Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(*NATIONAL OCCUPATIONAL SKILLS STANDARD*)

H512-001-3:2019

DRONE MISSION COMMANDING
PEMERINTAHAN MISI DRON

LEVEL 3

Department of Skills Development (DSD)
Federal Government Administrative Centre
62530 PUTRAJAYA, MALAYSIA

NATIONAL OCCUPATIONAL SKILLS STANDARD

DRONE MISSION COMMANDING

PEMERINTAHAN MISI DRON

LEVEL 3

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Abbreviation

1.	AGL	Above Ground Level
2.	AMSL	Above Mean Sea Level
3.	AR	As Required
4.	ARTF	Almost Ready to Fly
5.	ATC	Air Traffic Controller
6.	BGSP	Bahagian Geospatial Pertahanan
7.	CAAM	Civil Aviation Authority of Malaysia
8.	DRONE	Dynamic Remotely Operated Navigational Equipment
9.	EMF	Electromagnetic Field
10.	ERP	Emergency Response Plan
11.	ESC	Electronic Speed Controller
12.	FC	Flight Controller
13.	FPV	First Person View
14.	GCS	Ground Control Station
15.	GCS	Ground Control Systems
16.	GPS	Global Positioning Systems
17.	HSE	Health, Safety and Equipment
18.	IMU	Inertial Measurement Unit
19.	INS	Inertial Navigational Systems
20.	ISBN	International Standard Book Number
21.	JPK	Jabatan Pembangunan Kemahiran
22.	JUPEM	Jabatan Ukur Dan Pemetaan
23.	LED	Light Emitting Diode
24.	LIPO	Lithium Polimer
25.	LOS	Line of Sight
26.	M/S	Meter Per Second

27. MCMC	Malaysia Communication and Multimedia Commision
28. MUDAS	Malaysian Unmanned Drone Activist Associate Malaysia
29. NICD	Nickel Metal Hydride
30. NOSS	National Occupational Skills Standard
31. OSD	On Screen Display
32. PBL	Problem Based Learning
33. PPE	Personal Protective Equipment
34. RC	Radio Controller
35. RPM	Revolution Per Minute
36. RTF	Ready to Fly
37. RTH	Return to Home
38. RTL	Return to Launch
39. SBT	Scenario Base Training
40. SKMM	Suruhanjaya Komunikasi Dan Multimedia Malaysia
41. SOP	Standard Operating Procedure
42. UAV	Unmanned Aerial Vehicle
43. UTM	UniversitiTeknologi Malaysia
44. VTOL	Vertical Takeoff and Landing
45. WP	Waypoint
46. MSDS	Material Safety Data Sheet

Glossary

1.	2.4 Ghz Spread Spectrum	Ghz is short for gigahertz and describes the radio frequency rate used by a drone controller. The 2.4 gigahertz spread spectrum controllers have become the gold standard for low budget drones. Because the spread spectrum is "frequency agile," it can "hop" to different frequencies to account for any atmospheric or other issues a drone pilot may experience, which means fewer crashes.
2.	5.8GHz	Used in hobby and professional grade RC drones. A live feed sent from a drone's camera that provides better range and less lag, very popular in FPV racing and usually paired with a set of FPV goggles.
3.	Accelerometer	A device that measures the acceleration forces in a certain direction and helpful in maintaining the Drones orientation. These devices are used to staNo.ize quadcopters.
4.	AGL	Altitude above ground level.
5.	Altitude Hold function	Allows pilot to focus on the camera while the drone hovers steadily in air by itself at a set height. An Onboard barometer is needed to allow Altitude Hold.
6.	ARF	Almost ready to fly. ARF units will many times come without the transmitter and may require some assembly.
7.	Autopilot	A capaNo.ity of a drone to conduct a flight without real-time human control. For example, following pre-set GPS coordinates.
8.	Autonomous Flight	There are some SUAV's that are managed by internal programming that have instructions on where to fly as guided by an onboard GPS system. This is in opposition to steering mechanisms that are operated by radio control from the ground.
9.	Axis	One plane of potential flight. Most quadcopters have at least 4 axis controls, with 6+ being preferred.
10.	Balanced Battery Charger	This is a charger or an internal system for Lipo batteries (or different chemistries) which uses smart technology to charge multiple cells properly that are located within the battery and balances them.
11.	Bind	This is the process of making the controller (Transmitter) communicate with the drone.
12.	BNF	Bind N Fly. The unit is ready to bind to your transmitter and fly.

13. Brushless Motor — These motors have permanent magnets that rotate around a fixed armature, which eliminates any problems that could be associated with connecting current regarding a moving part. The brushless motors are much more efficient and hardier than brushed motors.

14. Build — A unit that is built at home as opposed to one that is store bought.

15. BVLOS — Beyond visual line of sight.

16. Camera gimbal — This is the holder of the camera used on drones. It can tilt and swerve, thanks to the servos that power it. The gimbal is strong enough to support even large DSLR cameras.

17. Commercial Flight — Flying a drone for money-making purposes. This is currently restricted by FAA, CAAM and ICAO regulations unless you have a Remote Pilot Certificate with a Small Unmanned Aircraft Rating.

18. Controller — A handheld device that is used by the drone pilot to control the drone. Controllers are also called a transmitter or radio.

19. Drone — UAV capable of autonomous flight.

20. (ESC) Electronic Speed Control — The device for controlling an electric aircraft's motor. It is the connection between the RC receiver and main battery. It usually includes a Battery Elimination Circuit (BEC), which provides the power for the onboard electronics like an autopilot and the RC system.

21. Fail Safe — System that helps protect a multi-copter in case of some type of error. For example, if a quadcopter loses control signal, a fail-safe will have the quadcopter return to the point of take-off (return home).

22. Firmware — Software loaded into the microprocessor-based products' non-volatile memory. The reason it is referred to as firmware is because it remains in non-volatile memory state even when power is removed. In the autopilots case, it is an application (App for smart phone users) or program that determines how and what the auto pilot does.

23. Flight Control System — This is a network of controls that is interconnected and allows the pilot to fly the quadcopter or any other multi-rotor airborne vehicle.

24. Fly Away — Unintended flight outside of operational boundaries (altitude/airspeed/lateral) as the result of a failure of the control element or onboard systems, or both.

25. Fly-Away Protection — A system that will return the UAV safely to the surface, or keep it within the intended operational area, when the link between the pilot and the UAV

System	is lost.
26. FPV	Acronym for “First Person View.” This is also known as “Remote Person View” (RPV). FPV is from a camera (such as GoPro) mounted on the front or bottom of the Quadcopter which allows the operator to view exactly what the aerial vehicle is viewing in real time.
27. Frequency	The radio frequency FPV equipment runs on. Can be brand-dependent. Allows for multiple channels so pilots don’t interfere with each other.
28. Geofencing	The use of GPS technology to create a virtual geographic boundary, enabling software to trigger a response when a drone enters or flies within a particular area.
29. Gimbal	This is a specialized mount for a camera, giving it the aNo.ity to swerve and tilt by utilizing servos. This gives the camera the capaNo.ity of staying in one position, regardless of the movement of the drone. This allows for a very smooth and staNo.ized looking image.
30. GIS	Geographic Information System designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data.
31. GPS	Global Positioning System that is used to track the position of an object in relation to the global spatial plane, track movement, or cause an airborne vehicle such as a quadcopter to hold position.
32. Ground Control Station	This software runs on the ground on a computer. It receives telemetry information via an airborne UAV. It displays its status and progress. This frequently includes sensor and video data. It can also be used for transmitting in-flight commands up to the UAV in the air.
33. Gyroscope	A gyroscope or gyro measures the rate of rotation of the UAV and helps keep the craft balanced correctly with respect to yaw, pitch and roll. Helps to maintain the orientation of the quadcopter while in flight. In most cases, quadcopters use a triple-axis gyroscope.
34. Head tracking	A feature on some goggles that allows you to manoeuvre your camera’s angle during flight by moving your head up and down or side to side.
35. Headless Mode	(see IOC) regardless of the orientation of the craft or the way the front of the craft is pointed, it will follow your stick movements.
36. Hexacopter	A multi-rotor drone having six rotors in which the beauty and advantage of the hexacopter is that it can lose any single engine and still maintain control to land.
37. IMU	The Inertial Measurement Unit is a controller which combines an accelerometer and a gyro, with the purpose of helping with the orientation

		and staNo.ization of a quad.
38.	INS – Inertial Navigation System	This is a means of calculating position that is based on the initial GPS reading. This is followed by speed and motion sensor readings that use dead reckoning. This is useful when the GPS has lost its signal temporarily or is not available.
39.	IOC: intelligent orientation control	Usually, the forward direction of a flying multi-rotor is the same as the nose direction. By using Intelligent Orientation Control (IOC), wherever the nose points, the forward direction has nothing to do with nose direction.
40.	Jello	Undesired effect of vibration impacting video. Video appears distorted like jelly jiggling, caused by the multirotor itself. Can be corrected with use of a quality Gimbal camera mounting device.
41.	LiPo	Short for Lithium Polymer, LiPo is the type of battery favoured by most drone manufacturers due to its low weight and maximized charge capacity and power. Although LiPos are safe, be aware overcharging the battery or breaking the flexible polymer case could result in fire.
42.	Lithium Polymer battery	The Lithium Ion battery (Li Ion) is a variant. Lighter weight and more power are offered by this battery chemistry compared to NiCad and NiMh batteries.
43.	LOS	Short for Line of Sight, refers to being able to see your drone from your operating position with your naked eye. Your drone should always be within your line of sight.
44.	mAh	milli Amp Hours. A unit of measurement that describes how much ‘power’ a battery can provide before it needs to be recharged.
45.	Multicopter	A generic name for a drone with multiple propellers, also known as rotors. Depending on the number of rotors, there are tricopters, quadcopters, hexacopters, octocopters and so on.
46.	Multi-rotor copters	Are referred to by many names, which include: drone, quadricopter or quadcopter.
47.	No Fly Zone	Areas where flying a drone is restricted by government regulations. Areas where a drone could interfere with an airplane or record sensitive information make up most of these areas.
48.	Octocopter	A drone with 8 horizontal propellers or rotors.
49.	OSD	Abbreviation for “On Screen Display” which shows flight data in text or graphical form. Typically used to show telemetry information such as speed, battery life, heading, etc.

50.	Payload	The amount of additional weight a drone able to lift in addition to its own weight and batteries. If you attach a camera and gimbal to your drone, the combined weight is the payload.
51.	PDB	Stands for Power Distribution Board. Component which allows the power from the battery to be distributed to all the various components on a craft.
52.	Pitch	A measure which describes the flight angle along one axis, usually measured from level in case of aerial vehicles. Forward and Backwards motion.
53.	Pre-Flight Planning	The activities conducted by the pilot and flight crew prior to take-off to ensure that the flight will be conducted safely and in accordance with all applicable standards and regulations. The activity includes, but is not limited to, such things as checking weather, route of flight, airspace, equipment configuration, support personnel, terrain and communications requirements.
54.	Power Distribution Board	Is the PDB and is a board that is used on the multicopters to help distribute the power to each of the motors to provide proper staNo.ization of the unit.
55.	Prop	Short for propeller.
56.	Quadcopter	Quad that typically has 4 propellers, each with its own motor and propeller, situated in a square formation for smooth and precise flight.
57.	Radio Controller	Wireless handheld device used to control flight of the drone.
58.	R/C	Shorter way of writing “Radio Controlled – it refers to control of a drone via radio waves.
59.	Receiver	Accepts the camera’s feed and relays it to your screen/goggles of choice.
60.	Return to Home	A GPS feature that returns the drone to the “home” position where it took off.
61.	RTF	Ready to Fly – This means the drone is sold with everything needed in the pack. All you need to do is charge the batteries and you are ready to use it. It is possible you may need to buy the batteries separately for the controller. This fact is usually mentioned on the box.
62.	Sense and Avoid	The capaNo.ity of a UAS to remain well clear from and avoid collisions with other airborne traffic. Sense and Avoid provides the functions of self-separation and collision avoidance.
63.	Servo	A shorter name for servomotor or servomechanism. Aerial vehicles use servomotors for various functions such as pan cameras and wing flaps

adjustments which can be controlled from the ground.

64. Skill Matrix — A grid or table that clearly and visibly illustrates the skills and competency held by individuals or teams.

65. Spotter — A person that keeps track of your drone by line-of-sight while you fly via FPV. They can let you know about hazards which may be out of your field of view through the goggles.

66. Throttle — Control that influences the RPM or the speed of electric motors. Higher throttle generates more thrust.

67. Thrust — The combined amount of force from a propeller and a motor which generates lift. Lift is what takes you up and into the sky.

68. Transmitter — A device that sends commands to the drone from the pilot or a component that relays the camera's feed to the receiver located on the goggles.

69. Trim — Setting to adjust the way a drone hover. Adjusting trim settings can help to keep it in place while hovering.

70. UAV — Unmanned aerial vehicle. A device that can propel itself through the air without a pilot onboard. Drones and quadcopters are UAVs.

71. Ultrasonic sensor — A sensor that uses the ultra sound wavelength to communicate with a transmitter. In aerial vehicles, ultrasonic sensors are used for calculating the distance to the ground by bouncing sound waves back and forth. They do not work further than a few meters from the ground.

72. Visual line of sight — Is the term that is going to control how the pilot can see the aircraft from the ground without the use of artificial vision.

73. Visual Observer — A crew member who assists the UAS pilot in the duties associated with collision avoidance. This includes, but is not limited to, avoidance of other traffic, airborne objects, clouds, obstructions, and terrain. Most associated with FPV flying.

74. VLOS — Abbreviation for Visual Line of Sight.

75. VRX — Video receiver.

76. VTX — Abbreviation for video transmitter, connected to your camera and transmits the video signal from your drone back to you down on the ground in real time.

77. Waypoint — A set of coordinates which define a point in space. Waypoints are useful in designing various autonomous missions for quadcopters. Mapping out would be impossible without a possiNo.ity to define these physical

	locations.
78. Yaw	The describes the quadcopter rotation around it’s centre axis on a level plane.

Acknowledgement

The Director General of DSD would like to extend his gratitude to the organisations and individuals who have been involved in developing this Standard including:

i. National Skills Development Council (NSDC)
ii. Standard Technical Committee (STC)
iii. Standard Technical Evaluation Committee (STEC)
iv. Standard Development Committee (SDC)
v. Facilitator
vi. Secretariat
vii. Civil Aviation Authority of Malaysia (CAAM)
viii. Malaysian Communications and Multimedia Commission (MCMC)
ix. Department of Survey and Mapping Malaysia (JUPEM)
x. University Technology of Malaysia (UTM)
xi. Malaysia Unmanned Drone Activity Society (MUDAS)
xii. Tanjung Plus Engineering
xiii. AECA Solutions Sdn Bhd
xiv. FoxieAerialgraphy
xv. Prestige Geomatic Resources
xvi. Aerospectral Technology
xvii. Ennova Sdn Bhd
xviii. Meraque Services Sdn Bhd

STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

DRONE MISSION COMMANDING

LEVEL 3

1. Introduction

1.1. Occupation Overview

The drone industry is one of the newest industries in the world. Since its infancy in the past 10 years, the operation of drones has always been with the military and researchers. The landscape has dramatically changed with the advancement of miniaturising components and lower costs. According to industry estimates, the drone business could generate No.lions for the world economy and create thousands of new jobs over the next 10 years.

In Malaysia, this has created a new opportunity for a new breed of drone enthusiasts. Many are hobbyists that we would categorise as recreational drone operators. Such activities like building and flying DIY drones and participating in drone racing or drone soccer has taken traction.

The natural progression of entering the amateur market as well as undertaking a lot of aerial photography to hone in on their flying skill is now very popular. Those who do so have also found that there is some remuneration involved and finally entering the commercial market is the goal of some pilots who see a career as a Drone Commander.

The demand for Drone Commander has been identified in nine industries namely (CAAM, 2018):

i) Agriculture, Aquaculture, Silviculture & Viticulture.
ii) Security Services.
iii) Infrastructure.
iv) Health, Emergency Services & Disaster Recovery.
v) Environmental Management.
vi) Media Communications.
vii) Urban Planning, Real Estate, Architecture & Engineering.
viii) Business & Commerce.
ix) Recreation & Entertainment.

In general, themarket for commercial drones,is expected to reach some 13 No.lion U.S. dollars by 2025.Commercial UAV productionfor mini-UAVs is currently valued at 58.4 million U.S. dollars.Interest in UAV usage is increasing with increasing deployments by several countries around the world. Theglobal research and development budget for dronesis estimated to reach nearly four No.lion U.S. dollars by 2020. Amazon, the

world's largest online retailer, is projected to have approximately 450,000drones in its delivery fleetby 2020 under its proposed service "Amazon Prime Air".

1.2. Rationale of NOSS Development

The NOSS Development is crucial to meet the existing demand of the various industries outlined earlier. The problem of inconsistent quality of work, unequal remuneration and unmet expectations from clients and employers alike can be mitigated with this program.

This NOSS Program will also be able to complement the relevant theory parts that include the topics of Malaysia Air Law, Principles of Flight, Airspace, Human Factors, Aviation Safety, UAS Components, Navigation, Meteorology and Airmanship.

For the NOSS Development program, it isbegin with Competency Training at Level 2 and further proceed to Level 3.

The result would be better work culture, improved safety records and a professional work output from the Drone Commander.

1.3. Rationale of Occupational Structure and Occupational Area Structure

The Occupational Structure and Occupational Area Structure for Drone Commander covers the operational practices and standards for a competent Drone Commander. The current demand for Drone Commander cuts across nine large industry sectors in Malaysia and the rest of the developing countries and we need to match this demand with a comprehensive competency program.

The ramifications of not addressing this demand will only subject the various industries with unskilled and amateur commander which could result in low quality work or worse, personal injury or property damage.

Hence, it is imperative for potential employers in Malaysia to have a standard of measurement for the hiring of Drone Commander with the confidence that the individual has undergone a competency course.

1.4. Regulatory / Statutory Body Requirements Related to Occupation

There are a few statutory bodies that regulate the drone industry. In Malaysia, the primary body is the Civil Aviation Authority of Malaysia. This is endorsed by the Civil Aviation Regulations 2016(CAR 2016). Other statutory bodies are as follows:

i) Civil Aviation Authority Malaysia(CAAM)

Established in 19th of February 2018, The Civil Aviation AuthorityMalaysia(CAAM)is a statutory body with enforcement powers in the Malaysian Airspace. Its primary role is to ensure airspace safety.

Its responsiNo.ities include aviation rules and procedures, governing such things as the operation of aircraft, types of airspace, licence privileges and Rules of the Air.

ii) Department of Survey and Mapping Malaysia(JUPEM)

JUPEM, is normally referred to a department under the Ministry of Water, Land & Natural Resources. JUPEM is one of the earliest agencies in Malaysia that performs the survey and mapping activities established in1885 at the Department of Survey Johor. During the1885and1957period, the States Survey & Topographic Department were gradually, established one by one and later merged as one entity as it is known as Department of Survey & Mapping. In1965, the government approved the setting up of "DirektoratPemetaan Negara Malaysia" (Directorate of National Mapping, Malaysia) whose responsiNo.ities include surveying, mapping, topographic and geodetic activities.

JUPEM is responsible for the country's survey and mapping activities and entrusted in such activities to safeguard country's sovereignty. Department's activities are vital as they are to spur the country's socio-economic development. For airborne activities such as aerial photography, aerial video and aerial mapping, user need to obtain permission/permit of flying drone and conventional aircraft referring to PEKELILING AM BILANGAN 1 TAHUN 2007 (Jabatan Perdana Menteri Malaysia- Mei 2007).

iii) Malaysian Communications and Multimedia Commission (MCMC)

The Malaysian Communications and Multimedia Commission (MCMC) is a regulatory body and its key role is the regulation of the communications and multimedia industry based on the powers provided for in the Malaysian Communications and Multimedia Commission Act 1998, the Communications and Multimedia Act 1998, and the Strategic Trade Act 2010. Pursuant to these Acts, its role is also to implement and promote the Government's national policy objectives for the communications and multimedia sector. MCMC is also charged with overseeing the new regulatory framework for the converging telecommunications and broadcasting industries and online activities. In 2001, MCMC's role was expanded to include overseeing the postal service sector pursuant to the Postal Services Act 1991 and licensing of the Certification Authorities under the Digital Signature Act 1997.

Primary functions of the MCMC are as follows:

- Advise the Minister on all matters concerning the national policy objectives for communications and multimedia activities;
- Implement and enforce the provisions of the communications and multimedia law;
- Regulate all matters relating to communications and multimedia activities not provided for in the communications and multimedia law;
- Supervise and monitor communications and multimedia activities;
- Encourage and promote the development of the communications and multimedia industry;
- Encourage and promote self-regulation in the communications and multimedia industry;

The radio communications equipment used by drone must adhere to the specific technical parameters indicated under Second Schedule of the Class Assignment as stated below:

Table 1: Second Schedule of the Class Assignment Technical Parameters

Radio Frequencies	**Maximum Equivalent Isotopically Radiated Power (EIRP)**
433.00 MHz – 435.00 MHz	100 mW
24000.00 MHz – 2500.00 MHz	500 mW
5725.00 MHz – 5875.00 MHz	1 W

Use of specific technical parameters other than as specified in the table above should require prior written approval from MCMC.

The drone operated the Class Assignment shall not be afforded protection from any interference and shall not be operated contrary to the Communications and Multimedia Act 1998.

The drone and/or any radio communications equipment used by the drone shall be certified by MCMC or its registered certifying agency in accordance with the Communications and Multimedia (Technical Standards) Regulation 2000 and shall bear MCMC label.

iv) Chief Government Security Office (CGSO)

Chief Government Security Officeor CGSO is a unit under thePrime Minister's Departmentof theMalaysian federal government. CGSO is responsible to provide 'security protection' on all government assets such as federal buildings and so on. CGSO also provides 'security clearance' for the candidates who wish to join the civil service to ensure that he or she is not a member of any extremist groups.

Primary functions of the CGSO are as follows:

- Ensure the Implementation of the Safety Management of Protection within the Government Agency at its best, Policy Maker and Enforcement Agency.;
- Act as an "Enforcement Agency" in cases involving any violation of the Government Protection Security Instructions. They have at least the power to "Investigate and Take Disciplinary Action In cases involving Non-Criminal Investigation by the PDRM;
- Acting as the lead agency in implementing Fine / Gross / Advanced Safety Filters for each Government Personnel and assisted by other agencies.

1.5. Occupational Pre-Requisite

Candidates for Drone Commander should fulfil all requirements set by the relevant statutory bodies.

The minimum requirement set forth for Drone Commander are as follows:

i) Minimum 18 years of age (Akta Kerja 1955).

ii) Medically fit to meet the high demands of job scope.
iii) Permit required from CAAM and JUPEM before flight.

1.6. General Training Pre-Requisite for Malaysian Skills Certification System

Candidates for this NOSS Program should fulfil all requirements below.

The minimum requirement set forth before registering for this program are:

i) Possess Malaysian Skills Certification Level 2.
ii) Able to read and write in Bahasa Melayu or English.
iii) Medically fit.

2. Occupational Structure (OS)

Section	(H) Transportation and Storage		
Group	(512) Air Freight Transport		
Area	Unmanned Aerial Vehicle	UnmannedGround Vehicle	Remotely Operated Water Vehicle
Level 5	Drone Project Manager	UGV Project Manager	ROWV Project Manager
Level 4	Drone Coordinator	UGV Coordinator	ROWV Coordinator
Level 3	Drone Commander	UGV Commander	ROWV Commander
Level 2	Drone Pilot	UGV Pilot	ROWV Pilot
Level 1	Drone Technician	UGV Technician	ROWV Technician

Figure 1: Occupational Structure for Drone Commander

3. Occupational Area Structure (OAS)

Section	(H) Transportation and Storage		
Group	(512) Air Freight Transport		
Area	Unmanned Aerial Vehicle	Unmanned Ground Vehicle	Remotely Operated Water Vehicle
Level 5	Drone Operation Management	UGV Operation Management	ROWV Operation Management
Level 4	Drone Operation Coordinating	UGV Operation Coordinating	ROWV Operation Coordinating
Level 3	Drone Mission Commanding	UGV Mission Commanding	ROWV Mission Commanding
Level 2	Drone Piloting	UGV Piloting	ROWV Piloting
Level 1	Embedded to L2	Embedded to L2	Embedded to L2

Figure 2: Occupational Area Structure for Drone Mission Commanding

4. Definition of Competency Levels

The NOSS is developed for various occupational areas. Below is a guideline of each NOSS Level as defined by the Department of Skills Development, Ministry of Human Resources, Malaysia.

Level 1: Competent in performing a range of varied work activities, most of which are routine and predictable.

Level 2: Competent in performing a significant range of varied work activities, performed in a variety of contexts. Some of the activities are non-routine and required individual responsiNo.ity and autonomy.

Level 3: Competent in performing a broad range of varied work activities, performed in a variety of contexts, most of which are complex and non-routine. There is considerable responsiNo.ity and autonomy and control or guidance of others is often required.

Level 4: Competent in performing a broad range of complex technical or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsiNo.ity and autonomy. ResponsiNo.ity for the work of others and allocation of resources is often present.

Level 5: Competent in applying a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsiNo.ity for the work of others and for the allocation of substantial resources features strongly, as do personal accountaNo.ities for analysis, diagnosis, planning, execution and evaluation.

5. Award of Certificate

The Director General may award, to any person upon conforming to the Standards the following skills qualifications as stipulated under the National Skills Development Act 2006(Act 652):

5.1 Malaysian Skills Certificate (MSC).
5.2 Statements of Achievement.

6. Occupational Competencies

The Drone Mission Commanding Level 3 personnel is competent in performing the following core competencies:

6.1 Fixed Wing Drone Pre-Flight Preparation.
6.2 Fixed Wing Drone Flying Operation.
6.3 Fixed Wing Drone Post-Flight Preparation.
6.4 Fixed Wing Drone Maintenance.
6.5 Unmanned Aerial Vehicle Supervision.

7. Work Conditions

Being a drone commander is very exciting and demanding. He will be exposed to many industries in his line of work. Every project has its own challenges and the drone commander will be faced with different conditions and demands which would require some degree of initiative, resourcefulness and proactive action.

The drone commander is exposed to working outdoor and in remote areas where necessary but spends time as well on work preparations which include pre-flight planning and general maintenance and responsible to lead the team.

When in the field, the drone commander must prioritise safety at all time ensuring being alert to weather and environment conditions.

8. Employment Prospects

Drone Mission Commander personnel could be employed by various sectors and industries either local or foreign companies. They can earn attractive salaries and may be required to travel frequently depending on selected industries. Other related industries which a Drone Mission Commander with respect for employment opportunities are:

i) Oil and Gas industry
ii) Port services industry
iii) Plantation industry
iv) Defence and security industry
v) Government agencies

9. Up Skilling Opportunities

Currently no upskilling training in this industry for all types of drone below 20kg of weight. However, for drone with maximum take-off weight (MTOW) of 20kg and above, drone pilots are required to take Private Pilot Licence – Restricted (PPL-R) from Authorised Training Organisation (ATO).

10. Organisation Reference for Sources of Additional Information

The following organisations can be referred as sources of additional information which can assist in defining the document's contents.

10.1. Civil Aviation Authority of Malaysia (CAAM)
Pihak Berkuasa Penerbangan Awam Malaysia
No.27, Persiaran Perdana
Aras 1-4, Blok Podium
Presint 3
62618 Putrajaya
Wilayah Persekutuan Putrajaya
Tel: +60 3 8871 4000
http://www.dca.gov.my
webmaster@caam.gov.my

10.2. Malaysian Communications and Multimedia Commission (MCMC)
MCMC Tower 1
Jalan Impact
Cyber 6
63000 Cyberjaya
Selangor Darul Ehsan
Tel: +60 3 8688 8000
https://www.mcmc.gov.my
scd@cmc.gov.my

10.3. Jabatan Ukur Dan Pemetaan Malaysia (JUPEM)
Wisma JUPEM
Jalan Sultan Yahya Petra
50578 Kuala Lumpur
Tel: +60 3 2617 0800
https://www.jupem.gov.my
hqweb@jupem.gov.my

10.4. Malaysia Unmanned Drones Activist Society (MUDAS)
F10, Kompleks Bazaar Rakyat PKPS
Bandar Putra Permai
43300 Seri Kembangan
Selangor
Tel: +60 19 541 6836 (Whatsapp)
http://mudas.my
mudas.my@gmail.com

10.5. World Drone Organization
5, Grey Oaks Circle Greensboro
NC 27408
Tel: +00 336 501 5230
https://worlddroneorganization.com
mic@worlddroneorganization.com

11. Standard Technical Evaluation Committee

NO	NAME	POSITION & ORGANISATION
1.	Lt. Kol Md Jamil Bin Supar	Assistant Director of Security, Bahagian Geospatial Pertahanan, JUPEM.
2.	Md. Rufi Bin A.Latiff	Art Director, Archidrone Sdn Bhd.
3.	Muhammad Ariff Bin Abidin	Engineer (Geospatial Solution/UAV) Tenaga Nasional Berhad
4.	Dr. Umran Bin Abdul Rahman	Manager Line Maintenance, Malaysia Airlines Berhad.
5.	Dr. Zulhimy Bin Sahwee	Senior Lecturer, Head of UAV Research Lab MIAT, UniKL.

12. Standard Development Committee

DRONE MISSION COMMANDING

LEVEL 3

NO	NAME	POSITION & ORGANISATION
1.	Abu Bakar bin Ali	Pengarah (M) BahagianPengangkutan Udara Civil Aviation Authority of Malaysia (CAAM)
2.	Associate Professor Dr.Anuar bin Ahmad	Pensyarah FakultiAlam Bina dan Ukur UniversitiTeknologi Malaysia (UTM)
3.	Fauziah Ahmad	Training Manager Ennova Sdn Bhd
4.	Khairul Ariffin bin Mohd Aris	Chief Operating Officer AECA Solutions Sdn Bhd
5.	Mejar Muhammad Haffeez bin Yusop	Officers in Command, UAV Jabatan Ukur dan Pemetaan Malaysia (JUPEM)
6.	Mohamad Noor bin Ab. Rahim	Chief Executive Officer Tanjung Plus Engineering
7.	MohdHairulFadli bin Mohd Hashim	Technical Director FoxieAerialgraphy
8.	Mohammad Razali bin Ismail	Director Meraque Services Sdn Bhd
9.	Sr. Mohd Juraidi bin Ahmad	Technical Manager Prestige Geomatic Resources
10.	Syaqir Al-Ezree bin Misni	Manager Aerospectral Technology
11.	Wan Amir Alauddin bin Wan Sharifuddin	Assistant Director Standard Development Department Malaysian Communications and Multimedia Commission (MCMC)
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FACILITATOR		
1.	Razalee bin Che Ros	CIAST/PPL/FDS-0016-2012 Department of Skills Development
2.	Mahazrul bin Kamarrudin	Department of Skills Development

STANDARD CONTENT

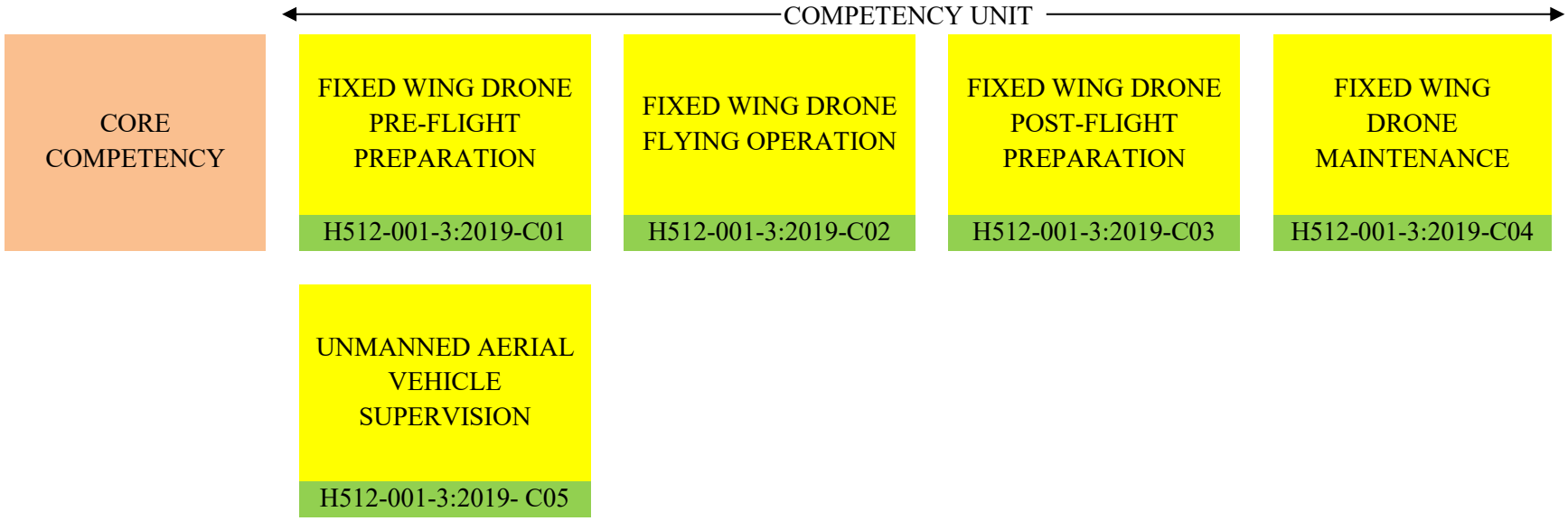
NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

DRONE MISSION COMMANDING

LEVEL 3

13. Competency Profile Chart (CPC)

SECTION	(H) TRANSPORTATION AND STORAGE		
GROUP	(512) AIR FREIGHT TRANSPORT		
AREA	UNMANNED AERIAL VEHICLE		
NOSS TITLE	DRONE MISSION COMMANDING		
NOSS LEVEL	THREE(3)	NOSS CODE	H512-001-3:2018



14. Competency Profile (CP)

SECTION	(H) Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
NOSS LEVEL	Three(3)	NOSS CODE	H512-001-3:2019

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
1. Fixed Wing Drone Pre-Flight Preparation H512-001-3:2019-C01	Fixed Wing Drone Pre-Flight Preparation describes the responsiNo.ity of preparing and setup devices and equipment before Fixed Wing Drone Pilot engage in flight operation. The person who is competent in this CU shall be able to charge fixed wing drone battery, setup Ground Control Station (GCS) and telemetry, assemble control surfaces, fix propeller, prepare fixed wing drone, check weather and environment conditions, calibrate avionic sensors and Centre of Gravity	1. Charge fixed wing drone battery.	1.1 Battery types and connector labelled and verified. 1.2 Battery meter specified readings indicated in accordance with manufacturer's specification. 1.3 Battery charging station at designated location. 1.4 Connector of battery and charger verified. 1.5 Charging status indicated. 1.6 Charging mode for battery voltage, current and types indicated. 1.7 Charging abnormalities which includes appearance, smell and sound indicated. 1.8 Charged battery placed at designated location. 1.9 Battery charging cycle time log

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	(CG), prepare take-off/landing zone and record pre-flight log accordance with manufacturer's specification. The outcome of this CU is to enable fixed wing drone to take-off, fly and land safely without any damages.		completed in accordance with manufacturer's specification.
		2. Setup Ground Control Station (GCS) and telemetry.	2.1 Correct radio controller for drone marked. 2.2 Live view displayed. 2.3 Battery full status indicated. 2.4 Mission planner program selected. 2.5 Link indicator between radio control and display unit lit. 2.6 Profile characteristics for the specific drone to be operated loaded in radio control flight parameter set. 2.7 Profile characteristics for the specific drone to be operated loaded in mission planner setting.
		3. Assemble control surfaces.	3.1 Fuselage holder used. 3.2 Wings, rudder, elevator & landing gear securely fixed. 3.3 Control connector securely plugged. 3.4 Servo mechanism, flight controller, sensors and battery securely fixed in accordance with manufacturer's manual.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		4. Fix propeller.	4.1 Types and size of propeller selected and verified. 4.2 Propeller overall condition inspected. 4.3 Propeller screw tighten, and safety lock secured. 4.4 Propeller assembly checklist confirmed.
		5. Prepare fixed wing drone.	5.1 Power LED lit observed. 5.2 Wind sock direction determined. 5.3 Fixed wing drone head direction confirmed. 5.4 Matching fixed wing model selected 5.5 Mission planner set as per plan verified.
		6. Check weather and environment conditions.	6.1 Awareness of current and forecast weather conditions are maintained. 6.2 Weather conditions are monitored and responded in accordance with regulatory body requirements and SOP. 6.3 Layout of current environment condition, obstacles and structures of flying area verified. 6.4 Supporting documents and layout provided by local authorities verified. 6.5 Pre-flight data acquired, and logbook completed in accordance with SOP.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		7. Calibrate avionic sensors and Centre of Gravity (CG).	7.1 Sensor with mounting fixed firmly demonstrated. 7.2 Data and control signal explained. 7.3 Sensor calibration and triggering status demonstrated and explained. 7.4 The CG of the fixed wing drone demonstrated. 7.5 ReliaNo.ity and validity of calibrated equipment checked and explained.
		8. Prepare take-off/landing zone.	8.1 Fixed wing drone take-off and landing zone confirmed. 8.2 Take-off and landing zone barrier placed. 8.3 Coordinate in digital map marked, operation area perimeter observed and recorded.
		9. Record pre-flight log.	9.1 Complete pre-flight log checklist ticked and adhered. 9.2 Awareness of physical inspection completed. 9.3 Awareness of control inspection and calibration executed in accordance with manufacturer’s manual.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
2. Fixed Wing Drone Flying Operation H512-001-3:2019-C02	Fixed Wing Drone Flying Operation describes know how and responsiNo.ity during fixed wing flying mission. The person who is competent in this CU shall be able to check abnormalities, check take-off and circling fixed wing drone functionality, manoeuvre fixed wing drone, engage mission, check telemetry information, execute Emergency Recovery Procedures (ERP) and prepare fixed wing drone landing. The outcome of this CU is to ensure fixed wing operate smoothly during flying mission with all objectives of the mission achieved.	1. Check abnormalities.	1.1 Drones components confirmed. 1.2 Temperature reading indicated in accordance with manufacturer's specification. 1.3 Battery voltage reading indicated in accordance with battery data sheet. 1.4 Minimum satellite number required indicated. 1.5 Sensors mount stabilized. 1.6 Propeller orientation checked. 1.7 Drone control surfaces checked.
		2. Check take-off and circling fixed wing drone functionality.	2.1 Propeller sound audible and telemetry reading indicated. 2.2 Drone behaviour monitored. 2.3 Drone safely airborne checked according to minimum 30 m from 'Above Ground Level (AGL)' subject to surrounding area.
		3. Manoeuvre fixed wing drone.	3.1 Drone airspeed determined in accordance with manufacturer's specification. 3.2 Drone roll/bank angle left and right confirmed. 3.3 Yaw/ heading confirmed.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		4. Engage mission.	4.1 Drone telemetry which include GPS, airspeed, battery voltage, Radio Signal Strength Indicator (RSSI), airtime reading indicated. 4.2 Drone flying mission commenced. 4.3 Flight height, waypoint and distance within range confirmed. 4.4 Drone mission plan recorded.
		5. Check telemetry information.	5.1 Battery status explained. 5.2 Flight height, distance and heading explained. 5.3 GPS status which include wind speed and direction explained. 5.4 Wireless telemetry status explained. 5.5 Drone speed which include air and ground speed explained. 5.6 Flight mode which include autonomous and stabilize mode explained. 5.7 Bank angle explained. 5.8 Telemetry signal which include sensor status explained. 5.9 Workplace safety requirements including weather and environmental condition complied. 5.10 Compilation of reports and documents

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			performed and explained. 5.11 Telemetry assessment process explained.
		6. Execute Emergency Recovery Procedures (ERP).	6.1 External and internal factors to emergency as telemetry are indicated. 6.2 Injury and damage are assessed. 6.3 Emergency response activated. 6.4 First Information Report (FIR) lodged.
		7. Prepare fixed wing drone landing.	7.1 Mission accomplished adhere to work order. 7.2 Landing procedure adhered to SOP. 7.3 Flight telemetry reading indicated. 7.4 Drone safely landed.
3. Fixed Wing Drone Post-Flight Preparation H512-001-3:2019-C03	Fixed Wing Drone Post-Flight Preparation describes the knowhow and responsiNo.ity on fixed wing drone postflying mission. The person who is competent in this CU shall be able to verify data collection, check fixed wing drone abnormalities,	1. Verify data collection.	1.1 Storage card verified. 1.2 Computer readiness confirmed. 1.3 Document control verified. 1.4 Data compiling confirmed in accordance with SOP.
		2. Check fixed wing drone abnormalities.	2.1 Motor abnormalities which includes appearance, smell and temperature confirmed. 2.2 Structure of propellers damage

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	dismantle fixed wing drone parts and record post-flight log. The outcome of this CU is to ensure fixed wing drone data collection from its sensors is collected and recovered safely, drone in good condition, dismantled properly and flight log recorded.		identified. 2.3 Drone fuselage structure verified. 2.4 Avionics, mechanical, radio controller and sensors abnormalities verified. 2.5 Abnormalities report list recorded.
		3. Dismantle fixed wing drone parts.	3.1 Propeller removed from motor. 3.2 Battery at the drone removed. 3.3 Control surfaces safely removed. 3.4 Drone in storage condition verified. 3.5 Drone parts cleaned and placed at designated compartment.
		4. Record post-flight log.	4.1 Airborne date and time recorded. 4.2 Landing information reported to ATC in accordance with CAAM NOTAM's. 4.3 Drone damage and problem reported 4.4 All checklist collected.
4. Fixed Wing Drone Maintenance H512-001-3:2019-C04	Fixed Wing Drone Maintenance describes the know-how and responsiNo.ity during drone maintenance management. The person who is competent in this CU shall be able to	1. Maintain fixed wing drone battery system.	1.1 Battery type and connector labelled. 1.2 Charger and connector overall condition verified. 1.3 Battery meter specified readings indicated in accordance with manufacturer's specification. 1.4 Battery abnormalities which include

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	maintain fixed wing drone battery system, monitor firmware maintenance, monitor motor maintenance, monitor propeller maintenance, monitor fixed wing drone accessories maintenance, monitor controller maintenance, maintain control surfaces, maintain avionic and servos and monitor sensors maintenance. The outcome of this CU is to ensure fixed wing drone, sensors and accessories coordination for maintenance are done properly as per manufacturer datasheets.		appearance, leakage and loose connection indicated. 1.5 Battery charging station at designated location. 1.6 Power LED status indicated. 1.7 Connector of battery and charger matched. 1.8 Charging mode for battery voltage, current and type indicated. 1.9 Charging abnormalities which includes appearance, smell and sound indicated. 1.10 Charged battery placed at designated location in accordance with manufacturer's specification. 1.11 Battery maintenance cycle time log completed in accordance with manufacturer's specification.
		2. Monitor firmware maintenance.	2.1 Drone and controller status LED indication verified. 2.2 Firmware status verified. 2.3 Latest firmware version verification checked in accordance with manufacturer's specification. 2.4 Maintenance logbook update verified.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		3. Monitor motor maintenance.	3.1 Battery placed at designated location verified. 3.2 Propeller placed at designated location verified. 3.3 Motors condition including sound, vibration, resistance, wiring, loose connection and solder joint maintenance verified. 3.4 Maintenance logbook update verified in accordance with SOP.
		4. Monitor propeller maintenance.	4.1 Propeller placed at designated location verified. 4.2 Propeller condition including crack, dent, chip, stiffness, balancing, connector maintenance verified. 4.3 Propeller adapter condition maintenance verified. 4.4 Maintenance logbook update verified in accordance with SOP.
		5. Monitor fixed wing drone accessories maintenance.	5.1 Drone accessories condition including crack, chip and dent maintenance verified. 5.2 Damaged accessories replacement verified in accordance with

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			manufacturer's specification. 5.3 Maintenance logbook update verified in accordance with SOP.
		6. Monitor controller maintenance.	6.1 Status LED indicated verified. 6.2 Radio controller battery placed at designated location verified. 6.3 Radio controller condition including crack, and chip and dent maintenance verified in accordance with manufacturer's specification. 6.4 Maintenance logbook updated in accordance with SOP.
		7. Maintain control surfaces.	7.1 Status LED indicated. 7.2 Control surfaces condition including appearance, crack, chip and dent maintained in accordance with manufacturer's specification. 7.3 Maintenance logbook updated in accordance with SOP.
		8. Maintain avionic and servos.	8.1 Status LED indicated. 8.2 All servos condition including appearance, crack, chip and dent maintained.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			8.3 Maintenance logbook updated.
		9. Monitor sensors maintenance.	9.1 Sensor status LED indicated verified. 9.2 Sensor battery placed at designated location verified. 9.3 Sensor condition including crack, chip dent, wiring, loose condition and solder joint maintenance verified in accordance with manufacturer's specification. 9.4 Malfunction sensors repaired by authorised service centres approved. 9.5 Maintenance logbook update verified.
5. Unmanned Aerial Vehicle Supervision H512-001-3:2019-C05	Unmanned Aerial Vehicle Supervision describes the responsiNo.ity before, during and after the fly mission of a fixed wing drone. The person who is competent in this CU shall be able to conduct pre-flight briefing, conduct	1. Conduct pre-flight briefing.	1.1 Project method, mission and product explained. 1.2 Task crew assigned. 1.3 Permits, checklist and all log prepared in accordance with SOP. 1.4 Sensors and flying platform decided in accordance with SOP. 1.5 Correct equipment selected and packed in accordance with SOP.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	team coaching, coordinate waste disposal, prepare work schedule, assess staff performance, monitor health, safety and environment compliance, monitor document control & monitor operation and product quality control. The outcome of this CU is to ensure supervisor for Unmanned Aerial Vehicle can manage and coordinate successfully the overall flying mission as per management request.	2. Conduct team coaching.	2.1 Sources for identifying skill set listed. 2.2 In-house training definition and benefits and activities described. 2.3 Training methods differentiated and described. 2.4 Training aids differentiated and described. 2.5 Assessment methods differentiated and described. 2.6 Skill matrix details described. 2.7 Identification of skills and competencies needed for effective staff performance performed. 2.8 Identification of type of training, training methods & equipment and training outcomes performed. 2.9 Compilation of reports and documents performed in accordance with SOP. 2.10 In-house training process explained.
		3. Coordinate waste disposal.	3.1 Parts disposal program proposal presented to manager and endorsed. 3.2 End of battery life, broken and deformed parts as per manufacturer's specification identified and segregated to designated area. 3.3 Local, state and federal government

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			rules & regulations regarding waste disposal of Lipo battery, plastic, metal & electronic parts were studied and followed. 3.4 Safety procedures as specified in Material Safety Data Sheet (MSDS) for every part to be dispose were adhered to avoid injury and toxification during handling. 3.5 Licensed disposable centre or agent were identified. 3.6 Log book registered for all disposed parts containing all necessary data for traceaNo.ity.
		4. Prepare work schedule.	4.1 Meeting schedule prepared. 4.2 Team personnel informed. 4.3 Requirement and specification are listed. 4.4 Mission workflow explained in accordanc with SOP. 4.5 Cost of project mobilisation are determined in accordance with SOP. 4.6 Document and flight operation details are prepared in accordance with SOP.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		5. Assess staff performance.	5.1 Appraisal requirements for personnel explained. 5.2 Scoring method used for appraisal explained. 5.3 Reporting format used explained. 5.4 Communication skills applied in appraisal explained. 5.5 Compilation of reports and documents performed. 5.6 Staff performance assessment process explained.
		6. Monitor health, safety and environment compliance.	6.1 Drone operators mentally and physically fit to work in accordance with HSE compliance standard policy. 6.2 Safety guidelines from the CAAM, JUPEM, MCMC and CGSO are followed. 6.3 Drone flight behaviour monitored. 6.4 Permission to fly has been obtained.
		7. Monitor document control.	7.1 Job order collected. 7.2 CAAM, JUPEM, CGSO and Local Authority permits filed. 7.3 All log and documents compiled and verified in accordance with SOP.

CU TITLE& CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		8. Monitor operation and product quality control.	8.1 Operation conducted according to schedule. 8.2 Maintenance logbook verified. 8.3 HSE Compliance Standard Policy verified. 8.4 Raw data and product are managed in accordance with SOP.

CURRICULUM OF COMPETENCY UNIT

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

DRONE MISSION COMMANDING

LEVEL 3

15. Curriculum of Competency Unit

15.1 Fixed Wing Drone Pre-Flight Preparation

SECTION	(H)Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
COMPETENCY UNIT TITLE	Fixed Wing Drone Pre-Flight Preparation		
LEARNING OUTCOMES	The outcome of this competency unit is to enable fixed wing drone to take-off, fly and land safely without any damages. Upon completion of this competency unit, trainees shall be able to: 1. Charge fixed wing drone battery. 2. Setup Ground Control Station (GCS) and telemetry. 3. Assemble control surfaces. 4. Fix propeller. 5. Prepare fixed wing drone. 6. Check weather and environment conditions. 7. Calibrate avionic sensors and Centre of Gravity (CG). 8. Prepare take-off/landing zone. 9. Record pre-flight log.		
TRAINING PRE-REQUISITE (SPECIFIC)	Not Available.		
CU CODE	H512-001-3:2019-C01	NOSS LEVEL	Three (3)

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Charge fixed wing drone battery.	1.1 Introduction to battery. • Types of battery • Types of connector • Safety precaution in charging drone battery • Transporting 1.2 Battery cells, voltage and internal resistance. • Battery tester • Battery voltage indicator 1.3 Introduction to battery charger. • Types of power supply • Types of charger • Setting of battery charging parameters • Procedure to inspect charger for	1.1 Identify battery type and connector. 1.2 Check battery voltage. 1.3 Prepare battery charger. 1.4 Connect battery to charger. 1.5 Switch on power supply and charger. 1.6 Set charging mode. 1.7 Start charging battery. 1.8 Monitor cells balancing. 1.9 Observe charging abnormalities. 1.10 Stop charging mode. 1.11 Turn-off charger power. 1.12 Disconnect battery charger. 1.13 Record battery charging cycle time. 1.14 Embarkation checklist.	<u>ATTITUDE</u>. • Compliance to manual and procedures. <u>SAFETY.</u> • Compliance to warning, caution and notes as stated in manufacturer's specification. <u>ENVIRONMENT.</u> • Minimising pollution and handling chemical waste in compliance to current environment's act.	1.1 Battery types and connector labelled & verified. 1.2 Battery meter specified readings indicated in accordance with manufacturer's specification. 1.3 Battery charging station at designated location. 1.4 Connector of battery and charger verified. 1.5 Charging status indicated. 1.6 Charging mode for battery voltage, current and types indicated. 1.7 Charging abnormalities which includes appearance, smell and sound indicated. 1.8 Charged battery placed at designated location. 1.9 Battery charging cycle time log completed in accordance with manufacturer's specification. 1.10 Fixed wing drone battery charging procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	visible damage • Charging sequence • Charging mode 1.4 Battery abnormalities. • Types of abnormalities • Inspect for visible abnormalities (during and after charging) 1.5 Battery log activity - manufacturer's specification and data sheet.			
2. Setup Ground Control Station (GCS) and telemetry.	2.1 Introduction to radio controller for drone. • Types of transmitter & receiver • Setting of transmitters • Types of signal • Type of display 2.2 Introduction to	2.1 Select radio controller for fixed wing drone. 2.2 Select live view unit. 2.3 Check for full battery capacity for both radio controller and live view unit. 2.4 Activate Mission Planner program. 2.5 Check for updated	<u>ATTITUDE</u>. • Compliance to manual and procedures. <u>SAFETY.</u> • Compliance to warning, caution and notes as stated in manufacturer's specification.	2.1 Correct radio controller for drone marked. 2.2 Live view displayed. 2.3 Battery full status indicated. 2.4 Mission planner program selected. 2.5 Link indicator between radio controller and display unit lit. 2.6 Profile characteristics for the specific drone to be operated

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Ground Control System. • Drone firmware • Drone configuration 2.3 Introduction to Mission Planning. • Type of mission • Mission Planning setup	version of Mission Planner. 2.6 Establish communication link between radio controller and live view unit. 2.7 Set radio controller parameters in accordance to drone profile. 2.8 Set Mission Planner parameters in accordance to current undertaken mission planning.	ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	loaded in radio controller flight parameter set. 2.7 Profile characteristics for the specific drone to be operated loaded in mission planner setting. 2.8 Ground Control Station (GCS) setting up processes are described in detail.
3. Assemble control surfaces.	3.1 Basic theory of drone flight. • Components of drone • Control surface • Thrust, drag, lift and weight 3.2 Introduction to drone avionic. • Flight Controller	3.1 Get assembly checklist. 3.2 Get fuselage on a flat surface. 3.3 Fix both wings onto the fuselage. 3.4 Fix rudder onto the fuselage. 3.5 Fix elevator onto the fuselage.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification.	3.1 Fuselage holder used. 3.2 Wings, rudder, elevator & landing gear securely fixed. 3.3 Control connector securely plugged. 3.4 Servo mechanism, flight controller, sensors and battery securely fixed in accordance with manufacturer's manual.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	(FC) • Air speed sensor • Servo • Electronic Speed Controller (ESC)	3.6 Fix landing gear onto the fuselage. 3.7 Plug-in all control cable. 3.8 Fix servos. 3.9 Check flight controller. 3.10 Fix sensors. 3.11 Install battery inside fuselage compartment. 3.12 Update assembly checklist.	ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	3.5 Fixed wing drone assembling procedures are described in detail.
4. Fix propeller.	4.1 Introduction of propeller. • Material • Structure 4.2 Pre-flight inspection procedures - maintenance	4.1 Select propeller. 4.2 Install propeller onto motor. 4.3 Secure the propeller.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution	4.1 Types and size of propeller selected and verified. 4.2 Propeller overall condition inspected. 4.3 Propeller screw tighten, and safety lock secured. 4.4 Propeller assembly checklist confirmed. 4.5 Fixed wing drone propeller installation process are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			and handling chemical waste in compliance to current environment's act.	
5. Prepare fixed wing drone.	5.1 Introduction to charts and flight plan. • Basic meteorology • Basic navigation • Basic flight planning 5.2 Introduction to drone airspace procedures - Civil Aviation Authority Malaysia 5.3 Introduction to Ground Control System. • Drone firmware • Drone configuration	5.1 Check wind direction using wind sock. 5.2 Place head of the fixed wing drone against the wind direction. 5.3 Set radio controller to the fixed wing drone parameters. 5.4 Set mission planner to the as per plan for autonomous flight mission. 5.5 Power on fixed wing drone.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	5.1 Power LED lit observed. 5.2 Wind sock direction determined. 5.3 Fixed wing drone head direction confirmed. 5.4 Matching fixed wing model selected. 5.5 Mission Planner set as per plan verified. 5.6 Fixed wing drone preparation procedures are described in detail.
6. Check weather and environment conditions.	6.1 Introduction to aviation weather sources. • Basic surface aviation weather	6.1 Obtain forecast checklist. 6.2 Identify weather and environment conditions.	ATTITUDE. • Compliance to manual and procedures. SAFETY.	6.1 Awareness of current and forecast weather conditions is maintained. 6.2 Weather conditions are monitored and responded in

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	observations • Aviation weather reports • Aviation forecasts • Convective Significant Meteorological Information (WST) 6.2 Applicable regulation - environment	6.3 Perform risk assessment and mitigation. 6.4 Record weather and environment compliance.	• Compliance to warning, caution and notes as stated in manufacturer's specification. <u>ENVIRONMENT.</u> • Minimising pollution and handling chemical waste in compliance to current environment's act.	accordance with regulatory body requirements and SOP. 6.3 Layout of current environment condition, obstacles and structures of flying area verified. 6.4 Supporting documents and layout provided by local authorities verified. 6.5 Pre-flight data acquired, and logbook completed in accordance with SOP. 6.6 Weather and environment assessment procedures are described in detail.
7. Calibrate avionic sensors and Centre of Gravity (CG).	7.1 Introduction to sensor. • Types of sensor • Sensor calibration and testing 7.2 Introduction to flight operational procedures. • Operation manual • Safety procedures	7.1 Check sensors. 7.2 Check control signal and data cable. 7.3 Calibrate and test sensors triggering mechanism. 7.4 Check the centre of gravity.	<u>ATTITUDE</u>. • Compliance to manual and procedures. <u>SAFETY.</u> • Compliance to warning, caution and notes as stated in manufacturer's specification.	7.1 Sensor with mounting fixed firmly demonstrated. 7.2 Data and control signal explained. 7.3 Sensors calibration and triggering status demonstrated and explained. 7.4 The CG of the fixed wing drone demonstrated. 7.5 ReliaNo.ity and validity of calibrated equipment

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	checked and explained. 7.6 Adherence to workplace safety requirements performed. 7.7 Avionic and Centre of Gravity (CG) calibration process explained. 7.8 Avionic and Centre of Gravity (CG) calibration procedure are described in detail.
8. Prepare take-off/landing zone.	8.1 Introduction to drone airspace procedures. • Controlled airspace • Uncontrolled airspace • Special use airspace • Air traffic control and national airspace system • Radio communication procedures • Visual Flight	8.1 Identify flying site location. 8.2 Locate open space at work site. 8.3 Mark permissible site area layout in digital map. 8.4 Locate for flat or level ground plane.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to	8.1 Fixed wing drone take-off and landing zone confirmed. 8.2 Take-off and landing zone barrier placed. 8.3 Coordinate in digital map marked, operation area perimeter observed and recorded. 8.4 Take-off/landing preparation procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Rules (VFR) terms and symbols • Notices to Airmen (NOTAMs)		current environment's act.	
9. Record pre-flight log.	9.1 Introduction to flight operational procedures. • Operation manual • Safety procedure • Log book • Emergency / recovery plan	9.1 Obtain pre-flight log checklist. 9.2 Compare past information. 9.3 Check regulations documentation compliance. 9.4 Check aircraft airworthiness. 9.5 Update checklist.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	9.1 Pre-flight log checklist completed and adhered. 9.2 Awareness of physical inspection explained. 9.3 Awareness of control inspection and calibration explained and in accordance with manufacturer's manual. 9.4 Pre-flight log documentation procedures are described in detail.

Employability Skills

Core Abilities

- Please refer NCS-Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

References for Learning Material Development

1 Adam Jupiter (2016), The Drone Pilot's Handbook: The Knowledge, The Skills, The Rules, Roly Allen. BOOK ISBN 978-1-78157-298-6

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15.2 Fixed Wing Drone Flying Operation

SECTION	(H) Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
COMPETENCY UNIT TITLE	Fixed Wing Drone Flying Operation		
LEARNING OUTCOMES	The outcome of this competency unit isto ensure fixed wing drone operate smoothly during flying mission with all objectives of the mission achieved. Upon completion of this competency unit, trainees shall be able to: 1. Check abnormalities. 2. Check take-off and circling fixed wing drone functionality. 3. Manoeuvre fixed wing drone. 4. Engage mission. 5. Check telemetry information. 6. Execute Emergency Recovery Procedures (ERP). 7. Prepare fixed wing drone landing.		
TRAINING PRE-REQUISITE (SPECIFIC)	Possess competency in CU01.		
CU CODE	H512-001-3:2019-C02	NOSS LEVEL	Three (3)

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Check abnormalities.	1.1 Basic theory of drone flight. • Components of drone	1.1 Obtain drone checklist. 1.2 Study checklist parameters	ATTITUDE. • Compliance to manual and procedures.	1.1 Drones components confirmed. 1.2 Temperature reading indicated in accordance with

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Control surface • Thrust, drag, lift and weight • Abnormalities	compliance. 1.3 Compare checklist with drone. 1.4 Update drone checklist.	SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	manufacturer's specification. 1.3 Battery voltage reading indicated in accordance with battery data sheet. 1.4 Minimum satellite number required indicated. 1.5 Sensors mount stabilized. 1.6 Propeller orientation checked 1.7 Drone control surfaces checked. 1.8 Drone abnormalities assessment procedures are described in detail.
2. Check take-off and circling fixed wing drone functionality.	2.1 Introduction to drone avionic. • Flight Controller (FC) • Air speed sensor • Servo • Electronic Speed Controller (ESC)	2.1 Test motor thrust. 2.2 Aileron drone to left and right. 2.3 Rudder drone to the left and right. 2.4 Take off fixed wing drone. 2.5 Confirm fixed wing drone circling.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical	2.1 Propeller sound audible and telemetry reading indicated. 2.2 Drone behaviour monitored. 2.3 Drone safely airborne at minimum 30m above ground level (AGL) subject to surrounding area. 2.4 Drone roll/bank angle left and right confirmed. 2.5 Yaw/ heading confirmed. 2.6 Take-off and circling fixed wing drone functionality procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			waste in compliance to current environment's act.	
3. Manoeuvre fixed wing drone.	3.1 Introduction to drone flight operational procedure. • Operation manual • Safety procedure • Log book 3.2 Introduction to small unmanned aircraft loading • Centre of Gravity • Stability • Load factors • Weight and balance	3.1 Set minimum thrust above minimum stall speed. 3.2 Loiter fixed wing drone.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	3.1 Drone airspeed determined in accordance with manufacturer's specification. 3.2 Drone roll/bank angle left and right confirmed. 3.3 Yaw/ heading confirmed. 3.4 Drone manoeuvring procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Engage mission.	4.1 Drone mission engagement. • Flying mission • Flight plan • Marking and tracking • Flight path completion	4.1 Activate flying mission. 4.2 Mark flight plan. 4.3 Track flight path status. 4.4 Confirm drone flying path completed. 4.5 Check telemetry information.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	4.1 Drone telemetry which include GPS, airspeed, battery voltage, radio signal strength indicator (RSSI), airtime reading indicated. 4.2 Drone flying mission commenced. 4.3 Flight height, waypoint and distance within range confirmed. 4.4 Drone mission plan recorded. 4.5 Mission engaging procedures are described in detail.
5. Check telemetry information.	5.1 Introduction drone telemetry signal. 5.2 Introduction to GPS system.	5.1 Check battery status. 5.2 Check flight height, distance & heading. 5.3 Check GPS status which include wind speed & direction. 5.4 Check wireless telemetry status. 5.5 Check fixed wing	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's	5.1 Battery status explained. 5.2 Flight height, distance and heading explained. 5.3 GPS status which include wind speed & direction explained. 5.4 Wireless telemetry status explained. 5.5 Drone speed which include

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
		drone speed. 5.6 Check flight mode which include autonomous & stabilize mode. 5.7 Check bank angle. 5.8 Check telemetry signal.	specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	air and ground speed explained. 5.6 Flight mode which include autonomous and stabilize mode explained. 5.7 Bank angle explained 5.8 Telemetry signal which include sensor status explained. 5.9 Workplace safety requirements including weather and environmental condition defined. 5.10 Compilation of reports and documents performed and explained. 5.11 Telemetry assessment process explained. 5.12 Telemetry assessment procedures are described in detail.
6. Execute Emergency Recovery Procedures (ERP).	6.1 Introduction to flight emergency procedure. • Operation manual • Drone safety	6.1 Identify types of emergency. 6.2 Determine level of damage. 6.3 Activate ERP	ATTITUDE. • Compliance to manual and procedures. SAFETY.	6.1 External and internal factors to emergency as telemetry are indicated. 6.2 Injury and damage are assessed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	procedure • Flight log book • Emergency and recovery plan procedures. 6.2 Introduction to hazard and risk • Risk management • Human factors • Situational awareness • Decision-making in a dynamic environment	procedure. 6.4 Record incident/ accident.	• Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	6.3 Emergency response activated. 6.4 First information report (FIR) lodged. 6.5 Emergency and recovery procedures are described in detail.
7. Prepare fixed wing drone landing.	7.1 Introduction to drone landing procedures. • Radio communication procedures • Traffic advisory practices 7.2 Drone landing area. 7.3 Drone RTH procedures.	7.1 Abort drone mission. 7.2 Check landing area from intrusion. 7.3 Return fixed wing drone to home (RTH).	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification.	7.1 Mission accomplished adhere to work order. 7.2 Landing procedure adhered to SOP. 7.3 Flight telemetry reading indicated. 7.4 Drone safely landed. 7.5 Drone landing preparation procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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14 Steven J. Zaloga (2008), Unmanned Aerial Vehicles, Robotic Air Warfare 1917-2007. BOOK ISBN 978-1-84603-243-1

15.3 Fixed Wing Drone Post-Flight Preparation

SECTION	(H) Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
COMPETENCY UNIT TITLE	Fixed Wing Drone Post-Flight Preparation		
LEARNING OUTCOMES	The outcome of this competency unit is to ensure fixed wing drone data collection from its sensor is recovered safely, drone in good condition, dismantle properly and flight log recorded. Upon completion of this competency unit, trainees shall be able to: 1. Verify data collection. 2. Check fixed wing drone abnormalities. 3. Dismantle fixed wing drone parts. 4. Record post-flight log.		
TRAINING PRE-REQUISITE (SPECIFIC)	Possess competency in CU01 & CU02.		
CU CODE	H512-001-3:2019-C03	NOSS LEVEL	Three (3)

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Verify data collection.	1.1 Introduction to data collection. • Type of data • Type of storage card, adapter and connector	1.1 Retrieve storage card from sensor. 1.2 Manage document control. 1.3 Verify data compiling.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to	1.1 Storage card verified. 1.2 Computer readiness confirmed. 1.3 Document control verified. 1.4 Data compiling confirmed. 1.5 Data collection verification

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	procedures are described in detail.
2. Check fixed wing drone abnormalities.	2.1 Basic theory of flight. • Components of drone • Control surface • Thrust, drag, lift and weight • Abnormalities 2.2 Introduction to drone avionic. • Flight Controller (FC) • Air speed sensor • Servo	2.1 Check motor and propeller condition. 2.2 Check drone frame structure. 2.3 Check electric, sensors, mechanical, and electronic components condition. 2.4 Update fixed wing drone condition.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to	2.1 Motor abnormalities which includes appearance, smell and temperature confirmed. 2.2 Structure of propeller damage identified. 2.3 Drone frame structure verified. 2.4 Avionics, mechanical, radio controller and sensors abnormalities verified 2.5 Abnormalities report list recorded. 2.6 Drone abnormalities assessment procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Electronic Speed Controller (ESC)		current environment's act.	
3. Dismantle fixed wing drone parts.	3.1 Introduction to UAV components. • Body/frame • Power supply/ platform • Computing • Sensors • Actuators • Software • Flight controls • Communications 3.2 Introduction to drone maintenance. • Uninstall drone parts • Post-flight maintenance	3.1 Uninstall propeller from motor. 3.2 Remove battery from battery slot. 3.3 Uninstall control surface. 3.4 Clean and store drone parts and equipment.	ATTITUDE. • Compliance to manual and procedures. SAFETY • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT • Minimising pollution and handling chemical waste in compliance to current environment's act.	3.1 Propeller removed from motor. 3.2 Battery at the drone removed. 3.3 Control surface safely removed. 3.4 Drone in storage condition verified. 3.5 Drone parts cleaned and placed at designated compartment. 3.6 Drone dismantling procedures are described in detail.
4. Record post-flight log.	4.1 Fixed wing drone flight operational procedure. • Operation manual • Safety procedure	4.1 Record flight time. 4.2 Record landing time. 4.3 Inform ATC on flying status. 4.4 Prepare written	ATTITUDE. • Compliance to manual and procedures. SAFETY	4.1 Airborne date and time recorded. 4.2 Landing information reported to ATC in accordance with CAAM

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Log book • Emergency/ recovery procedures	report regarding emergency incident and casualties.	• Compliance to warning, caution and notes as stated in manufacturer's specification. <u>ENVIRONMENT</u> • Minimising pollution and handling chemical waste in compliance to current environment's act.	NOTAM's. 4.3 Drone damage and problem reported. 4.4 All checklist collected. 4.5 Post-flight log and incident documentation procedures are described in detail.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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15.4 Fixed Wing Drone Maintenance

SECTION	(H) Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
COMPETENCY UNIT TITLE	Fixed Wing Drone Maintenance		
LEARNING OUTCOMES	The outcome of this competency unit is to ensure fixed wing drone, sensors and accessories for maintenance are done properly as per manufacturer specifications. Upon completion of this competency unit, trainees shall be able to: 1. Maintain fixed wing drone battery system. 2. Monitor firmware maintenance. 3. Monitor motor maintenance. 4. Monitor propeller maintenance. 5. Monitor fixed wing drone accessories maintenance. 6. Monitor controller maintenance. 7. Maintain control surfaces. 8. Maintain avionic and servos. 9. Monitor sensors maintenance.		
TRAINING PRE-REQUISITE (SPECIFIC)	Not Available.		
CU CODE	H512-001-3:2019-C04	NOSS LEVEL	Three (3)

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Maintain fixed wing drone	1.1 Introduction to battery.	1.1 Identify battery type and connector.	ATTITUDE. • Compliance to manual	1.1 Battery type and connector labelled.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
battery system.	• Types of battery • Types of connector • Safety precaution in charging drone battery 1.2 Battery cells, voltage and internal resistance. • Battery tester • Battery voltage indicator 1.3 Introduction to battery charger. • Types of power supply • Types of charger • Setting of battery charging parameters • Procedure to inspect charger for visible damage • Charging sequence • Charging mode 1.4 Battery	1.2 Inspect charger and connector for damage. 1.3 Check voltage. 1.4 Inspect drone and controller battery for abnormalities. 1.5 Prepare battery charger. 1.6 Connect battery to charger. 1.7 Switch on power supply and charger. 1.8 Set charging mode. 1.9 Start charging battery. 1.10 Monitor battery cells. 1.11 Observe charging abnormalities. 1.12 Stop charging mode. 1.13 Turn-off charger. 1.14 Disconnect battery charger. 1.15 Record battery internal resistance in maintenance log.	and procedures. <u>SAFETY.</u> • Compliance to warning, caution and notes as stated in manufacturer's specification. <u>ENVIRONMENT.</u> • Minimising pollution and handling chemical waste in compliance to current environment's act.	1.2 Charger and connector overall condition verified. 1.3 Battery meter specified readings indicated in accordance with manufacturer's specification. 1.4 Battery abnormalities which include appearance, leakage and loose connection indicated. 1.5 Battery charging station at designated location. 1.6 Power LED status indicated. 1.7 Connector of battery and charger matched. 1.8 Charging mode for battery voltage, current and type indicated. 1.9 Charging abnormalities which includes appearance, smell and sound indicated. 1.10 Charged battery placed at designated location. 1.11 Battery maintenance cycle time log completed in accordance with manufacturer's specification.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	abnormalities. • Types of abnormalities • Inspect for visible abnormalities (during and after charging). 1.5 Battery log activity - manufacturer's specification and data sheet.			1.12 Battery maintenance procedures are described in detail.
2. Monitor firmware maintenance.	2.1 Introduction to Ground Control System. 2 Drone firmware 3 Drone configuration	2.1 Refer to manufacturer's firmware update recommendation. 2.2 Power on drone and controller. 2.3 Check firmware update status. 2.4 Perform update firmware when prompted. 2.5 Verify firmware update successful. 2.6 Restart aircraft and controller power.	<u>ATTITUDE</u>. • Compliance to manual and procedures. <u>SAFETY.</u> • Compliance to warning, caution and notes as stated in manufacturer's specification. <u>ENVIRONMENT.</u> • Minimising pollution and handling chemical waste in compliance to	2.1 Drone and controller status LED indication verified. 2.2 Firmware status verified. 2.3 Latest firmware version verification checked. 2.4 Maintenance logbook update verified. 2.5 Firmware maintenance assessment procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
		2.7 Verify firmware version. 2.8 Record in firmware maintenance log.	current environment's act.	
3. Monitor motor maintenance.	3.1 Introduction to drone avionic. 4 Flight Controller (FC) 5 Air speed sensor 6 Servo 7 Electronic Speed Controller (ESC) 3.2 Basic soldering for maintenance.	3.1 Disconnect battery. 3.2 Remove propeller. 3.3 Check motors condition. 3.4 Check wiring and solder joint condition. 3.5 Replace motors when found abnormalities. 3.6 Re-solder joint when found loose connection. 3.7 Clean foreign matter from motors. 3.8 Record in fixed wing drone maintenance logbook.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	3.1 Battery placed at designated location verified. 3.2 Propeller placed at designated location verified. 3.3 Motors condition including sound, vibration, resistance, wiring, loose connection and solder joint maintenance verified. 3.4 Maintenance logbook update verified. 3.5 Motor maintenance assessment procedures are described in detail.
4. Monitor propeller maintenance.	4.1 Introduction to fixed wing drone propeller. • Material • Structure	4.1 Remove propeller from motors. 4.2 Check propeller mounting adapters	ATTITUDE. • Compliance to manual and procedures.	4.1 Propeller placed at designated location verified. 4.2 Propeller condition including crack, dent, chip, stiffness,

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	4.2 Fixed wing drone propeller maintenance - corrective/ preventive maintenance	condition. 4.3 Clean foreign matter from propeller. 4.4 Record in fixed wing drone maintenance logbook.	SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	balancing, connector maintenance verified. 4.3 Propeller adapters condition maintenance verified. 4.4 Maintenance logbook update verified. 4.5 Propeller maintenance assessment procedures are described in detail.
5. Monitor fixed wing drone accessories maintenance.	5.1. Introduction to fixed wing drone accessories. 5.2. Fixed wing drone accessories maintenance. • Corrective/ preventive maintenance	5.1 Identify types of accessories tools. 5.2 Remove accessories from fixed wing drone and camera. 5.3 Inspect accessories 5.4 Clean foreign matter from accessories. 5.5 Record in fixed wing drone maintenance logbook.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution	5.1 Drone accessories condition including crack, chip and dent maintenance verified. 5.2 Damaged accessories replacement verified. 5.3 Maintenance logbook update verified. 5.4 Drone accessories assessment procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			and handling chemical waste in compliance to current environment's act.	
6. Monitor controller maintenance.	6.1. Introduction to fixed wing drone controller. 6.2. Fixed wing drone controller maintenance - corrective/preventive maintenance	6.1 Turn off radio controller. 6.2 Remove battery from radio controller. 6.3 Inspect radio controller antenna. 6.4 Inspect radio controller command sticks. 6.5 Inspect radio controller switches and button. 6.6 Clean radio controller from foreign matter. 6.7 Record in controller maintenance log.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	6.1 Status LED indicated verified. 6.2 Radio controller battery placed at designated location verified. 6.3 Radio controller condition including crack, and chip and dent maintenance verified. 6.4 Maintenance logbook updated. 6.5 Controller maintenance assessment procedures are described in detail.
7. Maintain control surfaces.	7.1 Introduction to fixed wing drone control surfaces. 7.2 Fixed wing drone control surfaces	7.1 Power off aircraft. 7.2 Inspect control surfaces. 7.3 Clean foreign matters from control surfaces	ATTITUDE. • Compliance to manual and procedures. SAFETY.	7.1 Status LED indicated. 7.2 Control surfaces condition including appearance, crack, chip and dent maintained. 7.3 Maintenance logbook

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	maintenance - corrective/ preventive maintenance	7.4 Record in fixed wing drone maintenance log.	• Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	updated. 7.4 Control surface maintenance procedures are described in detail.
8. Maintain avionic and servos.	8.1 Introduction to fixed wing drone avionic and servos. 8.2 Fixed wing drone avionic and servos maintenance - corrective/ preventive maintenance	8.1 Power off drone. 8.2 Inspect avionic and servos. 8.3 Test avionic and servos movement, range and observe gears sound. 8.4 Clean foreign matters from avionic and servos. 8.5 Record in fixed wing drone maintenance log.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical	8.1 Status LED indicated. 8.2 All servos condition including appearance, crack, chip and dent maintained. 8.3 Maintenance logbook updated. 8.4 Avionic and servos maintenance procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			waste in compliance to current environment's act.	
9. Monitor sensors maintenance.	9.1 Introduction to fixed wing drone sensors. 9.2 Fixed wing drone sensors maintenance. • Corrective/ preventive maintenance	9.1 Power off sensor. 9.2 Unplugged battery from sensor. 9.3 Disconnect connection cable from sensor. 9.4 Inspect fixed wing drone sensors from crack, dent and chip. 9.5 Inspect for wiring damage. 9.6 Clean foreign matter from sensors. 9.7 Record in fixed wing drone maintenance log.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	9.1 Sensor status LED indicated verified. 9.2 Sensor battery placed at designated location verified. 9.3 Sensor condition including crack, chip dent, wiring, loose condition and solder joint maintenance verified. 9.4 Malfunction sensors repaired by authorised service centres approved. 9.5 Maintenance logbook update verified. 9.6 Sensors maintenance assessment procedures are described in detail.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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1	Adam Jupiter (2016), The Drone Pilot's Handbook: The Knowledge, The Skills, The Rules, Roly Allen. BOOK ISBN 978-1-78157-298-6
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13 Randal W. Beard & Timothy W. Mclain (2012), Small Unmanned Aircraft Theory and Practice, BOOK ISBN 978-1-40084-060-1
14 Steven J. Zaloga (2008), Unmanned Aerial Vehicles, Robotic Air Warfare 1917-2007. BOOK ISBN 978-1-84603-243-1

15.5 Unmanned Aerial Vehicle Supervision

SECTION	(H) Transportation and Storage		
GROUP	(512) Air Freight Transport		
AREA	Unmanned Aerial Vehicle		
NOSS TITLE	Drone Mission Commanding		
COMPETENCY UNIT TITLE	Unmanned Aerial Vehicle Supervision		
LEARNING OUTCOMES	The outcome of this competency unit is to ensure the supervisor for unmanned aerial vehicle can manage and coordinate successfully the overall flying mission as per management request. Upon completion of this competency unit, trainees shall be able to: 1. Conduct pre-flight briefing. 2. Conduct team coaching. 3. Coordinate waste disposal. 4. Prepare work schedule. 5. Assess staff performance. 6. Monitor health, safety and environment compliance. 7. Monitor document control. 8. Monitor operation and product quality control.		
TRAINING PRE-REQUISITE (SPECIFIC)	Not Available.		
CU CODE	H512-001-3:2019-C05	NOSS LEVEL	Three (3)

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Conduct pre-flight briefing.	1.1 Introduction to charts and flight plan. • Basic meteorology • Basic navigation • Basic flight planning 1.2 Introduction to drone airspace procedures. 1.3 Introduction to flight operational procedure. • Operation manual • Safety procedure • Log book • Emergency / recovery plan 1.4 Communication & presentation skills.	1.1 Obtain project information. 1.2 Call team member for meeting. 1.3 Brief on the project objective. 1.4 Assign task to crew member. 1.5 Ensure complete documentation available during briefing.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	1.1 Project method, mission and product explained. 1.2 Task crew assigned. 1.3 Permits, checklist and all log prepared. 1.4 Sensors and flying platform to use decided. 1.5 Equipment packed. 1.6 Pre-flight briefing procedures are described in detail.
2. Conduct team coaching.	2.1 Sources for identifying skill set. • Job description • Standard Operation Procedures • Work instructions	2.1 Identify skill set required. 2.2 Organise in-house training. 2.3 Demonstrate skill set. 2.4 Assess learning progress.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and	2.1 Sources for identifying skill set listed. 2.2 In-house training definition and benefits and activities described. 2.3 Training methods differentiated and described.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Training need analysis reports 2.2 In-house training. • Definition • Benefits of in-house • In-house training activities 2.3 Training methods which includes: • Shop talk • Demonstration • Discussion • Question & Answer 2.4 Training aids which includes: • Audio visual aids • Manuals and documents 2.5 Assessment methods which includes: • Feedback • Observation • Skill check 2.6 Skill Matrix details	2.5 Provide feedback. 2.6 Update skills matrix.	notes as stated in manufacturer's specification. <u>ENVIRONMENT.</u> • Minimising pollution and handling chemical waste in compliance to current environment's act.	2.4 Training aids differentiated and described. 2.5 Assessment methods differentiated and described. 2.6 Skill matrix details described. 2.7 Identification of skills and competencies needed for effective staff performance performed. 2.8 Identification of type of training, training methods and equipment training outcomes performed. 2.9 Compilation of reports and documents performed 2.10 In-house training process explained. 2.11 In-house training procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	which includes: • Competency level for various operations • Ability to multitask • Ability to teach others 2.7 Problem solving skills.			
3. Coordinate waste disposal.	3.1 Introduction to waste management. • Types of electronic waste • Disposal of electronic waste • Local regulation on electronic waste management • 3R waste management • Waste management body - Departmental of	3.1 Organize waste disposal program. 3.2 Evaluate conditions and circumstances of all UAV parts. 3.3 Execute compliance with local, state and federal regulations. 3.4 Take precaution against potential of personal injury. 3.5 Record disposable parts.	ATTITUDE. • Compliance to manual and procedures. SAFETY • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT • Minimising pollution and handling chemical waste in compliance to current environment's	3.1 Parts disposal program proposal presented to manager and endorsed. 3.2 End of battery life, broken and deform parts as per manufacturer specifications identified and segregated to designated area. 3.3 Local, state and federal government rules & regulations regarding waste disposal of Lipo battery, plastic, metal & electronic parts were studied and followed. 3.4 Safety procedure as specified

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Environment Malaysia guidelines.		act.	in Material Safety Data Sheet (MSDS)for every part to be dispose were adhered to avoid injury and toxification during handling. 3.5 Licensed disposable centre or agent were identified. 3.6 Log book registered for all disposed parts containing all necessary data for traceability. 3.7 Waste disposal coordination procedures are described in detail.
4. Prepare work schedule.	4.1 Introduction to mission planning. • Type of mission • Mission Planning setup • Basic Costing 4.2 Introduction to charts and flight plan. • Basic meteorology • Basic navigation • Basic flight planning	4.1 Acquire mission requirement and specification. 4.2 Plan timeline of the mission. 4.3 Prepare work schedule. 4.4 Prepare document and flight operation details for permit application.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT.	4.1 Meeting schedule prepared. 4.2 Team personnel informed. 4.3 Requirement and specification are listed. 4.4 Mission workflow explained in accordance with SOP. 4.5 Cost of project mobilisation are determined in accordance with SOP. 4.6 Document and flight operation details are prepared in accordance with SOP.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			• Minimising pollution and handling chemical waste in compliance to current environment's act.	4.7 Work schedule preparation procedures are described in detail.
5. Assess staff performance.	5.1 Appraisal requirements. • Job description • Record of work performance • Appraisal forms • Appraisal schedule 5.2 Scoring method. 5.3 Reporting format. 5.4 Communication skills.	5.1 Identify appraisal requirement. 5.2 Schedule appraisal. 5.3 Appraise staff. 5.4 Record details of appraisal performed. 5.5 Confirm agreeable outcomes. 5.6 Submit appraisal results to human resource.	ATTITUDE. • Compliance to manual and procedures. SAFETY • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT • Minimising pollution and handling chemical waste in compliance to current environment's act.	5.1 Appraisal requirements for personnel explained. 5.2 Scoring method used for appraisal explained. 5.3 Reporting format used explained. 5.4 Communication skills applied in appraisal explained. 5.5 Compilation of reports and documents performed 5.6 Staff performance assessment process explained. 5.7 Staff performance assessment procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
6. Monitor health, safety and environment compliance.	6.1 Introduction to health, safety and environment compliance. 6.2 Vision and flight. 6.3 Hazard and risk. 6.4 PAVE Checklist.	6.1 Execute drone operators health is in good condition for mission. 6.2 Execute monitor airspace safety. 6.3 Execute risk assessment or emergency. procedures in place 6.4 Execute permission to fly drone over any land owner/manager.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	6.1 Drone operators mentally and physically fit to work in accordance with HSE Compliance Standard Policy. 6.2 Safety guidelines from the CAAM, JUPEM, SKMM (MCMC) and CGSO are followed. 6.3 Drone flight behaviour monitored. 6.4 Permission to fly has been obtained. 6.5 Drone operator health, safety and environment compliance monitoring procedures are described in detail.
7. Monitor document control.	7.1 Introduction to document control. • Document management process	7.1 Collect job order. 7.2 Compile permits and log. 7.3 Execute document numbering and inventory followed accordingly.	ATTITUDE. • Compliance to manual and procedures. SAFETY. • Compliance to warning, caution and notes as stated in manufacturer's	7.1 Job order collected and filed. 7.2 CAAM, JUPEM, CGSO and local authority permits filed. 7.3 All log and documents compiled and verified in accordance with SOP. 7.4 Document control assessment procedures are described in detail.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			specification. ENVIRONMENT. • Minimising pollution and handling chemical waste in compliance to current environment's act.	
8. Monitor operation and product quality control.	8.1 Introduction to document control. • Document management process 8.2 Introduction to drone flight operation. 8.3 Introduction to health, safety and environment compliance.	8.1 Execute mission operated on schedule. 8.2 Execute all equipment's passed all maintenance standard check. 8.3 Supervised health, safety and environment. 8.4 Execute crew follows SOP and standard policy. 8.5 Secure data privacy.	ATTITUDE. • Compliance to manual and procedures. SAFETY • Compliance to warning, caution and notes as stated in manufacturer's specification. ENVIRONMENT • Minimising pollution and handling chemical waste in compliance to current environment's act.	8.1 Operation carried on according to schedule. 8.2 Maintenance logbook verified. 8.3 HSE Compliance Standard Policy verified. 8.4 Raw data and product are managed in accordance with SOP. 8.5 Operation and product quality control assessment procedures are described in detail.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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1	Adam Jupiter (2016), The Drone Pilot's Handbook: The Knowledge, The Skills, The Rules, Roly Allen. BOOK ISBN 978-1-78157-298-6
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10	Khairul Nizam Tahar & Anuar Ahmad (2012), A novel method for photogrammetric mapping using UAV rotary system, LAP LAMBERT Academic Publishing. 978-3848483945. BOOK ISBN 978-8484-8394-5
11	Legal Research Board (May 25th 2017), Communications and Multimedia Act 1998 (Act 588), Regulations, Rules and Order & Malaysian Communications and Multimedia Commissions Act 1998 (Act 589), International Law Book Services. BOOK ISBN 978-967-89-2638-6

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13 Randal W. Beard & Timothy W. Mclain (2012), Small Unmanned Aircraft Theory and Practice, BOOK ISBN 978-1-40084-060-1
14 Steven J. Zaloga (2008), Unmanned Aerial Vehicles, Robotic Air Warfare 1917-2007. BOOK ISBN 978-1-84603-243-1

16. Delivery Mode

The following are the **recommended** training delivery modes:-

KNOWLEDGE	SKILL
• Lecture • Group discussion • E-learning, self-paced • E-learning, facilitate • Case study or Problem based learning (PBL) • Self-paced learning, non-electronic • One-on-one tutorial • Shop talk • Seminar	• Demonstration • Simulation • Project • Scenario based training (SBT) • Role play • Coaching • Observation • Mentoring

Skills training and skills assessment of trainees should be implemented in accordance with TEM requirements and actual situation.

17. Tools, Equipment and Materials (TEM)

DRONE MISSION COMMANDING

LEVEL 3

CU No.	CU CODE	COMPETENCY UNIT TITLE
CU1	H512-001-3:2019-C01	Fixed Wing Drone Pre-Flight Preparation
CU2	H512-001-3:2019-C02	Fixed Wing Drone Flying Operation
CU3	H512-001-3:2019-C03	Fixed Wing Drone Post-Flight Preparation
CU4	H512-001-3:2019-C04	Fixed Wing Drone Maintenance
CU5	H512-001-3:2019-C05	Unmanned Aerial Vehicle Supervision

*Items listed refer to TEM's **minimum requirement** for skills delivery only.

No.	ITEM*	RATIO (TEM : Trainees or AR = As Required)				
		CU1	CU2	CU3	CU4	CU5
A. Tools						
1	Test pen	1:1			1:1	
2	Wind sock	1:25				
3	Anemometer	1:5				
4	Binocular	1:5				
5	Barricade cone	1:5				
6	Storage card container			1:5		
7	Battery container			1:5		
8	Propeller container			1:5	1:5	

No.	ITEM*	RATIO (TEM : Trainees or AR = As Required)				
		CU1	CU2	CU3	CU4	CU5
9	Accessory container				1:5	
10	Adapter			1:5		
11	Data cable			1:5	1:5	
12	Safety spectacles				1:1	
13	Safety jacket				1:1	
14	Soldering iron station				1:5	
15	ESD mate				1:5	
16	Drone battery container					1:5
17	Radio controller battery container					1:5
18	Propeller environmental proof storage box					1:5
19	Sensor environmental proof & non-magnetic storage box					1:5
B. Equipment						
1	Measuring equipment (Volt meter)	1:5	1:5			
2	Power supply	1:5				
3	Battery charger	1:5			1:5	1:5
4	Radio control (Remote transmitter)	1:5	1:5	1:5		
5	Sensors	1:5	1:5	1:5		
6	Laptop	1:5	1:5	1:5		1:5
7	Thermal probe	1:5	1:5			
8	Fixed Wings Drone		1:5	1:5	1:5	1:5
9	Drone		1:5	1:5	1:5	1:5
10	Propeller	1:5	1:5	1:5		
11	Display device		1:5	1:5		

No.	ITEM*	RATIO (TEM : Trainees or AR = As Required)				
		CU1	CU2	CU3	CU4	CU5
12	Drone storage bag			1:5		
13	Accessory bag			1:5		
14	Voltage tester				1:5	1:5
15	Smoke absorber				1:5	
C. Materials						
1	Battery	AR	AR	1:5		
2	Connector	AR	AR		AR	
3	SD Card	AR	AR			
4	Check list	AR				
5	Flight log book		AR			
6	Drone battery				AR	
7	Radio control battery				AR	
8	Mark sticker				AR	
9	Propeller log book				1:1	
10	Solder wire				AR	
11	Solder wick				AR	
12	Cleaning cloth				AR	AR
13	Accessory log book				1:1	
14	Maintenance log book				1:1	
15	Firmware maintenance log book				1:1	
16	Label sticker					AR
17	Checklist record sheet					AR
18	Flight log book sheet					1:1
19	Battery charging cycle log book sheet					1:1

18. Competency Weightage

The following table shows the percentage of training priorities based on consensus made by the Standard Development Committee (SDC).

DRONE MISSION COMMANDING

LEVEL 3

CU CODE	COMPETENCY UNIT TITLE	COMPETENCY UNIT WEIGHTAGE	WORK ACTIVITIES	WORK ACTIVITIES WEIGHTAGE
H512-001-3:2019-C01	Fixed Wing Drone Pre-Flight Preparation	21%	1. Charge fixed wing drone battery.	10%
			2. Setup Ground Control Station (GCS) and telemetry.	25%
			3. Assemble control surfaces.	5%
			4. Fix propeller.	10%
			5. Prepare fixed wing drone.	15%
			6. Check weather and environment conditions.	10%
			Calibrate avionic sensors and Centre of Gravity (CG).	10%
			7. Prepare take-off/landing zone.	10%
			8. Record pre-flight log.	5%
H512-001-3:2019-C02	Fixed Wing Drone Flying Operation	39%	1. Check abnormalities.	15%
			2. Check take-off and circling fixed wing drone functionality.	10%
			3. Manoeuvre fixed wing drone.	10%

CU CODE	COMPETENCY UNIT TITLE	COMPETENCY UNIT WEIGHTAGE	WORK ACTIVITIES	WORK ACTIVITIES WEIGHTAGE
			4. Engage mission.	25%
			5. Check telemetry information.	15%
			6. Execute Emergency Recovery Procedures (ERP).	15%
			7. Prepare fixed wing drone landing.	10%
H512-001-3:2019-C03	Fixed Wing Drone Post-Flight Preparation	10%	1. Verify data collection.	30%
			2. Check fixed wing drone abnormalities.	30%
			3. Dismantle fixed wing drone parts.	25%
			4. Record post-flight log.	15%
H512-001-3:2019-C04	Fixed Wing Drone Maintenance	21%	1. Maintain fixed wing drone battery system.	10%
			2. Monitor firmware maintenance.	5%
			3. Monitor motor maintenance.	15%
			4. Monitor propeller maintenance.	15%
			5. Monitor fixed wing drone accessories maintenance.	10%
			6. Monitor controller maintenance.	10%
			7. Maintain control surfaces.	15%
			8. Maintain avionic and servos.	10%
			9. Monitor sensors maintenance.	10%
H512-001-3:2019-C05	Unmanned Aerial Vehicle Supervision	10%	1. Conduct pre-flight briefing.	10%
			2. Conduct team coaching.	15%
			3. Coordinate waste disposal.	10%
			4. Prepare work schedule.	10%
			5. Assess staff performance.	10%

CU CODE	COMPETENCY UNIT TITLE	COMPETENCY UNIT WEIGHTAGE	WORK ACTIVITIES	WORK ACTIVITIES WEIGHTAGE
			6. Monitor health, safety and environment compliance.	20%
			7. Monitor document control.	10%
			8. Monitor operation and product quality control.	15%
		TOTAL PERCENTAGE (CORE COMPETENCY)		100%
		TOTAL PERCENTAGE (ELECTIVE COMPETENCY		Not Available
		CORE ABILITIES (HOURS)		80

Sample Calculation for Summary of Training Hours

The following table shows the nominal training hours based on recommendations made by the Standard Development Committee (SDC). For purpose of Malaysian Skills Certification through accredited centre training, the program duration is subject to Malaysian Skills Certification System.

DRONE MISSION COMMANDING

LEVEL 3

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITY	WORK ACTIVITY TRAINING DURATION (HOURS)		TRAINING DURATION (HOURS)	SKILLS CREDIT
			KNOWLEDGE	SKILLS		
H512-001-3:2019-C01	Fixed Wing Drone Pre-Flight Preparation	1. Charge fixed wing drone battery.	8	15	230	23
		2. Setup Ground Control Station (GCS) and telemetry.	16	42		
		3. Assemble control surfaces.	4	8		
		4. Fix propeller.	8	16		
		5. Prepare fixed wing drone.	9	24		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITY	WORK ACTIVITY TRAINING DURATION (HOURS)		TRAINING DURATION (HOURS)	SKILLS CREDIT
			KNOWLEDGE	SKILLS		
		6. Check weather and environment conditions.	8	15		
		Calibrate avionic sensors and Centre of Gravity (CG).	8	15		
		7. Prepare take-off/landing zone.	8	16		
		8. Record pre-flight log.	4	6		
H512-001-3:2019-C02	Fixed Wing Drone Flying Operation	1. Check abnormalities.	18	48	440	44
		2. Check take-off and circling fixed wing drone functionality.	12	32		
		3. Manoeuvre fixed wing drone.	12	32		
		4. Engage mission.	30	80		
		5. Check telemetry information.	18	48		
		6. Execute Emergency Recovery Procedures (ERP).	18	48		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITY	WORK ACTIVITY TRAINING DURATION (HOURS)		TRAINING DURATION (HOURS)	SKILLS CREDIT
			KNOWLEDGE	SKILLS		
		7. Prepare fixed wing drone landing.	12	32		
H512-001-3:2019-C03	Fixed Wing Drone Post-Flight Preparation	1. Verify data collection.	8	24	110	11
		2. Check fixed wing drone abnormalities.	8	24		
		3. Dismantle fixed wing drone parts.	8	18		
		4. Record post-flight log.	4	16		
H512-001-3:2019-C04	Fixed Wing Drone Maintenance	1. Maintain fixed wing drone battery system.	8	16	230	23
		2. Monitor firmware maintenance.	4	9		
		3. Monitor motor maintenance.	9	24		
		4. Monitor propeller maintenance.	8	24		
		5. Monitor fixed wing drone accessories maintenance.	8	16		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITY	WORK ACTIVITY TRAINING DURATION (HOURS)		TRAINING DURATION (HOURS)	SKILLS CREDIT
			KNOWLEDGE	SKILLS		
		6. Monitor controller maintenance.	8	16		
		7. Maintain control surfaces.	8	24		
		8. Maintain avionic and servos.	8	16		
		9. Monitor sensors maintenance.	8	16		
H512-001-3:2019-C05	Unmanned Aerial Vehicle Supervision	1. Conduct pre-flight briefing.	4	8	110	11
		2. Conduct team coaching.	4	12		
		3. Coordinate waste disposal.	4	8		
		4. Prepare work schedule.	4	8		
		5. Assess staff performance.	4	8		
		6. Monitor health, safety and environment compliance.	4	14		
		7. Monitor document control.	4	8		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITY	WORK ACTIVITY TRAINING DURATION (HOURS)		TRAINING DURATION (HOURS)	SKILLS CREDIT
			KNOWLEDGE	SKILLS		
		8. Monitor operation and product quality control.	4	12		
TOTAL HOURS (CORE COMPETENCY)			322	798	1120	112
TOTAL HOURS OF COMPETENCY UNIT					1120	
CORE ABILITIES (HOURS)					80	

The sample calculations performed are based on table in section 18 for delivery of Level 3 training program at 1200 hours including delivery of core abilities.