequency.
- Battery endurance planning is not corresponding to mission plan because of urgently changing mission. UAS pilots have to control the UAS to return home point for battery changing and fly back to complete the mission. The UAS pilots must create new power supply plans for any changing missions. They sometimes have only one chance to record a video.
- The immediate change of mission may not fit with the old flight plan or storyboards. The changing mission may affect time, light, objects and elements in media production. The UAS pilots should have backup plans. As a result, they will not miss the mission objectives.
- The UAS pilots must operate aircraft carefully in an area of valley, mountain, sea, wild or places obviously changing weather or wind and birds.

4.3. Post-Flight

- The UAS pilots must do post flight inspection immediately after finishing each flight because it is necessary to inspect and clean the aircraft. The advantages of inspection are to check any damages and to get aircraft ready for the next flight. Moreover, the UAS pilots need to clean the dust and another dirtiness. This activity is for safety purpose.
- The UAS pilots must record flight operation data into pilot logbook and aircraft logbook.

- The UAS pilots must periodically check and maintain the aircraft apparatus such as battery lifetime, gimbal and camera, vision system, airframe, propellers, motors, antenna, indicator light, landing gears, card slot or link port, system configuration or version and another equipment. The maintenance cycles should be started on each manual. For example, the battery is one important part for the source of power. There is the limited charged cycle for the performance and quality.
- The UAS pilots and production team must check the integrity of recording files and should arrange the media files before going for the next production processes.

5. UAS Cinematography for Defense Technology

A framing shot type is significant in media production. The defense technology media product mostly uses the wide and long shot because of safety reason of the aircraft. The UAS pilots must gain the knowledge, competency and skills in controlling both the aircraft and the camera. Many operations can be recorded only once. Camera assistant functions and application may assist the UAS pilots to operate the camera easily. However, the UAS and camera manual mode may provide better scenes. According to hands or manual operation, the UAS pilots are able to control not only the frame vibration between UAS speed and shutter speed but also the involvement of foreground, background and objects.

Most of military innovative research outputs have been tested during daytime (see Figure 4). The media production process has been performed along with the testing procedures. The photo format, photo modes, video resolution, white balance (Warm and Cold), aperture, shutter speed, ISO (Sensitivity), exposure values or EV (Brighten and Darken), EV compensation, camera histogram (White and Dark), camera orientation, dynamic range and focus are primary factors for media production. These factors can be configured for different frames and environments. The RAW photo format which is an uncompressed image format may produce a better photo quality than JPEG which is a compressed digital image but JPEG requires less time in processing. Manual camera settings may get better natural results than automatic camera setting but the automatic setting one can take several shots continuously. A histogram function can set the exposure which supports the dynamic range to camera. Lowest ISO values may reduce noise for light up but the high value can solve diffused light problems. The shutter speed is determined by the frames per second (fps); therefore, it is related to the bit of motion blur. EV

compensation should be configured before shooting photos or videos in order to compensate the light. The filter is another alternative solution for reducing light intensity, reflection and noise. White balance and color are used to show contrast, detail, shadow, highlight and dynamic range. Panorama shooting is captivated to the audiences for showing wide and overall scene while the point of view (POV) or point of interest (POI) is suitable for emphasizing an object. There are necessary to permit the flight permission and announce the NOTAM before operating the UAS for the nighttime mission. The thermal camera is more suitable than the electro optic camera or daytime camera. The spotlight, flashlight and torch are very important equipment for the safety takeoff and landing, specified takeoff and landing area, pre-flight and post-flight.

Figure 4**:** *The AAPC's sea testing operation photo by multi-rotor UAS*
(Source: Khongphueng, V. on June 2020)

For civilian mission example, the UAS DTI operating team has supported The Marine Department to surveying and inspecting the oil pipeline leakage under the east sea of Thailand by the hybrid tactical UAS. The operating radius is approximately 10 kilometers (see Figure 5 and 6).

Figure 5: *The hybrid tactical UAS from DTI*

(Source: Tantawutho, T. on March 2022)

Figure 6: *The oil pipeline leakage from UAS camera*

(Source: Tantawutho, T. on March 2022)

Many UAS severe incidents caused by the carelessness of staff members have been recorded. For situation awareness, the UAS pilots should identify, analyze, assess and control the flight situation. All the risks have to be controlled at higher than a standard level.

6. Conclusion and Future Opinions

UAS has been used widely in media production in Thailand. However, there is no central organization responsible for UAS registering, training pilots and supportive staffs and advising

for the UAS maintenance. Although, there are many UAS training courses offering in Thailand such as agriculture drone, mapping drone and drone course for beginner but not many of them have been approved or authorize by CAAT and ICAO. In 2022, The Unmanned Aircraft Systems Training Centre, Defence Technology Institute (DTI-UTC) is the only approved training organization (ATO) in Thailand which is compiled the standard from CAAT requirement. The 2 approved UAS training courses are Remote Pilot Visual Line of Sight Certification (RVC) and Instructor Remote Pilot Visual Line of Sight (Multi-Rotor) (IRPC). However, there is no approved UAS cinematography and UAS cinematography for defense technology training course directly in Thailand.

The knowledge and skills from UAS media production in defense technology training course are important and utilize widely in military missions. They also apply for non-military missions especially in critical situations such as disaster and public danger. As a result, a specific training course should be developed to serve non-military function. For future study, the ATO should emphasis on developing the UAS cinematography for defense technology training course for military and non-military mission in order to support the risky mission or crisis, defense technology experiment and research and defense industry. It also reflects some different perspectives in utilizing media production in defense technology for civilian operation.

The scope of this study is limited on the laws and regulations in Thailand such as Air Navigation ACT B.E. 2497 (A.D. 1954), Announcement of the Ministry of Transport on Rules to Apply for Permission and Conditions to Control and Launch Unmanned Aircraft in the Category of Remotely Piloted Aircraft B.E. 2558 (A.D. 2015) and Thai Remotely Piloted Aircraft (RPA) regulation. The UAS pilots must comply with the local laws, local regulations and controlled airspace on UAS flight. Additionally, safety, conflict and privacy are the concerned topics.

REFERENCES

Civil Aviation Authority of Thailand. (2016). Air Navigation ACT B.E. 2497. Retrieved from https://www.caat.or.th/wp-content/uploads/2016/09/THAILAND-AIR-NAVIGATION-ACT-B.E.-24971954-1.pdf

Civil Aviation Authority of Thailand. (2017). Announcement of the Ministry of Transport on Rules to Apply for Permission and Conditions to Control and Launch Unmanned

Aircraft in the Category of Remotely Piloted Aircraft B.E. 2558 (A.D. 2015). Retrieved from https://www.caat.or.th/wp-content/uploads/2017/02/Announcement-of-the-Ministry-of-Transport.pdf

Civil Aviation Authority of Thailand. (2017). Remotely Piloted Aircraft (RPA) Regulation. Retrieved from https://www.caat.or.th/en/archives/category/aviation-en/drone-en

Civil Aviation Authority of Thailand. (2020). ENR 5 Navigation warnings. Retrieved from https://aip.caat.or.th/2020-06-18-AIRAC/html/eAIP/VT-ENR-5.1-en-GB.html

Connecticut Department of Transportation. (2019). CTDOT Unmanned Aircraft Systems (UAS) Standard Operating Procedures, Newington.

Cromwell, C., Giampaolo, J., Hupy, J., Miller, Z., & Chandrasekaran, A. (2021). A Systematic Review of Best Practices for UAS Data Collection in Forestry-Related Applications. Forest 2021, 12(957), 1-19. https://doi.org/10.3390/f120709

Defence Technology Institute. (2009). *About Us Vision*. Retrieved from https://www.dti.or.th/page_a.php?cid=12&cname=Vision

Eaton, C. M., Chong, E. K. P., & Maciejewski, A. A. (2016). Multiple-Scenario Unmanned Aerial System Control: A Systems Engineering Approach and Review of Existing Control Methods. Journal of Research in Aerospace, 3(1), 1-26. https://doi.org/10.3390/aerospace3010001

Galvane, Q., Fleureau, J., Tariolle, F. L., & Guillotel, P. (2017). Automated Cinematography with Unmanned Aerial Vehicles. Eurographics Workshop on Intelligent Cinematography and Editing, 23-30. doi: 10.2312/wiced.20161097

Gupta S. G., Ghonge M. M., & Jawandhiya, P. (2013). Review of Unmanned Aircraft System (UAS). International Journal of Advanced Research in Computer Engineering & Technology, 2 (4), 1646-1658. https://doi.org/10.2139/ssrn.3451039

Harvard, J., Hyvönen, M., & Wadbring, I. (2020). Journalism from Above: Drones and the Media in Critical Perspective. Media and Communication, 8(3), 60-63. doi: 10.17645/mac.v8i3.3442. https://doi.org/10.17645/mac.v8i3.3442

Headquarters Department of the Army, Unmanned Aerial Vehicle Aircrew Training Manual (TC 34-212), Washington, DC.

Jawhara, I., Mohamedb, N., Al-Jaroodic, J., Agrawald, D. P., & Zhang, S. (2017). Communication and networking of UAV-based systems: Classification and associated

architectures. Journal of Research in Network and Computer Applications, 84, 93-108. https://doi.org/10.1016/j.jnca.2017.02.008

Mademlis, I., Mygdalis, V., Nikolaidis, N., & Pitas, I. (2018). Challenges in Autonomous UAV Cinematography: An Overview. International Conference on Multimedia and Expo (ICME). San Diego, USA. https://doi.org/10.1109/ICME.2018.8486586

Mademlis, I., Mygdalis, V., Nikolaidis, N., Montagnuolo, M., Negro, F., Messina, A., & Pitas, I. (2019). High-Level Multiple-UAV Cinematography Tools for Covering Outdoor Events. Transactions on Broadcasting, 65 (3), 627-635. https://doi.org/10.1109/TBC.2019.2892585

Mademlis, I., Nikolaidis, N., Tefas, A., Pitas, I., Wagner, T., & Messina, A. (2019). Autonomous UAV Cinematography: A Tutorial and a Formalized Shot Type Taxonomy. ACM Computing Surveys, 52 (5), 1-33. https://doi.org/10.1145/3347713

Marine corps combat service support schools. (2022). Combat Camera – Communication Strategies. Marine Corps Combat Service Support Schools. Retrieved from https://www.trngcmd.marines.mil/Units/South-Atlantic/MCCSSS/Units/Combat-Camera/

New England Departments of Transportation. (2021). Develop Implementation Procedures for UAS Applications. New England Transportation Consortium (NETC) NETC 18-3.

North Carolina Department of Transportation. (2022). UAS Standard Operating Procedures. Retrieved from www.ncdot.gov/aviation/uas

Oncu, M., & Yildiz, S. (2014). An Analysis of Human Causal Factors in Unmanned Aerial Vehicle (UAV) Accidents. California: Naval Postgraduate School. https://doi.org/10.21236/ADA620843

Phrommas, R. (2016). Aerial Photography: An Alternative Endorsement of Brand Advertising. NU Research and Innovation Towards Sustained Society, 12, 2094–2105.

Romero, A. M., González, A. T., Capitán, J., Montagnuolo, M., Metta, S., Negro, F., Messina, A., & Ollero, A. (2020). Director Tools for Autonomous Media Production with a Team of Drones. Applied Sciences, 10 (4). https://doi.org/10.3390/app10041494

Shinnamon, D. L. & Cowell, B. M. (2019). Building and Managing a Successful Public Safety UAS Program: Practical Guidance and Lessons Learned from the Early Adopter. *National Police Foundation.*

Šulyová, D. & Vodák, J. (2020). Benefits and limitations of using UAVs in different areas with a focus on the environment. Journal of Information, Control and Management Systems, 18(2).

The Federal Aviation Administration. (2018). Remote Pilot – Small Unmanned Aircraft Systems (Certification and Recurrent Knowledge Testing) Airman Certification Standards.

Tilak, G. (2020). Drones and media industry. RUDN Journal of Studies in Literature and Journalism, 25(2), 360-366. https://doi.org/10.22363/2312-9220-2020-25-2-360-366

Tmusic, G., Manfreda, S., Aasen, H., James, M. R., Goncalves, G. R., Dor, E. B., …McCabe, M. F. (2020). Current Practices in UAS-based Environmental Monitoring. Remote Sensing, 12 (6). https://doi.org/10.3390/rs12061001

Tsach, S., Tatievsky, A., & London, L. (2010). Unmanned Aerial Vehicles (UAVs). In The Encyclopedia of Aerospace Engineering. doi: 10.1002/9780470686652.eae385

Unmanned Aircraft Systems Training Centre, Defence Technology Institute. (2021). Standard Operation Procedure (SOP), 1 (1).

Valdovinos, M., Specht, J. & Zeunik, J. (2016). Law enforcement & unmanned aircraft systems (UAS): Guidelines to enhance community trust. Office of Community Oriented Policing Services and National Policing Institute. Retrieved from https://www.policinginstitute.org/publication/community-policing-unmanned-aircraft-systems-uas-guidelines-to-enhance-community-trust/

Weldon, W.T.,Hupy, J., Lercel, D., & Gould, K. (2021). The Use of Aviation Safety Practices in UAS Operations: A Review. Collegiate Aviation Review International, 39 (1), (pending). Retrieved from http://ojs.library.okstate.edu/osu/index.php/CARI/article/view/8090/7470

Zhou, X., Yi, Z., Liu, Y., Huang, K., & Huang, H. (2020). Survey on path and view planning for UAVs. Journal of Research in Virtual Reality & Intelligent Hardware, 2 (1), 56-69. https://doi.org/10.1016/j.vrih.2019.12.004