RAILSCAPE LTD
TRADING AS RUAS

Annex X
UAPS DJI M300
Spraying Operations

Version 3.0 Dated 18/08/22

Amendment Record

Amendment Number	Date	Amended by
1.0	22/02/2022	M Smith
2.0	08/07/2022	L Fox
3.0	18/08/2022	L Fox

Amendment procedure:

As defined in RUAS 008 – UAS – OSC – Volume 1 – Operations Manual

Revision History

1.0 22/02/2022 Initial version
2.0 08/07/2022 Updates to include spraying chemical and changes as per oversight report INC7711.
3.0 18/08/2022 Updates of images and inclusion of recent system changes

2
Acronyms and Abbreviations

All acronyms and abbreviations are as defined in RUAS 008-UAS – OSC – Volume1 – Operations Manual.

Table of contents

1. Introduction

This Annex contains the system specifications of the M300 UAPS spraying operations.

The details of the M300 UAPS system and procedures are contained within and will be used in conjunction with RUAS Vol 1 and OA issued by UK CAA and any relevant HSE authorisation.

The M300 UAPS system is for RD purposes and is the be used in conjunction with OA issued by the CAA. The spraying will be carried out with Roundup ProVantage IAW the spraying Application Plan.

The M300 UAPS system includes the Super Leggara (SL) which gives an overall mass of 7.2kg (full) and the HotSwap which gives an overall mass of 8.96kg.

Introduction

Railscape (Ltd) have operated on and around Britain's railway infrastructure since the early days of privatisation providing a range of services known in the industry as 'off track'. These services include fencing, environmental services and requirements associated with all elements of the infrastructure aside of engineering works on the permanent way. Our main provision of service is in the area of vegetation management, vegetation control and arbour.

The management of the railway lineside is and always has been an incredibly challenging environment to work in. In addition to all the risks involved in vegetation control, management and removal, operations on and around Britain's rail infrastructure import additional significant risk to any works required. These additional risks are not solely in relation to the juxtaposition of the operational rail risks but also many other factors such as the age of the infrastructure, adjacent operators (tramlines, airports, underground services, Highspeed Rail etc) lineside neighbours, environmentally sensitive sites (e.g SSSI's etc) all of which combine to create a work environment that requires thorough consideration and scrutiny prior to even beginning to scope the required vegetation works.

Much of Britain's rail infrastructure is either of original Victorian construction or on the foundation of and covering the same footprint as the original Victorian construction. This creates many problematic issues for Network Rail and the Train Operating Companies (TOCs) not only in delivering the train services they are committed to but also with maintenance and upgrades. If work is required on any infrastructure that is within close proximity to the permanent way, in order to ensure the highest possible levels of safety to all operatives the process is to carry out those works under 'possession' of the line within the pre-identified worksite area. If the intended worksite falls within an area of infrastructure that operates under electrification, in addition to the possession an 'isolation' of the live electrical assets is put in place.

The above process considerably limits the time available on site to carry out any works. It also usually dictates that the works are carried out at night. Clearly this imports additional risk (albeit risk that will have been considered at the planning stage and accounted for in the safe method of work plan submitted and approved prior to the commencement of any works). To this end, Railscape have been working for over 4 years now on introducing technology and innovation to their off track works specifically order to reduce working at height, working at night and working to deadlines dictated by train operations.

2. The Challenges

The arrangements for track possession and any required isolations can take up to 38 weeks and for cyclical plans up to 52 weeks. It is an expensive process that involves several pre-work planning meetings and several skilled & competent operatives to put in place the required and necessary protection. As this all has to fit within the operational train timetable and often, night freight train movements. This has the effect of giving a total amount of time on site of usually no more than 3-4 hours maximum. In areas of high traffic such as major stations, the window is often reduced to as little as 2 hours.

An additional problem that arises when working on the approach to any city centre or major station is that the approaches are generally either sub-surface (open air) or viaduct. These environments import the additional risk of working at height. Once this is added to working on and around the rail infrastructure, risk arising from interfacing infrastructure (often road closures are also required) and other lineside neighbours, along with the necessary safety procedures relating to the core operation of vegetation control, it is clear to see that any introduction of technology that can reduce or remove any one of these potential risks would be beneficial.

The current process for buddleia/vegetation control at height on the railway infrastructure will be carried out by utilising either height access equipment or IRATA (industrial rope access techniques association) competent operatives. Either method has a considerable set up time and is carried out under artificial lighting. This not only carries the usual risks associated with working at height but also has a serious impact on the available time left to carry out the planned, core operation. So much so, that at several locations across the UK rail network, the access for these types of work can be so restrictive that the vegetation isn't controlled in a consistent and planned manner and leads to failure of part of a structure.

A further consideration to all of the above and a common occurrence is once a possession & isolation have been put in place and all the necessary access equipment having been brought to site (a costly exercise) is for the operation to be cancelled due to inclement weather.

In addition to the many brick structures and difficult to access buildings on the UK rail infrastructure are the many cuttings and embankments that also require a programme of planned preventative maintenance in order to maintain structural integrity and prevent potential weakening, subsidence or collapse. It is recognised that management rather than eradication of the vegetation on these areas is best practice from an environmental, sustainability and a stability consideration. This then imports further risk to any operative working within this environment as not only are they working at height and most commonly under artificial lighting, they also have to operate around protruding vegetation that is to be left in situ.

3. The Solution

For the past five years, we at Railscape Ltd have been working to find a method of addressing all of the above issues in an attempt to remove the risks of working at height, predominantly at night, under artificial lighting in a restrictive area and under the pressure of time constraints. After much self-funded research, development and testing we have designed a fully functional method of applying herbicide in a precision manner to vegetation at height or in difficult to access areas.

Working alongside Harper Adams University and our commercial drone partners RUAS we feel we have established that herbicide can be applied directly to the target plant intended without the requirement for rope access or height access equipment such as scaffold towers or mobile elevated working platforms. Our unique process places the operative a far greater distance from the herbicide being applied and removes the need for almost all of the peripheral supporting operatives.

In addition to the obvious safety advantages and risk removal our process presents, the operation is precise in targeting, precise in delivery and will use considerably less chemical volumes with a far less risk of spill than conventional knapsack application. It will significantly reduce manual handling throughout the entire application process. It will lead to less time on site and will also allow us to treat several areas during normal railway operations during daylight hours as opposed to working at night.

In short, our technology will allow a far more robust and precise planned preventative maintenance regime than that could ever be established using current methods with the benefit of a vast amount of on-site risk removal.

4. Our Aims

We have had significant interest in this new, proposed method of delivery from across several industries and organisations. Examples being not only difficult to access infrastructure, but locations such as rhododendron colonies on steep embankments within national parks and Japanese knotweed colonies in the south west of England.

Initially we will only be proposing to offer this service to large, recognised land-owning bodies such as Network Rail, Network Rail Highspeed, the Environment Agency and Councils. This would allow us to assess actual 'in operation' experience permitting us to assess schedules, progress and any currently unidentified issues.

Our aim is to be permitted to operate the UAPS on all Network Rail owned and operated infrastructure and the Japanese Knotweed colony locations in Cornwall as shown in the accompanying documentation. This is in order to allow all relevant stakeholders to gather the volume of real operational data required which would then (subject to all parties being satisfied and all criteria met) permit us to bring this hugely innovative new method of herbicide application to the general market.

5. Technology and change

Railscape RUAS already have an OA for UAPS operations with the DJI M600 pro UAS reference 11426. To move this technology forward in conjunction with Railscape technologies have designed a very similar payload to be mounted on the far more superior airframe of the DJI M300.

All changes to the UAPS will be logged on Xl Spread sheet Technical Evolution of Railscape UAPS Super Leggara/HotSwap. This development can be found in section 8.

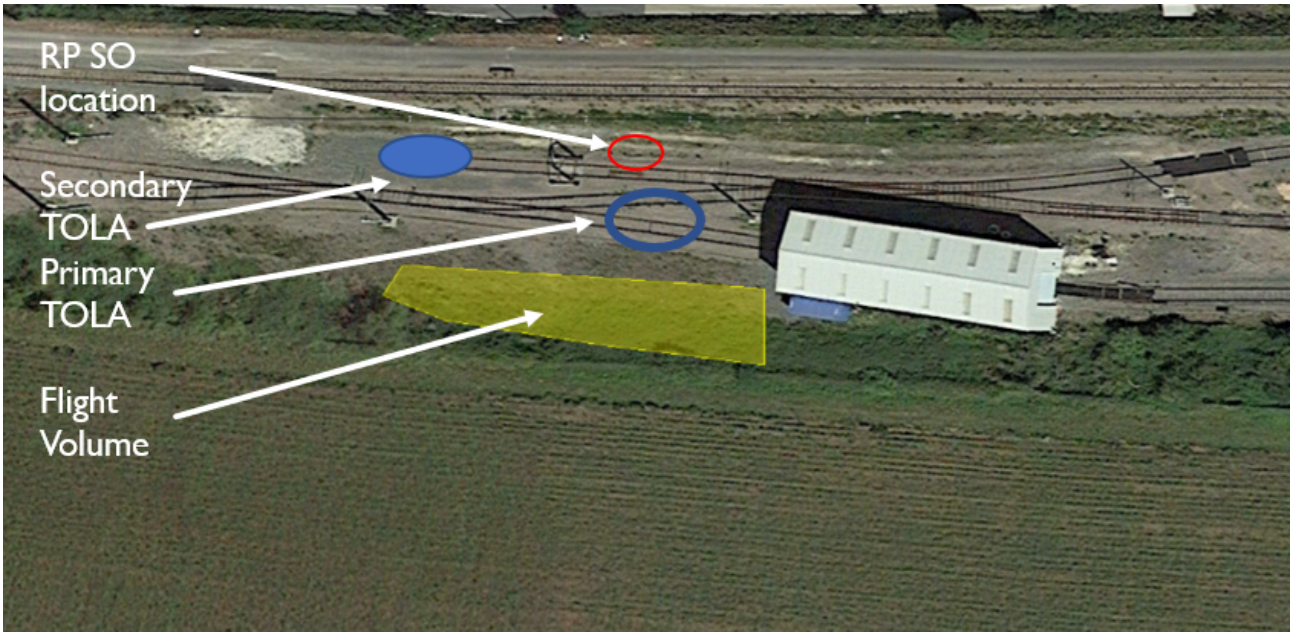
6. Locations

UAPS spay locations for RD are to be carried out at the below locations:

a) Tuxford Training Centre - Rural. Bridges.
b) Bushey Arches – urban, series of viaduct arches over multiple roads and industrial areas.
c) Watford Tunnels – semi urban. Overhead line equipment.
d) Primrose Hill Tunnels – urban. Grade 2 Listed site. Overhead line equipment.
e) Kensal Green Tunnels – urban. Overhead line equipment.
f) Liverpool - Lime Street Station. Urban – central Liverpool. Overhead line equipment.
g) London – Liverpool St station. Urban – central London. Overhead line equipment.
h) Audley End Tunnels - Rural. Overhead line equipment.
i) Ipswich station tunnels - Urban. Including 1 x SSSI site. Overhead line equipment. Approx. 100m from the station.
j) Tring and Pitstone cutting - Rural. Within 150 m of a protected site. Overhead line equipment.
k) Usk show ground RUAS training flight location
l) BPR7, Preston, Cotswold, Gloucestershire, South West England GL7 6GE. SP 04643 00431
m) RUAS Office C/O GCELL South Lake Drive, Imperial Park, Newport, NP10 8AS.

Any flights within 150m of an SSSI, special permission **must** be granted by the landowner and written consent recorded

Example of flight area



7. Flight team composition for UAPS operation.

The flight team will always consist of minimum of:

- Remote Pilot (RP) in Command
- Spray operative (SO)
- COSS (Controller of Site Safety) – For Network Rail sites ONLY

Remote Pilot (RP) in Command

The RP job role is laid out in section 3.3 of Vol 1 OSC he/she is the person in command of the aircraft and is overall in command of every aspect of flight.

- Adhere to the CAA CAP documents; CAP1789A, CAP 2013, CAP 382, CAP 722, CAP722A, this Operations Manual, Manufacturers technical specifications and issued UK CAA OA.
- Monitor own CRP, medical status and logbook.
- Ensure accuracy of flight planning.
- Liaise with local ATCU (if applicable) of intentions and location. If flying within an FRZ, permission must be sought from the Airfield.
- Brief the flight team on flight-by-flight basis ensuring they are aware of their responsibilities for standard, extended and emergency procedures.
- Conduct a meteorological assessment, including looking for wind effects such as windshear and turbulence and how these may affect RPAS operations. Readings and observations must be recorded.
- Conduct a Spectrum Analyser sweep before flight.
- Carry out two man checks with SO to ensure UAPS is fitted correctly and is in good working order.
- After take-off ensure gimbal calibration is carried out.
- During flight maintain constant situational awareness of the task area, both airspace and ground.
- Conduct PCM procedures including MOR (European Aviation Reporting Portal) (when required to do so).
- Submit details of the incident to the ASM within 48 hours of an occurrence happening.
- Maintain Flight Safety awareness at all times during task.
- Maintain currency.

Spot Spray operative (SO)

The SO details are laid out in section 3.3 of Vol 1 OSC he/she is the person in charge of spraying. The Payload Operator is responsible for communicating with the RP to move the aircraft to the correct position to allow the payload to spray during the flight.

Their duties include:

- Adhere to the UK CAA OA issued, the RUAS Operations Manual, Manufacturers technical specifications and User Handbook of the RPAS type operated.
- Carry out two man checks with the RP to ensure UAPS is fitted securely and working correctly.
- Monitor own CRP, medical status and logbook as appropriate.
- Assist the RP with PCM procedures including MOR (European Aviation Reporting Portal), (When required to do so).
- Adhere to HSE permit as per annex J/X.
- Any UAPS operator must hold relevant licences.

COSS (Controller of Sight Safety) – Network Rail Sites ONLY

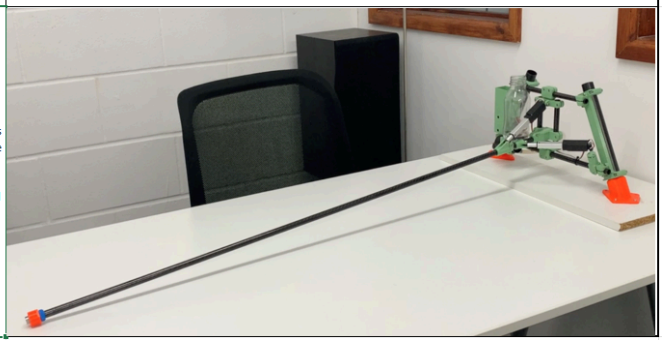
Is responsible for any line block or possession to be in place before flights can take place.

Their duties include:

- Must brief the whole team before any access to the rail site has taken place.
- Ensure all staff and visitors have signed on to the COSS Briefing paperwork.
- Be the eyes and ears for rail related safety for RP and SO.
- Liaise with network rail/Railscape on all rail safety related aspects.
- Is roaming and fixed to one site, must be within hearing distance of RP and SO.

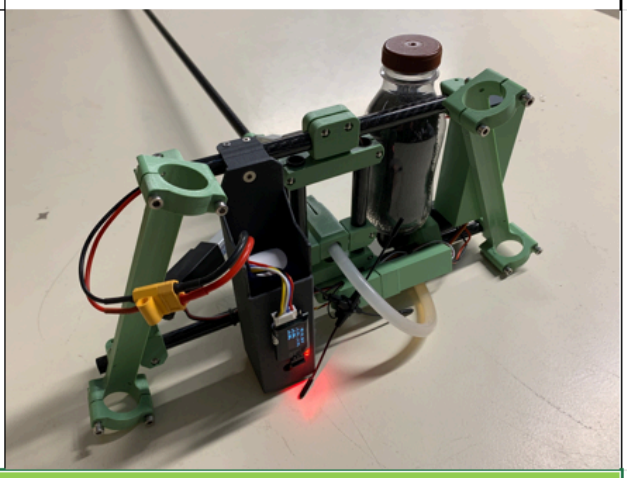
8. Development of M300 UAPS Spray System

The following are the current log changes:

Variant	UAPS Superleggara POC V1	Pictures
Notes	The UAPS Superleggara was originaly conceved as a response to a NWR Air Ops UAS weight limit of 7.3KG. In order to stand any chance of being able to operate a UAPS without isolation/possesion in the future we needed to produced a version of the UAPS with a mass budget of less than a 1KG to give a combined mass of less than 7.3KG when mounted on a DJI M300. The initial POC pictured oposite had a mass budget of 960g with a 0.3 liter resovoir.	

Number	Component
1	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX
1	Proprietary 3D printed battery enclosure and mounting Assy for M300
1	Proprietary 12mm carbon fibre tube subframe
2	Linear Actuators
1	0.3 litre payload resovoir
1	12V pump + tubing
1	2S 300mAh battery
1	3S 850 mAh battery

UAPS SL Mk1 (Current Version)

A	B	C
Variant	Mk 1 UAPS SL Prototype	Pictures
Notes	Having proved concept, this variant marks the move from POC to the first machine in the UAPS SL prototype series. The NWR air ops standard that the POC was built in response to has been relaxed so the mass budget less crucial. This allowed us to add a few more features such as a battery voltage telemitry sensor and a larger battery to increase overall utility. However all componants and design variables purtaining to spray drift are homogeneous with those on the original M600 UAPS varient. This is to preserve the integrity of drift charicteristics between varients.	
Upgrade	Addition of larger Carbon infused PLA battery Box	
Reason for Upgrade	To facilitate better battery / component security and alow for a single, higher capacity battery	
Upgrade	Addition of baffle foam in resovoir	
Reason for Upgrade	To reduce fluid movement within the payload tank to confine COG and increase overall stability	
Upgrade	Addition Telemetric voltage sensor	
Reason for Upgrade	To facilitate better battery monitoring	

Number	Component
1	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX
1	Proprietary 3D printed componant enclosure and mounting Assy for M300
1	Proprietary 3D printed battery enclosure
1	Proprietary 12mm carbon fibre tube subframe
1	Dual 12V 4A 5V 4A BEC
2	Linear Actuators
1	0.3 litre payload tank
1	12V pump + tubing
1	4S 2200 mAh battery
1	FrSky VLVSS voltage Sensor (Telemetry and data logging via OpenTX)

UAPS HotSwap Mk2

Notes	In this evolution, the UAPS SL has been fitted with a larger payload resovoir to increase overal utillity. The tanks are now 'hot swappable' so all chemical handeling can be done at home base rather than on site. The tank recever positioning is adjustable so that the CoG can be fine tuned latteraly.The battery and electronics enclosures have been rationalised along with the cable runs. In addition, the lance can now be broken down for easy storage and transportation.	
Upgrade	Addition of hot swap payload tank incorperating dry breaks	
Reason for Upgrade	To facilitate improved health a safety regime around chemical handeling	
Upgrade	Addition of lance break for easier transport and storage	
Reason for Upgrade	To facilitate greater overall utility	
Upgrade	Addition of larger payload tank	
Reason for Upgrade	To facilitate greater overall utility	
Upgrade	Rationalisation of the battery / electronics enclosure	
Reason for Upgrade	To give better battey access and improved battery security	
Upgrade	Enclosure of battery voltage telemetry sensor	
Reason for Upgrade	To give improved sensor security	
Upgrade	Rationalisation of cable runs	
Reason for Upgrade	Continued development of a wiring harness	

Number	Component
1	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX
1	Proprietary 3D printed componant / battery enclosure and mounting Assy for M300
1	Proprietary 12mm carbon fibre tube subframe
1	Dual 12V 4A 5V 4A BEC
2	Linear Actuators
1	1 litre hot swap payload tank inc dry breaks
1	12V pump + tubing
1	4S 2200 mAh battery
1	FrSky voltage Sensor (Telemetry and data logging via OpenTX)

UAPS HotSwap(MK3)

Variant	Mk 3 UAPS M300 Prototype	Pictures
Notes	In this evolution, the UAPS SL has been fitted with a DJI digital FPV camera/VTX to increase the payload operators' field of view and give the unit greater overall utility. We used the DJI Digital FPV system for a multitude of reasons. Digital vision systems have clear benefits over analogue systems particularly in terms of penetration, clarity, and range. Range and penetration characteristics are particularly important to us because they give us greater latitude in the safe placement of personnel within what can be a dangerous working environment. We also like the DJI system's low latency/wide FOV capabilities. In addition, the DJI FPV system outputs on 5.8GHz rather than 2.4GHz, massively reducing the risk of any potential C&C frequency interference. However, the systems facility to record the PO's working point of view, both locally on the VTX itself and simultaneously via the 5.8GHz link on the PO's monitor goggles is what really sets it apart. This feature, when used in conjunction with the UAPS M300 newly implemented telemetric data logging functions will give solid 'black box' type data in case of an incident, even if the UAPS itself is lost. This type of visual/telemetry data has excellent forensic value as a tool for increased flight safety. The only other changes to the M300 UAPS in this design iteration are very minor, they comprise a change in manufacturer and model of the 12V Pump and the Dry Breaks, although basic specification (voltage, flowrate etc) of both units remains the same. The new dry breaks are lighter and allow for a shorter, lighter feed tube from the payload tank to the pump and the new 12V pump is more reliable and	 
Upgrade	Addition of DJI 5.8GHz digital FPV system mounted in redesigned Lance Break	
Reason for Upgrade	To facilitate co-located recording of PO's operational viewpoint	
Reason for Upgrade	To facilitate better field of view for payload operator	
Reason for Upgrade	To alow safer placement of PO within the working environment	
Reason for Upgrade	To increase flight safety and system utility	
Upgrade	Implementation of telemetric data logging via Open TX	
Reason for Upgrade	To increase flight safety and system utility	
Upgrade	Change of 12V Pump make and model	
Reason for Upgrade	To increase Pump reliability	
Reason for Upgrade	To allow for easier priming	
Upgrade	Change of Dry Break make and model	
Reason for Upgrade	To decrease weight and increase reliabilty	
Reason for Upgrade	To facilitate improvments in payload feed tube	

Number	Component
1	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX
1	Proprietary 3D printed componant / battery enclosure and mounting Assy for M300
1	Proprietary 12mm carbon fibre tube subframe
1	DJI FPV 5.8 GHz Air Unit and camera
1	Dual 12V 4A 5V 4A BEC
2	Linear Actuators
1	1 litre hot swap payload tank inc dry breaks
1	12V pump + tubing + bleed valve
1	4S 2200 mAh battery
1	FrSky voltage Sensor (Telemetry and data logging via OpenTX)

Variant	Mk 4 UAPS - compact --M300 Prototype	Pictures
Notes	In this evolution, the UAPS Has been 'shortened' in the body in an effort to no longer obscur the downward facing sensors as they can no longer be turned off without throwing an error. This is a first fit and must be tested carefully due to new weight distrobution and payload deployment - velcro straps are used to secure the 'tank' -(there are two for redundancy, one is sufficient in testin) and the motor mount has a new integrated tube clip to hold the hose out of the way during flight - - incase it falls into the sensor's field of view.	
Upgrade	Removal of secondary cross member and change of position of bottle storage location	
Reason for Upgrade	New firmware update from DJI on M300 rendered an issue whereby if the downward sensors were turned of (as per SOP for UAPS) the aircraft would still throw an error per visual odometry AND wipe data logs as a result of the error	
Upgrade	motor mount alterd to place motor in better position and now a series of integral clips holds loose hose out of the way	
Reason for Upgrade	possibility of hoses moving iuin flight and obscuring the sensors which may be too sesative not to react	
Upgrade	Camera system mod kit interface	
Reason for Upgrade	Goggle system alternative for less visual obstucation on site // video reciever is a screen mounted either on tripod o on transmitter mount (to be created - but should not effect operation of UAPS itself)	
Upgrade		
Reason for Upgrade		
Upgrade		
Reason for Upgrade		

2x camera options over and above DJI Air unit (Walksnail and HDZERO FPV non goggle systems)

Flight test/fit - 07/02/2023

Issue occured - 0

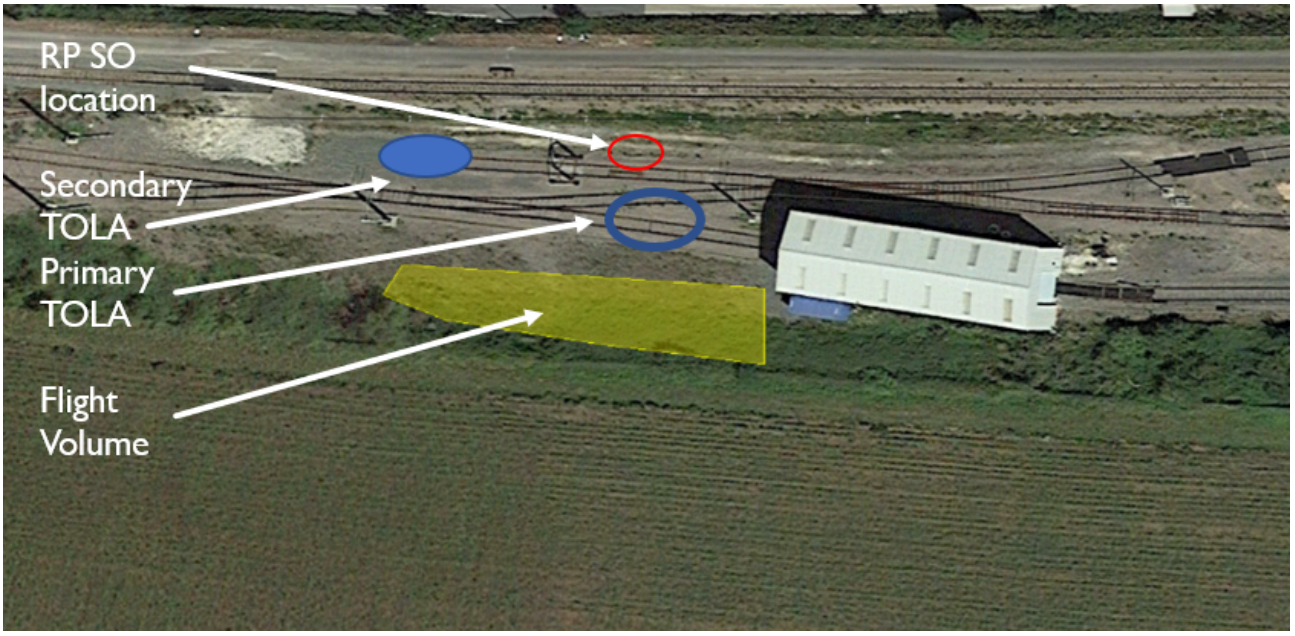
2x recievers for above transmitters - 1 has integrated screen - the other connects to a screen via HDM

Number	Component
1	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX
1	Proprietary 3D printed componant / battery enclosure and mounting Assy for M300
1	Proprietary 12mm carbon fibre tube subframe
1	DJI FPV 5.8 GHz Air Unit and camera
1	Dual 12V 4A 5V 4A BEC
2	Linear Actuators
1	1 litre hot swap payload tank inc dry breaks
1	12V pump + tubing + bleed valve
1	4S 2200 mAh battery
1	FrSky voltage Sensor (Telemetry and data logging via OpenTX)

9. Site set up

The TOLA will be selected by the RP in conjunction with the COSS and SO.

As an example:



10. UAPS FRCs

UAPS (HotSwap) DJI M300 Remote Pilot/Spray Operative Checklist

Introduction

1	The RP and SO must familiarise themselves with the FRCs and RAMS for the tasking.	☐

2	Ensure Aircraft and Controller batteries are fully charged	☐
3	Ensure UAPS and Viewing system batteries are fully charged, ensure headset communications devices are fully charged.	☐
4	Ensure DJI M300 is built and set up as per DJI M300 (Spraying) FRC's.	☐
5	Turn off downward sensors and precision landing.	☐

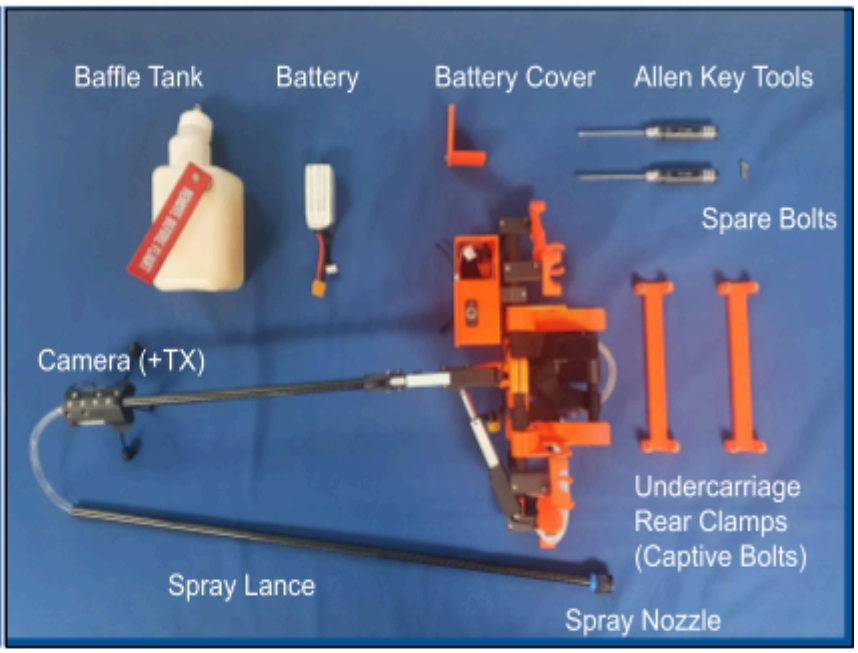
UAPS Spray System

1	The box is shown with the lid displaying a X and a no. It is important that nothing is placed on top of this box while the UAPS is in storage as this would damage the spray mechanism. The system is most fragile where the X is located.		☐
2	**UAPS HotSwap storage** It is vital that the spray lance is in its highest position or it will not fit in the box safely.		☐

UAPS Description and Identification

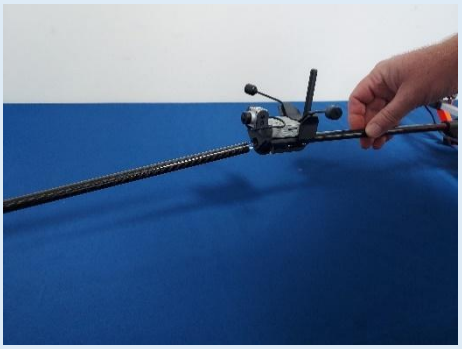
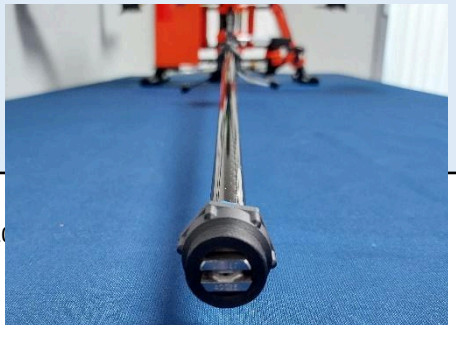
UAPS Controller

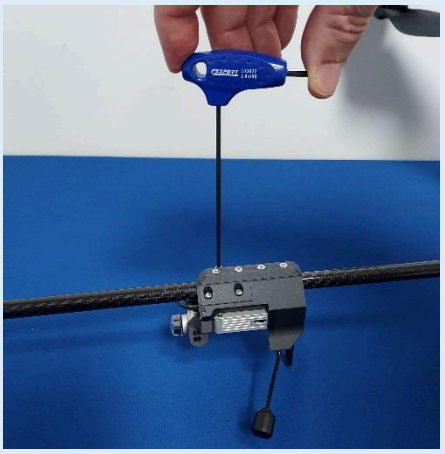
UAPS Vision System



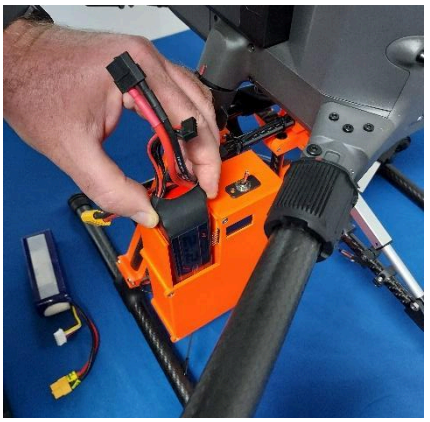
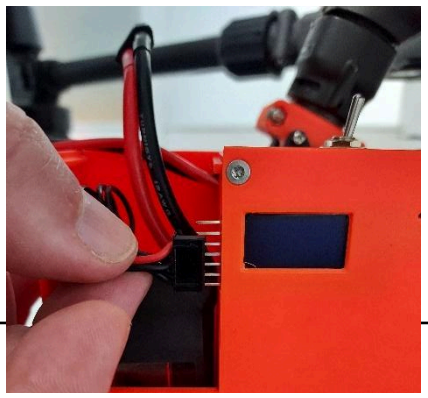
UAPS HotSwap Sprayer

UAPS System Set Up

1	To remove the UAPS from its box first remove the two foam inserts. Lift the spray lance upright and remove the spray system.		☐
2	Carefully insert the front spray lance tube section into its housing near the camera.		☐
3	Clip the undercarriage retaining clips onto the DJI M300 front legs. Place 4 x 3mm bolts loose into the top holes.		☐
4	Place undercarriage rear clamp onto the rear of the front legs, lining the bolts with the holes. Tighten the bolts using the 3mm Allen key. (Bolts must only be tightened finger tight or they may damage the structure). Add the 4 x 3mm bolts to the bottom holes and tighten using the 3mm Allen key.		☐
5	Line the spray nozzle horizontal.		☐

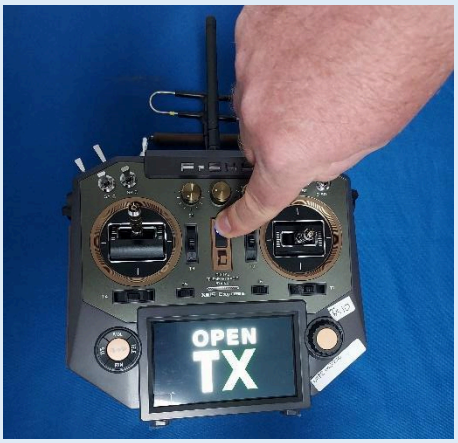
6	Tighten the spray lance tube clamp bolt with the 2.5mm Allen key (situated near the camera).		☐

Connecting the UAPS Battery

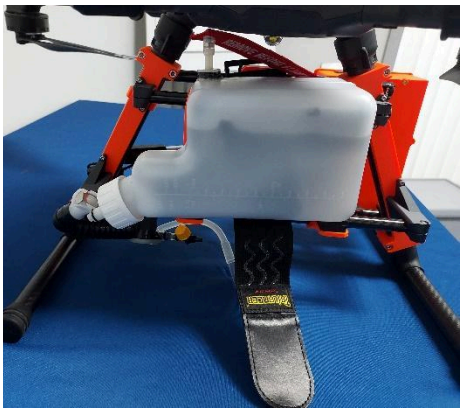
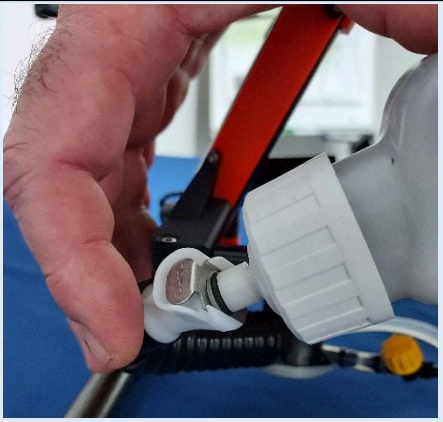
1	Check the battery for signs of damage. Remove the battery housing cover. Check the battery housing for signs of damage and ensure it is clear of any dirt of debris. Place UAPS battery into battery housing.	 	☐

2	Connect the balance lead to the bottom four pins (leaving the top two pins free) ensuring the lugs are outermost.		☐
3	Ensure the power switch is to the off position (pointing away from the spot). Connect the power lead. Tuck away all cables.		☐
4	Replace the battery housing cover tighten the bolt using the 2.5mm Allen key.		☐

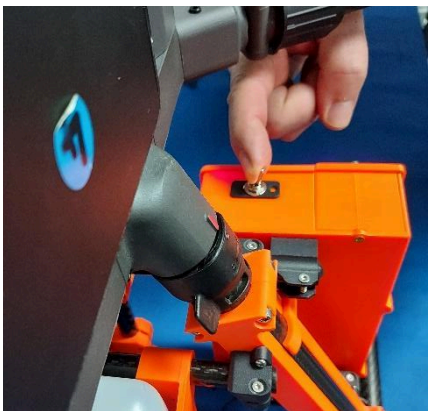
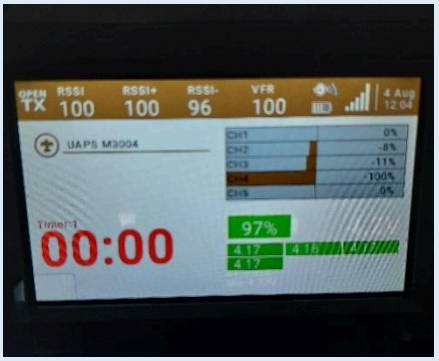
UAPS RC Controller Assembly

1	Attach the antenna to transmitter module. Remove the rear housing cover. Place the transmitter module into the rear of the RC controller housing (clip in).		☐
2	Ensure all switches are in the forward position. Press and hold the power button. The screen will light up and an audible welcome will sound. If the throttle stick is not in the bottom position you will get at throttle warning, to rectify, place the throttle stick to the bottom position and press the right mode button.		☐

Baffle Tank Connection

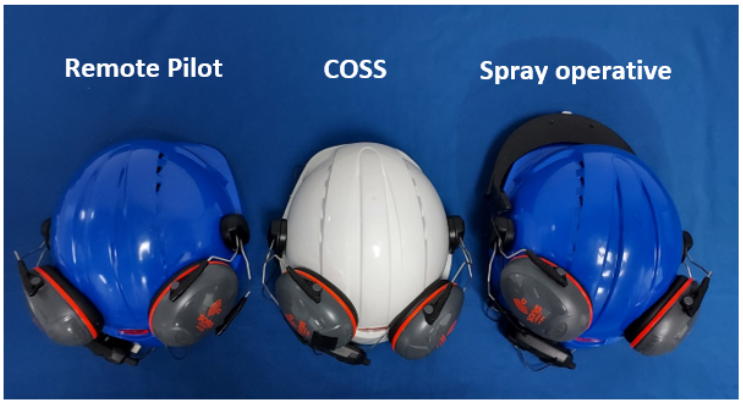
1	The baffle tank should come to the Remote Pilot/SO pre-filled. Ensuring the propellers are moved outwards place the baffle tank into the baffle tank housing.		☒
2	Place the Velcro buckle forwards onto the baffle tank. Pull the Velcro strap through the loop and press down on the Velcro connection to secure in place.		☐
3	Ensure the bleed valve is in the closed position. Remove the valve cover. Place the baffle tank nozzle into the UAPS hose connector.		☐

Connect RC Controller to UAPS

1	Set the throttle on the RC controller to the middle position. Switch the UAPS on by flicking the power switch to the 'On' position (towards the spot).		☐
2	Ensure the voltage shown on the RC controller is above 3.6V (this will be displayed in green, if this display is yellow, it is below 3.6V). The spray lance actuator will move into the central position and a red LED will flash.	 	☐
3	Remove the camera lens cover.		☐

	Perform a control check – ensure the lance moves up and down and left and right gently with stick inputs.		

Communications – Headset Helmets and Goggles

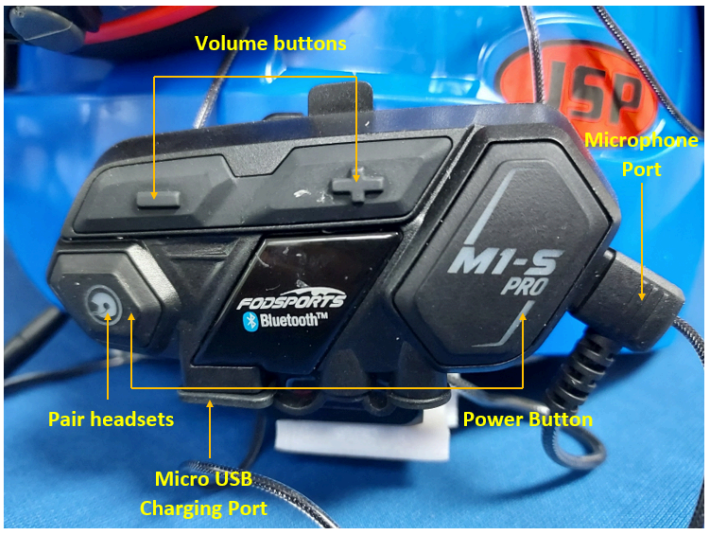


Spray Operative

1	Connect the power lead to the goggles. Connect the power lead to the battery.		☐
2	Screw the four antennas into place on the goggles.		☐
3			☐

	Line up ratchets on the goggles to the ratchets on the SO helmet visor. Slide forward and lock into position where comfortable.		
4	The helmet must be adjusted so it fits the Spray Operatives head comfortably by adjusting the band inside. The goggles should be placed for comfort and the headset should be seated comfortably over the ears.		☐

Switching on the Headsets and Pairing



	Ensure all headsets are fully charged.		☐

1	Turn on helmets by pressing and holding the helmet button and the M1-S Pro button together. The M1-S Pro button will light up blue.		
2	To pair the helmets, press the helmet button on all helmets. The M1-S Pro button will flash blue. Test comms between helmets to ensure the link has been established.		☐
3	To turn off the headsets off press and hold the helmet button and the M1-S Pro button at the same time. The M1-S Pro button will turn red and the headset will turn off.		☐

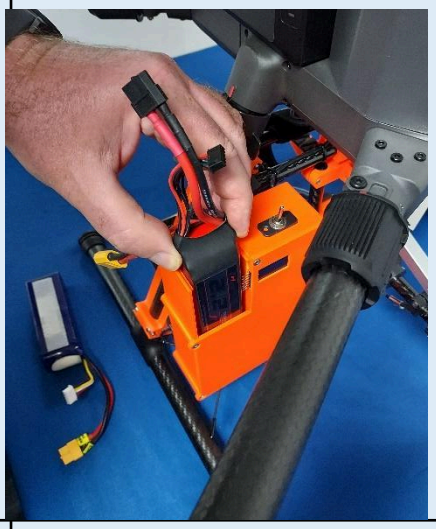
Spray Operations – Pre Flight

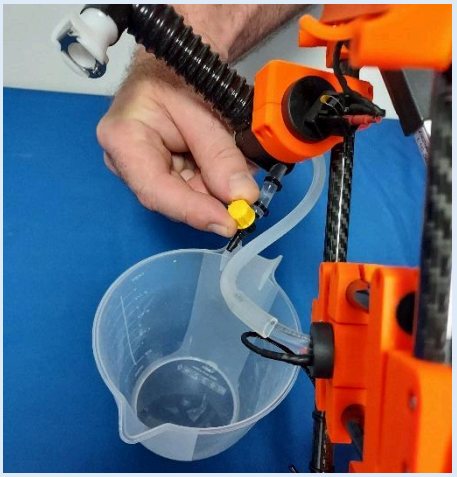
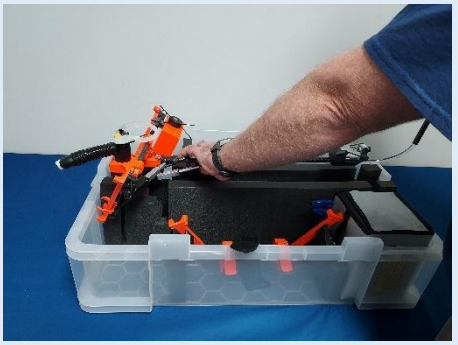
1	Ensure all pre-flight checks on the DJI M300 are complete (as per FRC's). Place the aircraft at the take-off site.		☐
2	Elevate the spray lance to the upmost position.		☐

	Check the safety string is taught (there should be a little give) with no signs of damage.		
3	Remove the baffle tank cap labelled with 'remove before flight'.		☐
4	Perform a communications check between the COSS/RP/SO prior to take off. Upon take off perform post take off checks as per DJI M300 FRC's. If you have an 'Infrared Sensor Blocked' warning – you have not turned the sensors off, this can be turned off in the aircraft controller menu. Check the UAPS is functioning correctly.		☐

Post Flight - Disassembly

1	**Goggles and headsets** – - Turn off the headsets by pressing both the helmet button and the M1-S Pro button until the M1-S Pro button illuminates red and powers off. - To remove the goggles from the SO helmet, pinch the sides of ratchet and slide off. - Remove antennas from the goggles by unscrewing. - Place away in its storage box.		☐

2	**UAPS and Controller** - On the controller switch the throttle stick to the fully up position to move the spray lance fully down. - Switch the UAPS off – the red LED will extinguish. - Turn off RC Controller by pressing the power button. - Remove the battery housing cover. - Unclip the power lead. - Unclip the balance lead. - Remove the battery and check for signs of damage.		☐
3	**Baffle Tank** - Place the drip tray under the hose connector. - Press down on the hose clip. - Disconnect hose. - Replace the ‘Remove before flight’ clip. - Undo the Velcro strap. - Remove the baffle tank by sliding it out towards you. - Store the baffle tank in the correct container.		☐
4	**Controller** - Remove transmitter antenna module from the back of the controller. - Disconnect the antenna and the transmitter module. - Replace the housing cover. - Replace the stick covers - Place in its storage bag.		☐

5	**UAPS** - Replace the camera lens cover. - Undo the undercarriage rear clamp by unscrewing 8 x 3mm bolts using the 3mm Allen key. - Remove the undercarriage rear clamp and place in the storage box. - Unclip undercarriage retaining clips and remove from the DJI M300. - Separate the front spray tube section.		☐
6	**UAPS** - Open the bleed nozzle to drain any remaining fluid into a container. - Close the bleed nozzle.		☐
7	**UAPS** - Replace the UAPS components back into its storage container. - Pull the hose through enough not to kink. - Place all batteries in LiPo bags for storage. - Replace the foam inserts.		☐

11 Technical Specifications – UAPS 'Type' (Configuration Mass)

DJI M300 SL UAPS

DJI M300 HotSwap UAPS

DJI M300 RTK + **HotSwap** UAPS

M300

Max take-off weight = 9000g

Weight of drone with batteries but no payload	6300g
Weight of drone + UAPS with stnd battery WET	8955g
Weight margin below max take-off threshold	45g
Weight saving if smaller battery used	51g

HotSwap UAPS

Weight 2700g

500-800ml tank capacity

UAPS is dual axis motion.
Hot swap of pre-charged tanks gives aprox 130 seconds spray time.
Lance stores folded and is screw locked in place for flight.

PS weight can be slightly adjusted by amending total fluid carried and or size of batt

12 Attachment of UAPS – Effect of CofG

The attachment of the UAPS has minimal impact on the CofG of the M300, there is a minimal impact on the front motors – resulting in the front motors having to work slightly harder to maintain momentum of the aircraft. The RP MUST calibrate the CG after the UAPS has been fitted.

The RP in their initial set up checks are aware of this and are required to visually and physically check all motors paying particular attention to the front motors. On doing this there should be a slight resistance caused by the bearings – if the motors are freely moving with no friction felt this must be changed and no flight is to be undertaken with that aircraft.

Spraying will only be conducted in wind speeds up to 5m/s as – this will reduce the resistance on the motors this would reduce the likelihood of the motors overloading / overheating and reduce overall wear.

13 M300 UAPS 3D Model

M300 UAPS 3D Model

14 Payload Operator SOP Checklist

Spray Operative (SO) SOP Checklist	Check	NOTES
PREPARATION AT BASE		
Familiarise with RAMs arrange meeting on site with RUAS pilot		
Fully Charge TX and a UAPS and goggle battery for testing		
Unbox and assemble UAPS for use as per UAPS FRCs		
Attach UAPS to test stand		
Perform touch and visual check of safety cables, anchor points and shackles		
Perform touch and visual check of lance support cables, anchor points and shackles		
Perform touch and visual check of four attachment clips		
Run up UAPS check for good operation Inc. TX and goggles		
Insert, format micro-SD card in goggles and UAPS cam and check for good recording indicators on both		
Fill UAPS reservoir with water, perform flowrate test		
Physically inspect UAPS for leaks and check nozzle operation		
Recharge TX		
Charge UAPS battery's x3 as per charging instructions pack in Lipo bag and prepare for transport		
Charge DJI Goggles/monitor battery's x3 as per charging instructions pack in Lipo bag and prepare for transport		
Check and charge comms pack x2 and prepare for transport		
Check required tools and prepare for transport		
Breakdown and box UAPS for transport		
Gather and check required PPE as per PA1&6 and prepare for transport		N/A if only using water
ON ARRIVAL		
Arrive on site meet Remote Pilot and COSS		
Familiarise with site and perform environmental and COSHH risk assessment as per PA1&6		N/A if only using water
Discuss operation with pilot agree point by point ops plan Inc. emergency procedures and kit and set up + ops area for PO		
Issue and check comms for good operation with pilot		
Select assembly point and prepare folding table/van		
Unbox and assemble UAPS for use as per UAPS FRCs		
Perform touch and visual check of four attachment clips.		
Attach UAPS to M300		
Run up UAPS check for good operation		

Put on PPE		
Fill UAPS		
Commence recording on cam and goggles/monitor and fly operation as discussed with pilot		
Remember to turn off recording and shut down UAPS, Goggles and TX when taking breaks		
PRE DEPLOYMENT AND DURING FLIGHT		
Move aircraft with UAPS attached to suitable location for TOLA		
Carry out final checks as per FRC and ensure Annex B (Onsite survey) of Vol 1 is completed		
Ensure collision avoidance is setup and turned on		2-man checks
Ensure CofG check is carried out		
Manually Fly the aircraft with UAPS attached to within 2 meters of the desired target		
Start UAPS operations ensuring good communication between UAPS operator and RP		
RP manually fly's aircraft as directed by UAPS operator to different target repeat as necessary		RP has final say and to ignore direction if unsafe
While spraying from the UAPS the RP must be within 150m of the aircraft at all times		
After spraying has finished or RP needs to bring the aircraft back the RP will manually fly the aircraft back to TOLA and land the aircraft.		
Repeat above sections if another flight is needed if not carry out Completion drills		
ON COMPLETION OF OPERATION		
Remove SD cards from UAPS cam and goggles box and label as per job		
Empty any remaining liquid		
Shut down UAPS, Goggles and TX prepare TX and Goggles for transport		
Detach UAPS with allen key		
Breakdown and box UAPS for transport		
Remove PPE		
ON RETURN TO BASE		
Store equipment carefully remembering to ensure free movement of air in UAPS box in case of moulding (silica Bags)		
Remove and store Lipos as per good practice		
Upload files from SD cards to trial database		
Store SD cards appropriately		

15 Safe Work Pack – Railscape (Example)

Safe Work Pack

RAILSCAPE

Cover Information

About

Name of person receiving SWP: Jesse Culleton
Register Number: 39285 **Week number:** 34
Pack Type: Non Cyclical
On Call Manager Name: David Phipps **Tel:** 07773 050 240
Region: Wessex **ELR:** BML1 **Mileage:** 27.1518 (69 ch) to 28.0198 (9 ch)

Site

Possession Reference: ITEM 67 WORKSITE 7775768
Local Name: BROOKWOOD
Job Number: South East Litter Contract
Planned start time: 26/11/2021 01:05 **Planned finish time:** 26/11/2021 05:15
Nature of Work: Install & remove earthing straps & marker boards / Litter Clearance

Prohibitions for working with warning SSOW (formerly Red Zone) within your Primary and Related ELRs: Yes

Access Point: Brookwood station (51.3037581000, -0.6360459000)
Egress Point: Brookwood Station (51.3037581000, -0.6360459000)

Emergency

Hospital Name: Royal Surrey County Hospital - A & E
Hospital Postcode: GU2 7XX **Hospital Tel:** 01483 571122

Signatures

SWP checked by:	 Katie Lewis	Date:	16/11/2021
SWP verified by:	 Jesse Culleton	Date:	16/11/2021
SWP authorised by:	 David Phipps	Date:	16/11/2021
Shift #1 (T/F)			
SWP Form accepted by:		Date:	

UNCONTROLLED WHEN PRINTED

Reference Material Included:

1. Possession Details
2. RT9909 Forms
3. SWP Validation Form
4. SSOW Selection
5. Appendix A
6. Task/Site Risks
7. Welfare
8. Permits
9. Hazard Directory
10. Signal Diagrams
11. Sectional Appendix
12. Alternative Access Points
13. Worksite to nearest A&E hospital Map and directions
14. First Aid Arrangements
15. Other Details
16. Lessons Learned
17. Comments
18. Life Saving Rules

1. Possession Details / Works Schedule

NETWORK RAIL S.E & Wessex
Litter
Record of Work Arrangements

Date: / /	Driver/Team Leader:

JOB DETAILS Time Left Yard/Home: : hrs Time Returned to Yard/Home: : hrs

Location and Type of work: Job Number: / /

Job Sheet		Hazard Directory		HS Operators Manual	
Method Statement		Emergency Arrangements		Risk Assm'nt/Risk Control	
Local Risk / Task Brief		COSHH Assessments		Completion Sheets	

Personnel Details: HS Permit / RSL

Name	Permit / RSL No:	Name	Permit / RSL No:
1.		4.	
2.		5.	
3.		6.	

Vehicle Registration: _____

PRE START CHECK LIST: DRIVER OUT:_____DRIVER BACK:_____

Oil		Fire Extinguisher		Spill Kit	
Water		First Aid Kit			
Lights (all inc trailer)		Eye Wash Kit			
Seat Belts		Fuel		**Start Mileage**	
Wash Wipe		Fuel Cards		**Finish Mileage**	

Record any Problems:

Action Taken:

Plant and Equipment Details:

Description i.e. Strimmer, Chainsaw	Tool No (in full) i.e. CTRL001	Date of next service / inspection	Faults, damage, problems and Action taken

Any Plant hired (include details):

Materials Details:

Description	COSHH Sheet	Description	COSHH Sheet

Signed as accurate Log: …….. Team Leader

2. RT9909 - Shift 1

RAILSCAPE
RT9909

GENERAL INFORMATION			
Name of PIC/COSS	Jesse Culleton	Sentinel Card No.	416606
Planned Start Time	26/11/2021 01:05	Planned Finish Time	26/11/2021 05:15
Actual Start Time		Actual Finish Time	
Authority No. Sign In		Authority No. Cancelled Time Out	

Nature of Work *	Install & remove earthing straps & marker boards / Litter Clearance
Location and lines affected *	BML1 27.1518 - 28.0198 - Up Slow (BML1), Up Fast (BML1), Down Fast (BML1), Down Slow (BML1)

How to contact the Signaller in an emergency *	Signal Box	Internal	External
	Woking - West Byfleet (incl) to Farnborough (excl), Woking Jn to Worplesdon and Pirbright Jn to Ash Vale (excl) Berrylands to West Byfleet (excl), Chertsey (excl) to Weybridge and Addlestone Jn to Byfleet Jn Hampton Court Jn to Hampton Court/Cobham	00 69410, 00 69420	01483 714898

ECR/ECO	Name	Emergency	Internal	External	Email
	Eastleigh	Emergency line 173 / Mobile 07771830393	075 7547 / 075 7472	02380 613 314	ECR.Eastleigh@networkrail.co.uk

Lines at the site *	Direction	Open/blocked?*	Speed (line or T/ESR)	LOR	Mileage
Up Slow (BML1)	Uni	Blocked	90	SW105	27m 79ch
Up Fast (BML1)	Uni	Blocked	100	SW105	27m 79ch
Down Fast (BML1)	Uni	Blocked	90	SW105	27m 79ch
Down Slow (BML1)	Uni	Blocked	90	SW105	27m 79ch

Access and egress arrangements to/from working area *	Access: Brookwood station Egress: Brookwood Station
Nearest Line	
Hazards associated with access/egress (conductor rails, tripping, vegetation, overhead cables or OLE, etc.) *	*OPERATIONAL RAILWAY - TRAINS & ON TRACK PLANT - OTHER WORK GROUPS - UNDERFOOT CONDITIONS - SLIPPING & TRIPPING HAZARDS - WEATHER - NOISE - WORKING AT NIGHT - MANUAL HANDLING - PUBLIC INTERFACE*
Hazards associated with the site (conductor rails, tripping, vegetation, overhead cables or OLE, buried services, etc.) *	*OPERATIONAL RAILWAY - TRAINS & ON TRACK PLANT - OTHER WORK GROUPS - UNDERFOOT CONDITIONS - SLIPPING & TRIPPING HAZARDS - WEATHER - NOISE - WORKING AT NIGHT - MANUAL HANDLING - PUBLIC INTERFACE – RED ZONE WORKING PROHIBITED – DC RAIL - SSSI - HAZARD WORKING PRACTICES - SPT BARRED TO HSM – ASBESTOS – COSS/IWA CANNOT WORK ALONE - CONSERVATION AREA*

Other Risks and Hazards
750v DC **LIVE UNLESS PROVEN ISOLATED** DC RAIL MUST BE TESTED USING NETWORK RAIL APPROVED LLT – Always Test Before Touch!

Limits of the working area (miles.yards) and how these are defined *	BML1 from 27.1518 to 28.0198 Defined by: As defined by coss
Permit to work arrangements (AC or DC lines) if appropriate. If no permit to work is held electrified lines are LIVE *	Permit

SAFE SYSTEM OF WORK				
Tick the relevant box. Only tick 'Planned' column if you have been provided with a planned safe system of work	Walking on or near the line to/from the working area		Whilst carrying out the work	
	Planned *	Actual	Planned *	Actual
Safeguarded Site Of Work	Yes		Yes	
Fenced Site Of Work				
Separated Site Of Work				
Warning Systems - Permanent				
Warning Systems - Train Operated Warning System (TOWS)				
Warning Systems - Human Activated Equipment				
Warning Systems - Portable				
Lookout Warning				
Reason and authority for change from planned safe system of work				
Name of Responsible Manager authorising the change			Signature / Authority No.	

FENCED OR SITE WARDEN WARNING ONLY (complete as applicable) *	
Type of fence (fenced only)	
Distance from line (fenced only)	
Separation distance (separated only)	
How Site Warden will give the warning, or	☐
COSS plus one other with no Site Warden, or	☐
Over 3m from line with no Site Warden, or	☐
IWA working alone	☐

EQUIPMENT OR LOOKOUT WARNING ONLY	
How the warning will be given *	
Location(s) of position(s) of safety	

Details of any Site Wardens, ATWS Operator or Lookouts (TOWS, LOWS, distant, intermediate, site, machine or touch)			
Name	Sentinel Card No.	Location	Role

DECLARATION. By signing as acknowledgement of the SWP briefing, we also acknowledge briefing of Permits which are attached to it (e.g. TBS, Permit to dig etc)			
Print Name & Signature	**Sentinel Card No / Worker Name**	**Print Name & Signature**	**Sentinel Card No / Worker Name**
Additional Information			
750v DC **LIVE UNLESS PROVEN ISOLATED** DC RAIL MUST BE TESTED USING NETWORK RAIL APPROVED LLT – Always Test Before Touch!			
COSS DECLARATION. I have made the above arrangements and I am satisfied that all members of the work group understand the safe system of work.			
Signature			

3 SWP Validation Form

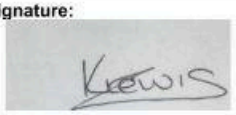
Ref:	NR/L2/OHS/019/F01
Issue:	2
Date:	01 December 2018

Rejected	YES	NO
Errors / Changes	YES	NO

Cyclical	**Non-Cyclical**		Repeated	
SWP Ref. 39285	SWP expiry date	26-11-2021 05:15:00	Date & Time of Work	26-11-2021 01:05:00
Brief Description of Work	Install & remove earthing straps & marker boards / Litter Clearance			

CREATED by: Planner

I confirm this SWP has been checked and compliant with NR/L2/OHS/019:

Planner Name: Katie Lewis	**Signature:** 	**Date: 16/11/2021**

VERIFIED by: Person in charge

I confirm the following are appropriate for the task and included in the SWP. Tick **Yes** or **No** for each question, and sign the declaration below	Y	N	N/A
Protection / Warning arrangements (hierarchy of control) suitable for the work Coss Signature and Endorsement:	☑	☐	
Task / Site Risk and controls	☑	☐	
Any necessary permit to work arrangements identified	☑	☐	☐
If any of the above statements are answered NO, reject the SWP and return it to the Planner.			
The welfare facilities have been identified and are appropriate	☑	☐	

Comments if SWP rejected:

Name of Person in charge: Jesse Culleton	**Signature:** 	**Date: 16/11/2021**

AUTHORISED by: Responsible Manager			
Complete as part of review/discussion with person in charge. Tick **Yes** or **No** for each question, and sign the declaration below.	**Y**	**N**	**N/A**
Work content is understood by the person in charge	☑	☐	
Necessary competence within team to undertake task	☑	☐	
Risk controls are suitable and sufficient	☑	☐	
The appropriate hierarchy of Safe System of Work has been selected	☑	☐	
Any additional specific controls identified	☑	☐	☐
Responsible Manager's authorisation and confirmation this SWP is complete, and includes any specific additional information required to manage risk on site (cannot be the same person as the verifier). If any of the above statements are answered **NO**, reject the SWP.			
The welfare facilities have been identified and are appropriate	☑	☐	
Comments if SWP rejected:			
Print Name: David Phipps	**Signature:**	**Date: 16/11/2021**	

ACCEPTED by: Person in charge on site		Shift #1
Person in charge at the site of work completes this section. Endorse declaration below.		
I Accept / Reject this SWP (Please circle)		
If rejected, detail briefly change(s) needed: **General Comments:**		
Person in charge (Name):	**Signature:**	
Date:	**Location:**	
Change of PIC (if required)		
Relief PIC Name:	Signature:	Date/Time:
By signing this form, you are confirming you have received a full brief on the operational, task and site risks for this work and the controls that are to be used. If you have any questions, think that the controls are not being applied or it is unsafe then tell the PIC.		

Name (print)	Signature	Sentinel card no.

Completion of work sign off by PIC			
Complete as part of review/discussion with person in charge. Tick **Yes** or **No** for each question, and sign the declaration below.	**Y**	**N**	**N/A**
Protection / Warning arrangements were suitable for the work	☐	☐	
Task Risk & Site Risk controls were suitable	☐	☐	
Appropriate permits to were included	☐	☐	☐
Welfare facilities were appropriate	☐	☐	
The work at site is completed and clear for the safe passage of trains	☐	☐	
State any changes or additions that should be made to improve this SWP for future use. If not applicable, state "None".			
Person in charge (Name):	**Signature:**		

Risk Control Briefing and PIC Acceptance

SWP Ref.		Date & Time of Work	
Brief Description of work			

Risks identified and controls to be applied (Not applicable where task briefing sheets are included)

Specific Risk Requiring Control	Control to be applied	Person in charge of risks (if different from PIC)	Signature of Person Controlling Risks	Confirm Risks Briefed (signature)

4. SSOW Selection Form

Ref:	NR/L2/OHS/019
Issue:	10
Date:	05 December 2020
Compliance date:	06 March 2021

SSOW Selection
Selection of Safe System of Work On or Near the Line

Date of Work:	26/11/2021 *to* 26/11/2021	**Time of Work:**	01:05 *to* 05:15
Nature of Work:	Install & remove earthing straps & marker boards / Litter Clearance		
Location:	BML1 27.1518 (69 ch) - 28.0198 (9 ch)		

SAFE SYSTEMS OF WORK		DESCRIPTION	SELECTED?	
PROTECTION METHOD			YES	NO
1.	**PROTECTION: Safeguarded site of work** Reasons:	Where every line at the site of work has been blocked to normal train movements (formerly known as Safeguarded Green Zone).	☑	☐
2.	**PROTECTION: Fenced site of work** Reasons:	Where there is a suitable barrier between the site of work and any line open to the normal movement of trains or moving vehicles (formerly known as Fenced Green Zone).	☐	☑
3.	**PROTECTION: Separated site of work** Reasons:	• Where there is a distance of at least 2 metres (6 feet 6 inches) between the nearest running rail of an open line and the site of work, and a site warden has been appointed to maintain the safe limits of the protected area. There is an identifiable limit to the site of work; or • Where there are 2 people in the group a site warden does not need to be appointed. Neither member of the group is to go any closer than 2 metres (6 feet 6 inches) to the nearest running rail of the open line. There is an identifiable limit to the site of work. (formerly known as Separated Green Zone).	☐	☑
WARNING METHOD			YES	NO
4.	**WARNING: Warning systems - Permanent** Reasons:	Where there is permanently installed equipment which will provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work.	☐	☑
5.	**WARNING: Warning Systems - Train Operated Warning System** Reasons:	Where there is permanently installed TOWS that will provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work. Supplemented where necessary by other methods of warning (formerly known as Red Zone with warning from TOWS).	☐	☑
6.	**WARNING: Warning Systems - human activated equipment** Reasons:	Where portable equipment can be deployed and activated by a lookout in order to provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before	☐	☑

		any train arrives at the site of work (formerly known as Red Zone with warning from LOWS)		
7.	**WARNING: Warning systems - Portable** Reasons:	Where portable equipment can be installed which will provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work..	☐	☑
8.	**WARNING: Lookout warning** Reasons:	• Where one or more lookouts are positioned to provide enough warning to allow everyone involved to reach a position of safety at least ten seconds before any train or vehicle arrives at the site of work (formerly known as Red Zone); or • Where a COSS/IWA is working alone and looking out for him/herself (formerly known as Red Zone).	☐	☑

Prepared by: Katie Lewis	**Position:** Planner Manager COSS PIC/SWL
Signed: 	**Date:** 16-11-2021

Authorisation

Authorised by: David Phipps	**Position:** Responsible Manager
Signed: 	**Date:** 16-11-2021

5. Appendix A Form

Ref:	NR/L2/OHS/019
Issue:	10
Date:	05 December 2020
Compliance date:	06 March 2021

Appendix A
Contents of a Safe Work Pack

The SWP contents should include the contents shown in table A.1 as a minimum where it is applicable.

This information may be extracted from other documents.

Only include extracts that are relevant to the SWP.

	Safe Work Pack minimum contents	Comment	Y	N	N/A
Task/Site Risk Controls	**SWP Validation Sheet (will be included in the final created pack)**		◉	○	○
	task risk information and controls required	e.g. TRCSs, relevant extracts from a WPP and associated TBSs	◉	○	○
	site (location) risk information and controls required	e.g. ALO, runaway risk	◉	○	○
	permits, where applicable	such as lifting plans, electrical, isolation, hot works, confined spaces	◉	○	○
	welfare arrangements and their location		◉	○	○
	part completed RT9909 Record of Arrangements		◉	○	○
	part completed RT3181/NR3180 form(s)	where blockage(s) of the line are part of the safe system of work	○	○	◉
	possession arrangements details, including protection/warning arrangements		◉	○	○
	safe access and egress information including walking to and from site		◉	○	○
Operational Risk Controls	**Sectional Appendix extracts**	showing the relevant running lines, track layout and work location for the entire mileage for which the work group will be on or near the line;	◉	○	○
	National Hazard Directory extracts	that are relevant to the work and location (these may be included on the RT9909 form);	◉	○	○
	signalling or track diagrams where used		◉	○	○
	emergency arrangements	including first aid provisions	◉	○	○

Table A.1 - SWP mininum contents

6. Task/Site Risks - Shift 1

1. Operational Safety (Risk Control from Trains)

Risk	When and where will the risk be present?	Permits Required	How will this risk be controlled?
Risk from trains			Safeguarded Site Of Work

3. Occupational Safety (Risk Control from Work)

What are the main risks (including health)?	When and where will the risk be present?	Permits Required	How will this risk be controlled?
BROKEN GLASS	AT ALL TIMES	N/A	SITE SURVEY/PPE/HYGIENE
BBV	AT ALL TIMES	N/A	SITE SURVEY/PPE/HYGIENE
WEILS DISEASE	AT ALL TIMES	N/A	SITE SURVEY/PPE/HYGIENE
BIO HAZARDS	AT ALL TIMES	N/A	SITE SURVEY/PPE/HYGIENE
LIVE DC RAIL	AT ALL TIMES	YES	TEST BEFORE TOUCH

RAIL SCAPE

Contractor: Railscape

TASK BRIEFING

Task Title: CLEARANCE OF LITTER & BIO WASTE

Contract Ref. ECM 26669
WPP Reference Project Number: 1516 032.

FIR: Various
Mileage: As per SWP

Location - SE (Kent & Sussex) & Wessex Routes

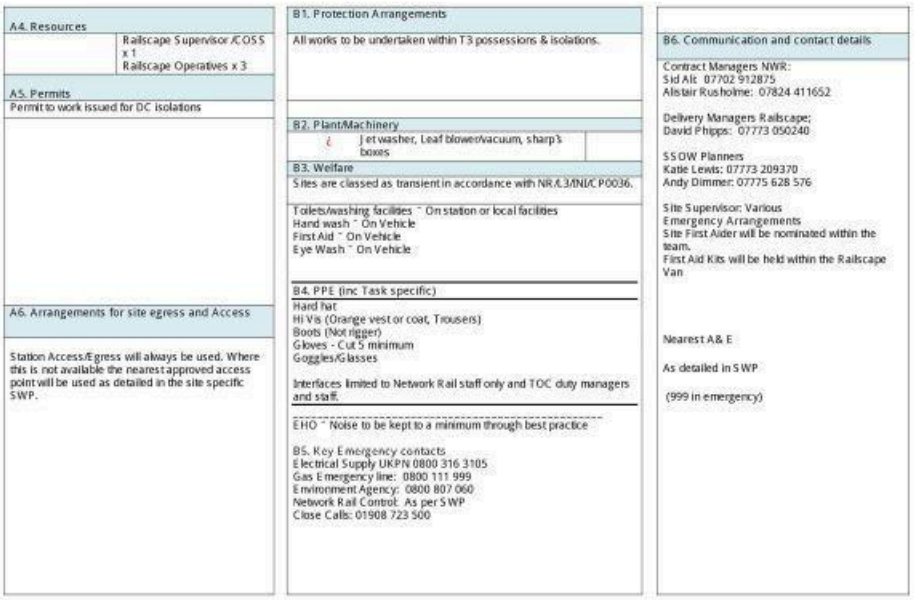
Version	Prepared By:	Date:	Approved By:
1	J. Gorman	01/07/2021	J. Gorman

Description of Task

The works involve operatives to clear bio waste, litter clearance from the track-bed within station limits including 100m in either direction from the platform ramps.

A1. Description/Outline Methodology of Work
Railscape is contracted to undertake the removal of bio waste and litter from the track-bed on South East (Kent & Sussex) & Wessex Route stations. The work-sites will always be within a safeguarded area with adequate protection and DC Isolation for operational staff
Railscape's COSS/SWL shall conduct a site-specific risk assessment where they identify the site conditions or task present additional hazards not adequately covered within the Task Briefing Sheet. The works may only continue if an adequate safe system of work can be put in-place to reduce the risks to an acceptable level. The revised safe system of work shall be recorded on-site by amending the Task Briefing Sheet and producing a site-specific risk assessment.
On arrival at the site all operatives will sign in at the contractor signing in point. The COSS/SWL shall then brief the Railscape team. The team are to unload all required tools and equipment (SAI 2) while the COSS/SWL organises access to the work-site, carries out a local Risk Assessment.
All tools and equipment to be unloaded from the van (SAI 02). Track-bed litter will be removed from each platform dependant on access using hand held pickers (SAI 30). Bio waste to be shovelled or removed using back-pack vacuum cleaners (fig a1) and loaded into bio bins provided for disposal (SAI 38).
Particular attention and care should be paid to Sharps and they are to be removed and placed in the waste containers provided. SAI 32 correct PPE must be worn at all times. The following Safety Activity Information Sheets will apply: - (in site file or e-safety library)
SAI 03 Driving Road Vehicles. SAI 02 Manually Loading/unloading vehicles SAI 30 Litter Clearance SAI 32 Removal of Hypodermic syringes SAI 70 Collection of Bio Waste SAI 38 Use of Vacuum back packs

A2.	Activity Risks:
Hazard	Controls
Exposure to Leptospirosis	PPE, Wash Hands & exposed skin prior to eating
Struck by Trains	Safeguarded working, SSOW, briefing
Slips, Trips and Falls	Authorised walking route Boots with ankle protection Adequate access & Egress
Working with hazardous waste	PPE Briefing/Toolbox talks Washing practice
Working with Hazardous chemicals/fuels oils	COSHH Assessments
Manual Handling	Kinetic lifting methods. Training and briefing
Risk of injury from discarded needles	Training & Briefing, Correct PPE and disposal containers
A3.	Site Risks
Hazard	Controls
Uneven Ground Conditions	Authorised walking route Boots with ankle protection Adequate access & Egress
Lighting Levels	Headlamps, temporary lighting where required.
Working near to DC Rails and live equipment	SSOW, briefing, Isolation, permits to work, Live Line Testing



A4. Resources

	Railscape Supervisor /COSS x 1 Railscape Operatives x 3

A5. Permits

Permit to work issued for DC isolations

A6. Arrangements for site egress and Access

Station Access/Egress will always be used. Where this is not available the nearest approved access point will be used as detailed in the site specific SWP.

B1. Protection Arrangements

All works to be undertaken within T3 possessions & isolations.

B2. Plant/Machinery

¿	Jet washer, Leaf blower/vacuum, sharp's boxes

B3. Welfare

Sites are classed as transient in accordance with NR/L3/INI/CP0036.

Toilets/washing facilities ¯ On station or local facilities
Hand wash ¯ On Vehicle
First Aid ¯ On Vehicle
Eye Wash ¯ On Vehicle

B4. PPE (inc Task specific)

Hard hat
Hi Vis (Orange vest or coat, Trousers)
Boots (Not rigger)
Gloves - Cut 5 minimum
Goggles/Glasses

Interfaces limited to Network Rail staff only and TOC duty managers and staff.

EHO ¯ Noise to be kept to a minimum through best practice

B5. Key Emergency contacts
Electrical Supply UKPN 0800 316 3105
Gas Emergency line: 0800 111 999
Environment Agency: 0800 807 060
Network Rail Control: As per SWP
Close Calls: 01908 723 500

B6. Communication and contact details

Contract Managers NWR:
Sid Ali: 07702 912875
Alistair Rusholme: 07824 411652

Delivery Managers Railscape;
David Phipps: 07773 050240

SSOW Planners
Katie Lewis: 07773 209370
Andy Dimmer: 07775 628 576

Site Supervisor: Various
Emergency Arrangements
Site First Aider will be nominated within the team.
First Aid Kits will be held within the Railscape Van

Nearest A& E

As detailed in SWP

(999 in emergency)

Principal Contractor: Network Rail
Responsible Contractor: Railscape Limited

Task Briefing Record

Briefing given by:

Name	Sentinel Number	Position	Signature

Briefed to: (By signing below, I confirm that I have received and understood the briefing for this task.)

Name	Sentinel Number	Signature	Date & Time

Changes to a Task Brief ˜ Revised Risk Assessment

Task Title and Reference:	
Date:	
Person Undertaking the Review (Below):	

Section No. & heading	Changes made & reason(s) why change is required	What further action is required? e. g. Change to Order of Works, Additional PPE required, new method of working etc.	Who needs to undertake these actions?	Tick when complete

Figure B.5 - Changes to a Task Brief ˜ Revised Risk Assessment

Remember to re-brief the above to the relevant persons within your workgroup / site / possession (etc.)

7. Welfare - Shift 1

Additional Welfare Info
Category A From NWR Matrix: Category A Transient Site: Arrange for sufficient and suitable local facilities to be used. These may be public or private facilities, e.g. NR Stations/depots/buildings/signal boxes, garages and shops. For the Most Local Public Convenience please search the link https://greatbritishpublictoiletmap.rca.ac.uk/

8. Permits - Shift 1

Additional Permit Info
The PIC / COSS will need to sign in with and obtain a Conductor Rail Permit from the Engineering Supervisor

9. Hazard Directory

BML1 (QW) WATERLOO (MAIN) - NORTHAM (SHORT MILE) HAZARDS BETWEEN: 27.1518 AND 28.0198

Mileage				
From	**To**	**Description**	**Local Name**	**Track**
26.1600	31.1400	Site of Special Scientific Interest (SSSI)	Basingstoke Canal	All/Multiple Tracks
OS Grid Ref.: Not available				
Hazard Ref: 70318105		*Last Update:* 22/08/2016	*Hazard Description* This SSSI follows the canal and is sometimes adjacent to, other times crosses the track	
27.0880	29.0858	Hazard-Working Practices	Brookwood hazard working practices	All/Multiple Tracks
OS Grid Ref.: Not available				
Hazard Ref: 110070997		*Last Update:* 22/08/2016	*Hazard Description* Poor access on a bank - Take special care.	
27.1589	27.1589	Signal Post Telephone Barred to Hand-signal Person	Brookwood Signal post telephone	Up Slow
OS Grid Ref.: 495174,157416				
Hazard Ref: 70261179		*Last Update:* 22/08/2016	*Hazard Description*	
27.1694	28.0110	Red Zone Working Prohibited	WITH IN BROOKWOOD PLATFORM LIMITS	All/Multiple Tracks
OS Grid Ref.: Not available			*Hazard Description* WARNING SSOW WORKING PROHIBITED DUE TO NO POSITION OF SAFETY WITH IN PLATFORM LIMITS.	
Hazard Ref: 110146458		*Last Update:* 22/08/2016		
27.1697	27.1697	Authorised Walking Route	Brookwood walking route	Unknown
OS Grid Ref.: Not available				
Hazard Ref: 110071440		*Last Update:* 22/08/2016	*Hazard Description* Via station subway to down platform. Walk to country end, then along safe cess to ground frame. Approximately 30 yards.	
27.1697	27.1697	Authorised Walking Route	Brookwood walking route	Unknown
OS Grid Ref.: Not available				
Hazard Ref: 110071437		*Last Update:* 22/08/2016	*Hazard Description* Via station subway to down side platform. The REB is located at the country end of the down platform.	
27.1738	27.1738	COSS or IWA may not work alone	Brookwood COSS or IWA may not work alone	All/Multiple Tracks
OS Grid Ref.: Not available				
Hazard Ref: 110069785		*Last Update:* 22/08/2016	*Hazard Description* Distant Lookout & Lookout or possession.	
27.1738	27.1738	Asbestos Hazard	Brookwood asbestos hazard	Unknown
OS Grid Ref.: Not available				
Hazard Ref: 70265693		*Last Update:* 22/08/2016	*Hazard Description* Please refer to asbestos register	
27.1738	27.1738	Conservation Area	Brookwood Cemetery CA	All/Multiple Tracks
OS Grid Ref.: Not available				
Hazard Ref: 70100352		*Last Update:* 22/08/2016	*Hazard Description* Brookwood. Adjoins BR boundary on south side of station. Planning Authority: Woking Borough	
28.0000	28.0000	Authorised Walking Route	Brookwood walking route	Unknown

Mileage

From	To	Description	Local Name	Track
OS Grid Ref.: 495092,156924				
Hazard Ref: 70240714		*Last Update:* 22/08/2016	*Hazard Description*	
28.0144	28.0144	Signal Post Telephone Barred to Hand-signal Person	Brookwood Signal post telephone	Down Main/Fast
OS Grid Ref.: 494895,157382				
Hazard Ref: 70261181		*Last Update:* 22/08/2016	*Hazard Description*	

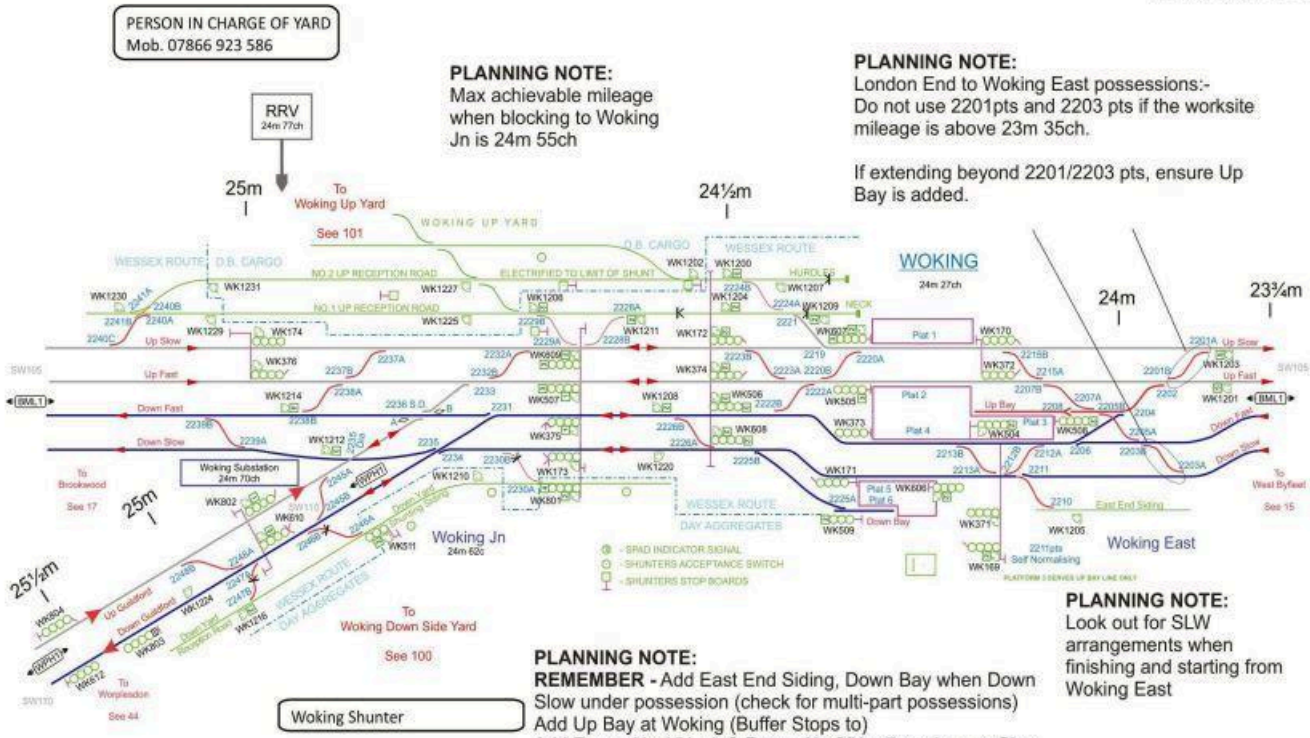
Comprehensive Track Diagram (CTD) Area Reference
Woking: SR/EL/9/1/8

PERSON IN CHARGE OF YARD
Mob. 07866 923 586

PLANNING NOTE:
Max achievable mileage when blocking to Woking Jn is 24m 55ch

PLANNING NOTE:
London End to Woking East possessions:-
Do not use 2201pts and 2203 pts if the worksite mileage is above 23m 35ch.

If extending beyond 2201/2203 pts, ensure Up Bay is added.



PLANNING NOTE:
Look out for SLW arrangements when finishing and starting from Woking East

PLANNING NOTE:
REMEMBER - Add East End Siding, Down Bay when Down Slow under possession (check for multi-part possessions)
Add Up Bay at Woking (Buffer Stops to)
Add Recep No.1/Neck & Recep No.2/Hurdles when up Slow under possession.

Woking Shunter

Woking Panel 2
Int. 0069410 Ext. 01483 714 898

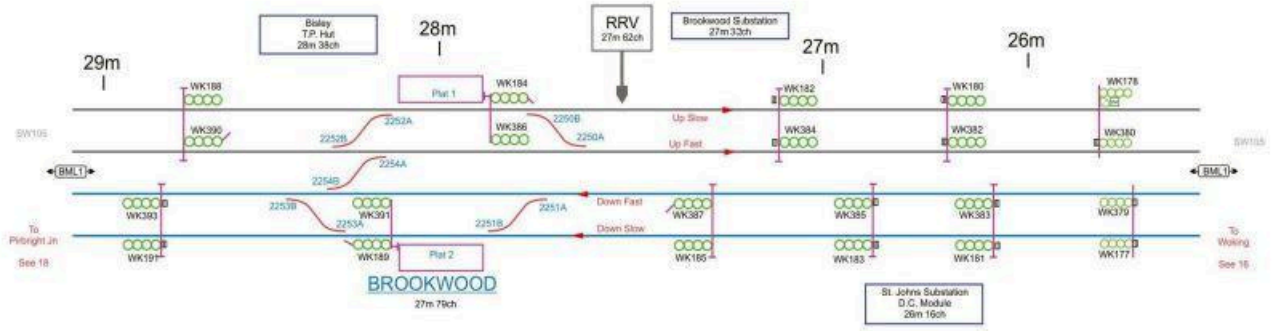
All auto WK signals can be controlled by the signaller

Wessex 16

Please note that this diagram was updated locally and is deemed uncontrolled and should be used accordingly.

This diagram is uncontrolled

Comprehensive Track Diagram (CTD) Area Reference
Brookwood: SR/EL/9/1/6



Woking Panel 2
Int. 0069410 Ext. 01483 714 898

All auto WK signals can be controlled by the signaller

Wessex 17

ELR: BML1 (25.0880 miles to 29.0330 miles)

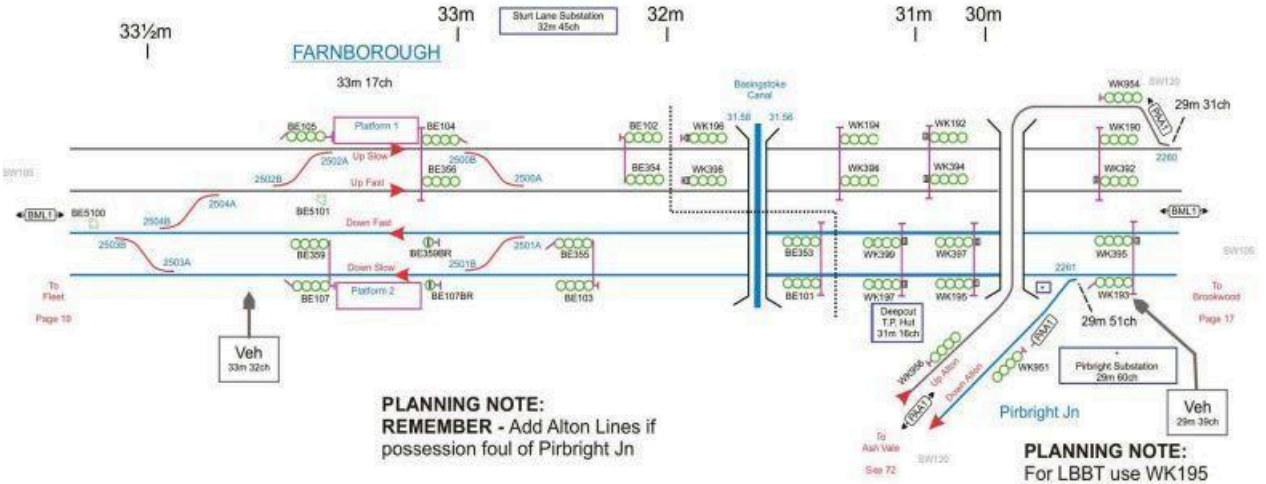
Please note that this diagram was updated locally and is deemed uncontrolled and should be used accordingly.

This diagram is uncontrolled

Comprehensive Track Diagram (CTD) Area Reference
Pirbright Junction: SR/EL/5/1/5
Farnborough: SR/EL/5/3/10

All auto WK signals can be controlled by the signaller

Woking Panel 2
Int. 0069410 Ext. 01483 714 898



PLANNING NOTE:
REMEMBER - Add Alton Lines if possession foul of Pirbright Jn

PLANNING NOTE:
For LBBT use WK195 when possible to allow access to PAA1.

Basingstoke SB (BE) Panel
Int. 0750193 Ext. 01256 478 756

Wessex 18

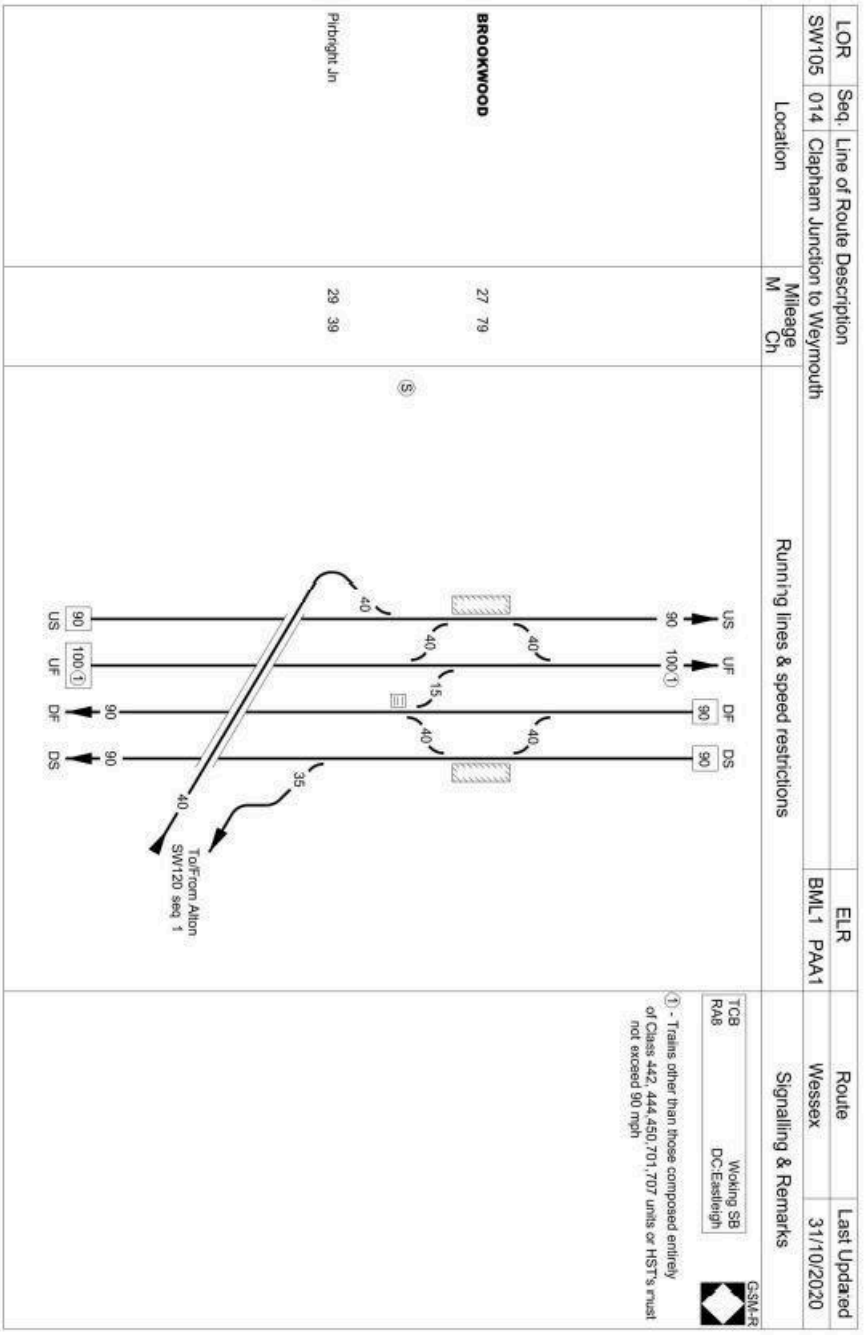
This diagram is uncontrolled

Please note that this diagram was updated locally and is deemed uncontrolled and should be used accordingly.

ELR: BML1 (29,0330 miles to 33,1100 miles)

11. Sectional Appendix

ELR: BML1 (26.0000 miles/yards to 30.0858 miles/yards)



12. Alternative Access Points

ELR: BML1 (Wessex)

Mileage	Type	Local Name	OS Grid Ref.	Nearest Track
26.1710	Authorised Access Point - Pedestrian	Blackhorse Rd Bridge 90	SU96645724	Down Slow
27.0704	Authorised Access Point - Pedestrian	BROOKWOOD SUBSTATION 27m32ch		Up Slow
27.0891	Authorised Access Point - Pedestrian	Bagshot Rd Bridge 91	SU95795709	Down Slow
27.0924	Authorised Access Point - Pedestrian	Brookwood Substation, Track and LCP access 27m42ch		Up Slow
27.1386	Authorised Access Point - Road-Rail Machines	End of Brookwood Stn car park	SU95035698	Up Slow
28.0033	Authorised Access Point - Pedestrian	Brookwood Station	SU94985698	Down Slow
28.0222	Authorised Access Point - Vehicle	Country end of Brookwood Stn car park	SU94805696	Up Slow
28.0792	Authorised Access Point - Pedestrian	Bisley TP Hut	SU94285689	Up Slow
28.1650	Authorised Access Point - Pedestrian	Pirbright Jn Off Sole Road	SU93525680	Up Slow

13. Work Site to Accident & Emergency

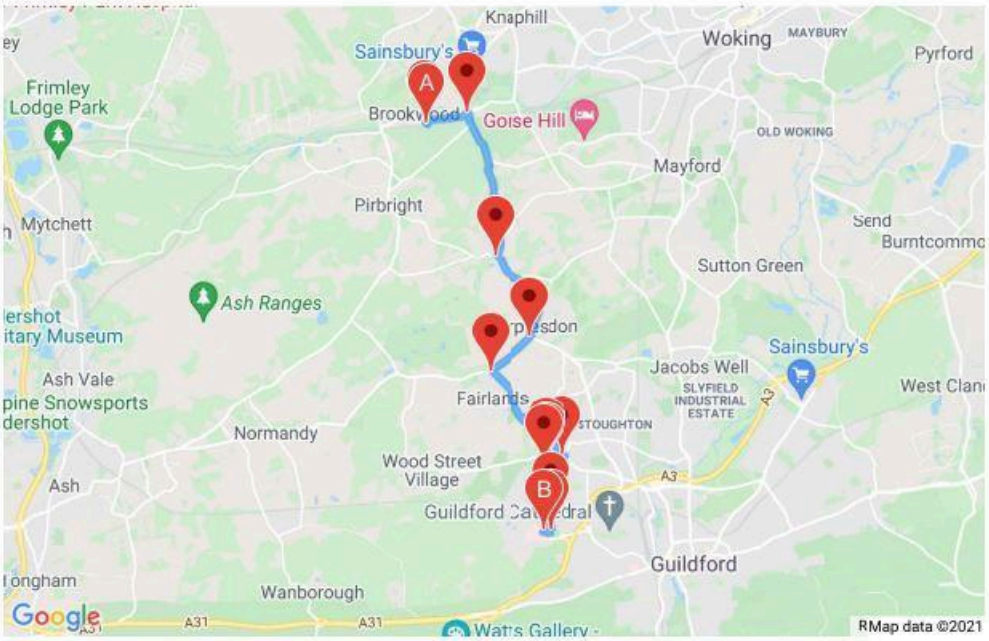
Closest A&E departments to Brookwood station

Listing nearest A&E departments to work site

	Hospital	Phone	Distance (miles)	Address
1	Royal Surrey County Hospital - A & E	01483 571122	4.5	Egerton Road, Guildford, Surrey GU2 7XX
2	Frimley Park Hospital - A & E	01276604604	4.69	Portsmouth Road, Frimley, Surrey GU16 7UJ
3	St Peter's Hospital - A & E	01932 872000	6.84	Guildford Road, Chertsey, Surrey KT16 0PZ
4	Epsom Hospital - A & E	01372 735 735	15.73	Dorking Road, Epsom, Surrey KT18 7EG

13. Work Site to Accident & Emergency (Continued)

Closest A&E departments to Brookwood station



Quickest route to Royal Surrey County Hospital - A & E

Instruction	Distance	Cumulative
Head **west** on **The Brook Wood** towards **Connaught Rd/A324**	230 ft	0.043 mi
Turn **right** at the 1st cross street onto **Connaught Rd/A324**	0.5 mi	0.508 mi
Turn **right** onto **Bagshot Rd/A322**	1.6 mi	2.121 mi
At the roundabout, take the **1st** exit onto **Rickford/A322** Continue to follow A322	1.1 mi	3.188 mi
At the roundabout, take the **2nd** exit onto **Holly Ln**	0.6 mi	3.750 mi
At the roundabout, take the **1st** exit onto **Aldershot Rd/A323**	1.2 mi	4.933 mi
At the roundabout, take the **3rd** exit onto **Broad St**	0.2 mi	5.116 mi
At the roundabout, take the **1st** exit onto **Broadacres**	328 ft	5.179 mi
Turn **right** onto **Wood Rise**	203 ft	5.217 mi
At the roundabout, take the **1st** exit onto **Park Barn Dr**	0.6 mi	5.802 mi
At **Southway Roundabout**, take the **2nd** exit onto **Egerton Rd**	0.2 mi	6.006 mi
At the roundabout, take the **2nd** exit Destination will be on the left	440 ft	6.089 mi

14. First Aid Arrangements

First Aid Arrangements Information
FIRST AIDER ON SITE APPOINTED BY COSS

15. Other Details

RAIL SCAPE

Works Completion Record

CERTIFICATE OF COMPLETION FOR GENERAL WORKS UNDERTAKEN

LOCATION(s): _____

ELR: _____ BETWEEN _____ AND

MILEAGE: M CH *UPSIDE *DOWNSIDE *OTHER

Details: Week Number:

DETAILS OF WORKS UNDERTAKEN

WORK COMPLETED ON SITE. DATE: / / TIME :

Team Members: _____

_____

_____

Works Supervisor : _____

16. Lessons Learned

Please use the space below to provide details of any discrepancies with the information contained within this pack.

SWP Number: **39285**
Comments:

Reported By:
Company:
Date:

17. Comments

18. Life Saving Rules

16 DJI Matrice M300 (UAPS) FRCs

Introduction

The MATRICE M 300 RTK (M300 RTK) is a powerful industrial drone platform with an advanced flight controller system, 6 Directional Sensing and Positioning system and FPV camera. To enhance reliability and safety, it also supports CSM Radar - an additional obstacle detection component that can be mounted on top of the drone. It features several advanced flight functions including 6 directional sensing and positioning*, AI spot-check*, Smart Track*, PinPoint*, Location Sharing, Primary Flight Display and more. The built-in AirSense provides awareness of nearby aircraft within the surrounding airspace to ensure safety.

Its airframe design gives it an IP45 Ingress Protection, in accordance with the global IEC 60529 standard. The mechanical design, along with quick-release landing gears and mounted folding arms, makes it easy to transport, store, and prepare for flight. The safety beacons on both the top and the bottom of the aircraft allow the aircraft to be identified at night or in low light conditions.

The auxiliary lights help the vision positioning system achieve better performance at night or in low light conditions, improving aircraft takeoff, landing and flight safety. It has a built in RTK module, which provides more accurate heading data for positioning. An advanced power management system along with dual batteries ensures power supply and enhances flight safety. Without a payload, the M300 RTK has a flight time of up to 55 minutes.

Technical specification and characteristics

a. Designation and type

Item	Detail
Manufacturer: DJI	DJI 17th Floor, West Wing, Skyworth Semiconductor Design Building, No18 Goaxin South 4th Ave, Nanshan District, Shenzhen, China, 518057
Model:	DJI Matrice 300 RTK
Type:	Multi-rotor

b. Design Flight Envelope (UAS Performance characteristics)

Item	Detail
Operating modes:	P Mode (Positioning) S Mode (Sport) A Mode (Altitude/Atti)
Maximum Operating Parameters	Max Ascent Speed S mode: 6 m/s P mode ： 5 m/s Max Speed S mode: 23 m/s P mode ： 17 m/s Max Wind Speed Resistance 15m/s Max Wind speed for Spraying 5m/s
Launch type:	Vertical Take-Off and Landing (VTOL)
Maximum flight time:	TB60 55Minutes (No Payload)
C2 Range:	8km

c. RPA technical specification & Characteristics

RPA- Remotely Piloted Aircraft

Item	Detail
Airframe Dimensions	Unfolded, propellers excluded, 810×670×430 mm (L×W×H) Folded, propellers included, 430×420×430 mm (L×W×H)
RPA Mass:	6.3Kg (inc 2X TB60 Battery) 7.2Kg (SL fully loaded) 8.96kg (HotSwap fully loaded) **If the aircraft is flown exceeding 7.7kg the 3-propeller emergency landing may not function.**
Battery Mass:	TB60 1.35kg
Transceiver Mass Only	120grams
Transceiver Dimensions	57x82x30mm
MTOM:	9Kg
Motor type:	4 x Electric Brushless Motors
Power source:	TB60 Lithium Polymer (Li-Po) Battery 52.8v 5935mAh
C2 Frequency:	2.4000-2.4835 GHz: 29.5 dBm (FCC); 18.5dBm (CE) 18.5 dBm (SRRC); 18.5dBm (MIC) 5.725-5.850 GHz: 28.5 dBm (FCC); 12.5dBm (CE) 28.5 dBm (SRRC)
Video data downlink:	2.4000-2.4835 GHz: 29.5 dBm (FCC); 18.5dBm (CE) 18.5 dBm (SRRC); 18.5dBm (MIC) 5.725-5.850 GHz: 28.5 dBm (FCC); 12.5dBm (CE) 28.5 dBm (SRRC)

Item	Detail
Ground Obstacle Collision Avoidance sensing range	F/B/L/R – 0.7-40m U/D – 0.6-30m
Operating Environment	Surfaces with clear patterns and adequate lighting (>15 lux)
FOV	F/B/D – 65°(H), 50°(V) L/R/U – 75°(H), 60°(V)
Infrared ToF Sensing System	
Obstacle Range	0.1-8m
FOV	30° (+/- 15°)
Operating Environment	Large, diffuse and reflective obstacles (reflectivity >10%)
Top and Bottom Auxiliary Light	
Effective Light Distance	5m

d. Payload types

Item	Detail
Model:	**Railscape UAPS**
Overview	The UAPS Super leggara was originally conceived as a response to a NWR Air Ops UAS weight limit of 7.3KG. In order to stand any chance of being able to operate a UAPS without isolation/possession in the future we needed to produce a version of the UAPS with a mass budget of less than a 1KG to give a combined mass of less than 7.3KG when mounted on a DJI M300. The initial POC pictured opposite had a mass budget of 960g with a 250-300ml reservoir delivering approx. 12s spray time. The UAPS HotSwap has been modified from the original designed UAPS it is a bespoke payload and has been rigorously tested to ensure that it can be operated safely and efficiently from the DJI Matrice 300 capable of delivering approx. 130s of spray time (500-800ml capacity).
Aircraft Weight (inc Full Tank)	**7.2kg – SL** **8.96kg - HotSwap**

Integration	**Standalone system – not integrated to the M300**
Length of Lance	**1170mm**
UAPS FPV Camera	**DJI Digital FPV - 5.8GHz**
Payload Control Data Link	**868MhZ @ 100mW using a FrSky Horus X10S TX and X8R RX (40mw)**
Payload Video Data Link	**5.8 Ghz @ 25mW Digital DJI FPV Camera Air Unit**
Components	FrSky RC - Horus X10s express TX running OpenTX + FrSky R9M 2019 ACCESS 868MHz module + R9SX OTA 868MHz RX Proprietary 3D printed componant enclosure and mounting Assy for M300
	Proprietary 3D printed component enclosure and mounting Assy for M300
	Proprietary 3D printed battery enclosure
	Proprietary 12mm carbon fibre tube subframe
	Dual 12V 4A 5V 4A BEC
	Linear Actuators
	0.5 litre payload tank
	12V pump + tubing
	4S 2200 mAh battery
	FrSky voltage Sensor (Telemetry and data logging via OpenTX)
	

e. Electrical Power Provision and Distribution

Item	Detail
Cell chemistry:	Lithium Polymer 12S
Battery power output:	TB60 Intelligent Flight Battery × 8 WB37 Intelligent Battery × 4
Battery design:	Standard Lithium Polymer
Recharge time:	220V input: 60 minutes (fully charging two TB60 batteries), 30 minutes (charging two TB60 batteries from 20% to 90%) 110V input: 70 minutes (fully charging two TB60 batteries), 40 minutes (charging two TB60 batteries from 20% to 90%)
Battery Charger:	DJI BS60 Intelligent Battery Station

f. Propulsion System

Motor type:	4 x Electric Brushless Motors
Propellers (length)	53cm

3 propeller controlled emergency landing	**Three-propeller Emergency Landing** During flight, if the aircraft lacks one lift output (e.g. propulsion system failure of a motor), it will automatically switch to the Three-propeller Emergency Landing Mode. The flight controller will try to maintain the stability and controllability of attitude and velocity, and make the aircraft automatically descent in this mode. This mode enables a user to land the aircraft onto a safe zone by controlling the aircraft, helps to reduce the chance for the aircraft and payload to drop, and damage the people and property on the ground. When the aircraft enters the Three-propeller Emergency Landing Mode, the remote controller will alert the user by vibrating. At this time, the aircraft will enter rapid spin and automatically descend by default. The stick that controls back and forth movement will be adjusted to control the north-south movement and the stick that controls the left and right movement will be adjusted to control the west-east movement. The user can operate the sticks to move the aircraft to the appropriate landing area as soon as possible. When the aircraft reaches near to the ground, user can use the Emergency propeller stop to land the aircraft to minimize the drop loss caused by the aircraft spin. ⚠ • Three-propeller Emergency Landing requires that the takeoff weight of the aircraft to be less than 7.7 kg and it should work in open space with the flight height that exceeds 10 m. • Once such a failure occurs, please move the aircraft immediately away from people and valuables, and land on a level and soft surface (e.g. grass) to reduce damaging the aircraft. • If a propeller is damaged but the motor is still working normally, the aircraft will not enter the Three-propeller Emergency Landing Mode. • Three-propeller Emergency Landing is only used as an emergency protection function when the propulsion system fails. Please do not actively trigger it. • Make sure that all firmware is up-to-update. • After landing, contact DJI support for the propulsion system maintenance as soon as possible.

g. Flight Control and / or Autopilot System

Item	Detail
Flight Controller	OCUSYNC Enterprise Technology & TimeSync system
Dual Operator Mode	2 controllers connected to the same aircraft that have the same priority so either pilot can assume control at any time.
RTH	Smart RTH Low Battery RTH Failsafe RTH
Vision System:	
Obstacle Sensing Range	F/B/L/R – 0.7-40m U/D – 0.6-30m
FOV	F/B/L/R – 65°H / 50°V U/D – 75°H / 60°V
Operating Environment	Surfaces with clear patterns and adequate lighting (>15lux)

h. Positioning Navigation and Guidance

<table>
<tr><th>Item</th><th>Detail</th></tr>
<tr><td>GNSS</td><td>GPS + GLONASS + BeiDou + Galileo (including RTK)</td></tr>
<tr><td>GNSS Function (Flight Modes)</td><td>P Mode (positioning)
S-Mode (sport)
T-mode (Tripod)
A-Mode (Attitude)</td></tr>
<tr><td>Geo-caging Function</td><td>Ability to set maximum altitude and radius restrictions using the DJI Pilot app.</td></tr>
<tr><td>Geo Zone Flight Restrictions</td><td>
MATRICE 300 RTK User Manual

GEO Zone Flight Restrictions
<table>
<tr><th>GEO Zone</th><th>Description</th></tr>
<tr><td rowspan="3">Restricted Zone</td><td>Takeoff: The aircraft's motors cannot be started.</td></tr>
<tr><td>In-flight: When GNSS signal changes from weak to strong, DJI Pilot starts a countdown. Once the countdown is over, the aircraft immediately lands in semi-automatic descent mode and turns off its motors after landing.</td></tr>
<tr><td>In-flight: When the aircraft approaches the boundary of the Restricted Zone, it automatically decelerates and hovers.</td></tr>
<tr><td rowspan="2">Authorization Zone</td><td>Takeoff: The aircraft's motors cannot be started. Takeoff is only available after submitting an unlock request with the user's phone number.</td></tr>
<tr><td>In-flight: When GNSS signal changes from weak to strong, DJI Pilot starts a countdown. Once the countdown is over, the aircraft immediately lands in semi-automatic descent mode and turns off its motors after landing.</td></tr>
<tr><td>Enhanced Warning Zone</td><td>The aircraft flies normally but the user is required to confirm the flight path.</td></tr>
<tr><td>Warning Zone</td><td>The aircraft flies normally but the user receives warning messages.</td></tr>
<tr><td rowspan="3">Altitude Zone</td><td>When GNSS signal is strong, the aircraft cannot exceed the specified altitude.
In-flight: When GNSS signal changes from weak to strong, if the aircraft is higher than the height limit, the aircraft will descend and hover below the altitude limit.</td></tr>
<tr><td>When the GNSS signal is strong, the aircraft approaches the boundary of the Altitude Zone. If it is higher than the altitude limit, the aircraft decelerates and hovers in place.</td></tr>
<tr><td>When the GNSS signal changes from weak to strong, if the aircraft is higher than the height limit, DJI Pilot app starts a countdown. Once the countdown is over, the aircraft will descend and hover below the altitude limit.</td></tr>
<tr><td>Free Zone</td><td>The aircraft flies normally with no restrictions.</td></tr>
</table>
</td></tr>
<tr><td>RF Interference</td><td>Eliminated with RTK</td></tr>
<tr><td>Built in AirSense System</td><td>Alerts of nearby aircraft in surrounding airspace</td></tr>
</table>

i. **Environmental Operating Limitations**

Item	Detail
Maximum ceiling height:	400ft as per VLOS rules
Maximum Operating Radius	500m as per VLOS rules
Maximum endurance (no payload):	55 Minutes
Maximum surface wind for take-off*:	15 m/s 5m/s for UAPS operations
Maximum operating temperature:	+50°c
Minimum operating temperature*:	-20°c
Can operate in:	IP45 Rated Light Precipitation

j. Airworthiness

i. Lifed parts

Lifed parts on the DJI Matrice 300 RTK are include the batteries and propellers.

All batteries are monitored for performance this means that underperforming batteries can be replaced earlier if required. Life extension of a battery is permitted if it is still performing to a satisfactory level, any extension must be authorised by the Project / Equipment Manager.

The battery charge status of each individual battery will be initially checked prior to fitting it to the aircraft by pressing the battery button – all LEDs should light green to show a fully charged battery – if this is not the case the battery will be charged and checked again. If after what has been deemed a full charge all LEDs are not illuminating this battery will be deemed unsatisfactory and discarded. If all LEDs are showing battery fully charged they can be fitted to the aircraft. Once the aircraft is turned on the overall battery status will be checked by the status indicator on the DJI Go App, this should read >98% - each individual battery charge status will then be checked in the app – if any one battery is showing <95% on what is expected to be a full charge it will be deemed unserviceable and discarded.

All propellers must be replaced after 300 hours of flight or one year of use, once the propellers are replaced RUAS will contact DJ I technical support or an authorised agent for overhaul as soon as possible as per DJI M300 RTK Maintenance Manual.

**Because the M300 RTK is a state-of-the-art flying platform and has more power and propulsion than our previous platforms, it has high requirements for the proper installation and upkeep of its propellers. We recommend contacting your local authorized repair services or DJI technical support to replace your propellers. If you must replace the propellers yourself in, for example, an emergency flight situation, please contact your local authorized repair agent or DJI technical support for maintenance as soon as possible after landing

ii. Inspections and Servicing

The whole system is inspected for air worthiness on the following occasions:

- At the beginning of each flight.
- Post flight

Monthly advanced checks will be conducted this will include:

- Thoroughly cleaning of the motors to ensure they are clear of any debris using compressed air
- Checking the torque settings of all nuts and bolts on the aircraft
- Ensuring all motors and propellers are within their lifespan
- Checking batteries for signs of damage or degradation

iii. Transportation

While in transit the manufacturer supplied case must be used in folded position, once in location the RPAS may be moved around site in the unfolded position.

The UAPS will be transported in its own custom made box.

iv. Repair

First line (operator) maintenance of the DJI Matrice 300 RTK is limited and only the following procedures are permitted to be carried out by trained RUAS personnel:

Replacement of propeller(s)
Once the propellers are replaced RUAS will contact DJ I technical support or an authorised agent for overhaul as soon as possible as per DJI M300 RTK Maintenance Manual.

Any other repair task will be carried out by the manufacturer at their facility.

All repairs are documented in the system flight documentation.

Repairs to the UAPS system will only be carried by Railscape technologies experimental department and any repair logged and reported to RUAS air safety manager.

k. Known failure modes

Events which could make the drone fly outside (laterally or vertically) the space previously dedicated to the flight	**Corrective action to be taken to maintain the drone in the allocated space**	
Software malfunction or electronic component failure leading to an abnormal behaviour of the RPA (fly away)		
	Action 1:	Select RTH
	Action 2:	Switch off the Transmitter. to activate the emergency landing.
Loss of the Data link	Prevention:	Scanning the area using a spectrum analyser on the control frequency.
	Action:	In the event that the data link is lost the RPA will enter the lost link failsafe. As soon as the link is re-established one may take control again and continue the flight.

l. Single points of failure

The DJI Matrice 300 RTK has 3 single points of failure:

- Complete electrical failure
- Complete IMU failure
- Failure of any 1 of the 4 motors will result in unstable control and ungraceful descent

Prevention of these events is procedural, ensuring that Pre and Post flight checks are carried out.

m. Replacement of parts and sourcing

Only parts authorised by DJI will be used.

n. Record of maintenance

Any maintenance carried out must be recorded in the system maintenance log in Drone Cloud See Annex U as an example.

Maintenance Checks will be carried out on a monthly basis and recorded in Drone Cloud as per annex U.

o. System Modifications

No physical modification of the system is permitted unless authorised by the Project / Equipment Manager and specified by the manufacturer.

Periodically software and firmware updates will be released by the manufacturer, these may be applied to the system by trained personnel.
When any maintenance / modification(s) / firmware update has been made there will be a period of test flying at a safe location away from any uninvolved persons prior to being used operationally to ensure the aircraft is flightworthy.

Test flight will include:

- When the aircraft is on the ground start Propellers and watch for 30 seconds to ensure the aircraft is performing as it should.
- Take off the aircraft to 3-5 meters and perform input manoeuvre checks (roll, pitch yaw).
- Engage RTH to ensure the aircraft responds correctly.
- Cancel RTH.
- Fly the aircraft to a distance of >100m, ensure the aircraft is responding as expected.
- If the aircraft is functioning correctly the flight test is complete and operations can continue as per granted Operational Authorisations.

p. Emergency Recovery or Safety Systems

RTH Function (the aircraft cannot RTH when GPS signal is weak or is unavailable)

- There are three RTH procedures that can be triggered – Smart RTH, Low-Battery RTH and Failsafe RTH.
- Failsafe RTH (enabled in the app) is automatically activated if the remote controller and the aircraft are disconnected, this includes two stages of RTH: historical flight path and Smart RTH.
- When Failsafe RTH is enabled, the aircraft will RTH based on its historical flight path. Within a maximum distance of 50m, the aircraft will try to reconnect to the remote controller. If the aircraft cannot reconnect to the remote controller within 50m or the aircraft detects obstacles in front of it the aircraft will exit this stage of RTH and enter Smart RTH. When the remote controller is connected to the aircraft during RTH users can use the controller to control the aircrafts flight speed and altitude and cancel RTH.
- Obstacle Avoidance during RTH – The aircraft can sense and actively attempt to avoid obstacles during RTH, provided that lighting conditions are adequate for the Forward Vision System, upon detecting an obstacle, the aircraft will decelerate when an obstacle is sensed at approx. 20m ahead, the aircraft stops and hovers then starts ascending vertically to avoid the obstacle, the aircraft will stop climbing when it is at least 5m above the detected obstacle. RTH procedure continues, aircraft flies to home location at this current altitude.

Maximum Altitude and Radius Restrictions

- Limits to the aircrafts flight altitude and distance can be set in the DJI Pilot App.
- Maximum flight altitude restricts the aircraft's height.
- Maximum flight radius restricts the aircraft's distance.

GEO System

- DJI's GEO System is a global information system committed to providing real-time airspace information within the scope of international laws and regulations.
- It provides flight information, flight times and location information.
- It includes unique Regional Flight Restrictions feature which provides real-time flight safety and restriction updates and blocks UAVs flying in Restricted Airspace, with the ability to unlock certain flights in certain circumstances.

Weak GNSS Signal

- Altitude is restricted to 8m when GNSS signal is weak, and the Vision System is activated.
- Altitude is restricted to 30m when the GNSS signal is weak and the Vision System is deactivated.

Assisted Braking from Obstacle Sensing

- Powered by the Vision System, the aircraft is able to actively brake when obstacles are detected in front, Obstacle Sensing works best when lighting is adequate and the obstacle is clearly textured.
- The aircraft must fly at no more than 38mph with a maximum pitch angle of 25° to allow for sufficient braking distance.

Three-Propeller Emergency Landing

Three-propeller Emergency Landing

During flight, if the aircraft lacks one lift output (e.g. propulsion system failure of a motor), it will automatically switch to the Three-propeller Emergency Landing Mode. The flight controller will try to maintain the stability and controllability of attitude and velocity, and make the aircraft automatically descent in this mode. This mode enables a user to land the aircraft onto a safe zone by controlling the aircraft, helps to reduce the chance for the aircraft and payload to drop, and damage the people and property on the ground.

When the aircraft enters the Three-propeller Emergency Landing Mode, the remote controller will alert the user by vibrating. At this time, the aircraft will enter rapid spin and automatically descend by default. The stick that controls back and forth movement will be adjusted to control the north-south movement and the stick that controls the left and right movement will be adjusted to control the west-east movement. The user can operate the sticks to move the aircraft to the appropriate landing area as soon as possible. When the aircraft reaches near to the ground, user can use the Emergency propeller stop to land the aircraft to minimize the drop loss caused by the aircraft spin.

⚠
- Three-propeller Emergency Landing requires that the takeoff weight of the aircraft to be less than 7.7 kg and it should work in open space with the flight height that exceeds 10 m.
- Once such a failure occurs, please move the aircraft immediately away from people and valuables, and land on a level and soft surface (e.g. grass) to reduce damaging the aircraft.
- If a propeller is damaged but the motor is still working normally, the aircraft will not enter the Three-propeller Emergency Landing Mode.
- Three-propeller Emergency Landing is only used as an emergency protection function when the propulsion system fails. Please do not actively trigger it.
- Make sure that all firmware is up-to-update.
- After landing, contact DJI support for the propulsion system maintenance as soon as possible.

RPA Mass (HotSwap) 8.96Kg – UAPS fully loaded – it is anticipated that the Three-Propeller Emergency Landing will not operate as it should, and an uncontrolled loss of altitude (UCLA) may be expected, so therefore, is not considered a form of mitigation when operating the M300 with the HotSwap UAPS fully loaded. All individuals involved in the operation must adopt the 1:1 rule when flying i.e 1m distance for 1m in height. (As a minimum)

RPA Mass (SL) is 7.2Kg full. The Three-Propeller Emergency Landing can be considered as mitigation providing all other criteria are met.

When operating, where possible operations will be conducted in an open space and flight height will exceed 10m in height in order to satisfy the requirements of the Three-propeller Emergency Landing, where this is not possible it is understood that the Three-propeller Emergency Landing may not work as well and an uncontrolled loss of altitude (UCLA) may be expected, where this is the case all individuals involved in the operation must adopt the 1:1 rule when flying i.e 1m distance for 1m in height (as a minimum).

Equipment loading list and FRCs

q. DJI Matrice 300 RTK list

The table below is a checklist of the equipment that is required for operating the RPAS in the field.

Item	Checked	Remarks
Operations Manual		Check manufacturers website for latest firmware version, manual, software and operations manual edition
Maps & Charts Relevant to tasking and flight area		Maps & Charts Relevant to tasking and flight area
Crystal Sky		Check Charged
Weather meter		Check operation
Spectrum analyser/power cable/antenna		Check operation
Map/charts		Relevant to task area and route.
VHF/UHF radios/charger		As required for task
Task information		Check contact details, location, access and correct forms such as pre-deployment and on-site survey
Fire extinguisher		Check serviceable
First aid kit		Check contents
Florescent vests		Sufficient for task and crew
Cordon equipment		Tape, cones, sign
Digital camera (SD card fitted PCM)		
Lipo bag (PCM)		Lithium Battery Disposal/Storage

DJI Matrice 300 RTK Complete:	Checked	

DJI Matrice 300 RTK		
RPA & RPS (WB37) Batteries		Check Charged
Hand Held controller		Check charged and serviceable
RPA Battery Charger & Power Cable		Check
Ground Station Receiver		Check Serviceable
Spare propellers		Check Serviceable Replace propellers after flying over 300 hours or after using them for one year.
UAPS SL Spray System		Complete

r. Pre-flight checks

Site

Action	Remarks	Check
COSS Briefing	If working on railway sites (all to sign COSS Briefing Paperwork).	
Carry out site survey		
Ensure Possession in place (if required)	Responsibility of COSS	
Weather check	**Wind Speed** **Temp**	
Spectrum analysis	Spectrum Analysis is purely to warn the pilot that there may be the risk of spectrum fratricide. The pilot can also attempt to identify other locations where the interference may be reduced If the pilot feels it may be warranted a test flight can be conducted to validate the platforms operational suitability. Once the test flight has been conducted the pilot will make the final decision to fly.	

Observer/Assistant Brief	Brief Observer/Assistant on roles & responsibilities (Emergency Procedures & Failsafe).	

RPS

RA Inspection & Set Up	Remarks	Check
UAPS set up	Attach UAPS as per set up procedures detailed in UAPS FRCs	
Check RPA for Signs of Visible Damage	RPA Body for cracks, cleanliness, stresses & damage	
Check RPA Battery Mount	Electrical Connections, clear from moisture & debris.	
Check RPA Batteries	Check electrical connections. Check for no physical swelling of battery. Check for leaks. Ensure charge is full and sufficient	
Fit RPA Battery	Insert RPA batteries into compartment ensure firmly connected	
Camera & Gimbal	Check bolts are tightened but not overly tight.	
Motors	Check all motors rotate freely without resistance.	
Propellers	No chips, cracks (replace if necessary). Check all propeller locks are fitted and secure (where applicable).	

Action	Remarks	Check
Take-off and Landing Area/s Identified and Secure	Normal and Emergency Landing Areas identified, coned off and clear of FOD.	
Place RPA in Take-off & Landing Area	Check area for FOD. Ensure RPA is minimum of 3m from persons.	
Check Transmitter	Ensure all switches set to correct position. Ensure free movement of joysticks.	
Power-on RPA	Power ON RPA - RPA the RPA LEDS will show green and the drone will carry out motor and gimbal checks. Allow RPA to warm-up.	

Pre-flight Checks – Compass Calibration & System Conformation

Action	Remarks	Check
Compass Calibration	**1.** Is this the first flight of the day? **YES** Calibrate Compass by selecting **the drone symbol at the top of the menu bar and select drone calibration.** **The app will direct you on how to complete a successful calibration.** **NO – Continue to item 2** **2.** Has the flight location moved from previously calibrated location **YES – Carry Out Compass Calibration** **NO –** Continue below	
Status Indications	Check battery strength of controller and app. Application indicating Safe to Fly.	
GPS Satellites	Minimum number of GPS Satellites received (can be found by selecting the drone symbol at top of screen) DJI App confirm Home Point updated	
RPA Battery Indication	RPA Battery % indication (record as required).	
DJI Application	Configured, set for flight, telemetry and video received with no warnings indicated. Camera set as required.	

s. **Start Up/Take Off Procedure**

Site

Action	Remarks	Check
Final weather check	Wind Speed Temp	
Video Data	Check & Confirm sensor operation	
Collision Avoidance	Ensure turned on and set up correctly as per operation	
Check area clear for take- off	All persons must remain a minimum of 3m from take-off site (30m if not under your control)	
Check Air Space for other Users	Ensure area of operation clear	
Check Ground Area Clear	Ensure area of operation clear	
Request take-off clearance Commence Take-off	If under ATC control Call "CLEAR" and select Take Off	

t. **Post Take Off Checks**

Action	Remarks	Check
Establish Stable Hover (3m)	Check RPA stability	
CoG check		
Carry out gimbal calibration	Ensure calibration completed	
RPA Control Check	Check RPA control in all axis	
Check Camera	Check FPV camera feed and record functionality	
Record Take-off Time	Record as required.	
Ensure UAPS is operating as it should	SO to check	
Continue On Mission	If deemed safe carryout flight as directed by SO	

u. **Pre-Landing Checks**

RPS/RPA

Action	Remarks	Check
Check Landing Area Clear	Check area is clear off FOD.	

	Safe on the ground. All persons remain 3m from area (30m if not under my control). Brief observer prior to landing.	
Weather Check	Wind Speed: Temperature:	
Select Type of Landing (Manual or Auto-land)	Call "CLEAR" Carry out landing procedure.	

Post Flight Checks

Action	Remarks	Check
Record Flight time & Battery Level	Record in Running Log RPA Maint Documents	
Camera	N/A	
Turn off RPA		
Power Down Transmitter	Check Voltage, Power off the transmitter and record in maintenance documents.	
Remove RPA battery	Press and hold battery until lights extinguish Check battery for serviceability breaks, bulges, and leaks etc. Place battery in LiPo bag.	
Check RPA for signs of visible damage	RPA body for cracks, cleanliness	
Check propellers and motors	Chips, cracks (Replace if necessary) any excess heat	
Check RPA landing gear	Replace if necessary	
Record any damage/repair carried out.	In RPAS maintenance logbook	
Pack RPA away if task complete	Or carry out Pre Flight Check if second flight required	

v. Post Flight Actions

Action	Remarks	Check
Pack and account for all equipment	Ensure all equipment is accounted for	
Check area		

Further Flights Required?	Yes – Carry out all checks from; Pre-flight – Weather No – Proceed with items below	
Camera & Gimbal	Remove Camera & Gimbal store in transport case	
Propellers	Remove and store in transport case.	
Fit Bty	Insert Bty and ensure it is correctly fitted	
RPA Travel Mode	Switch On TX & RPA and engage travel mode	
Power Down RPA & TX	Switch OFF RPA & TX.	
RPA Battery	Remove RPA battery and store in LiPo bag.	
Pack Away RPA & Equipment	Store/send/copy any imagery from task as required and carry out quality check of imagery to ensure it is of required standard.	
Final Check of Flight Area	Ensure all signage is returned	

w. Night Flight Checks

Site

Action	Remarks	Check
Ensure that the take-off and landing area is clear and clearly marked.	Prior to take-off and landing, use white light to check area is safe. All persons must remain a minimum of 7m from take-off site (30m if not under your control)	
Ensure the landing site remains lit throughout the flight.	Landing site must remain lit (with white light) throughout the duration of the flight. (If light fails land RPA safely).	
Check Aircraft LEDs	Check the LED's on aircraft are functioning before take-off.	
Check Communication Radio's	Check that they have been issued to all involved in the operation and fully charged.	
Check Visibility	Check sufficient visibility for night task	
Brief all personnel	Brief all personnel who are involved in the task of what is expected of them	

x. LED Lighting

There is a front/rear LED on each frame arm of the Matrice 300 RTK to show the orientation of the aircraft. Front LEDs are red and the rear LEDs are green. An aircraft status indicator is located at the rear of the aircraft and shows the status of the flight controller.

Aircraft Status Indicator Description

Normal		
Ⓡ Ⓨ Ⓖ Ⓑ Ⓟ	Red, yellow, green, blue, and purple flashes	Turning On and Self Diagnostic Testing
Ⓨ ×4	Four yellow flashes	Warming Up
Ⓖ	Slow green flashing	P-mode with GPS*
Ⓖ ×2	Two green flashes	P-mode with Forward and Downward Vision Systems*
Ⓨ	Slow yellow flashing	No GPS and Forward and Downward Vision Systems
Ⓖ	Fast green flashing	Braking
Warning		
Ⓨ	Fast yellow flashing	Remote Controller Signal Lost
Ⓡ	Slow red flashing	Low Battery Warning
Ⓡ	Fast red flashing	Critical Low Battery Warning
Ⓡ	Red flashing	IMU Error
Ⓡ ——	Solid Red	Critical Error
Ⓡ Ⓨ	Fast alternating red and yellow flashing	Compass Calibration Required

* Slow green flashes indicate P-mode, and fast green flashes indicate S-mode.

Emergency Procedures

y. Loss of Control Data Link

Symptom	MGS Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
RPA not responding to commands	Link LED on RPS YELLOW Indicating Controller signal lost. No telemetry (GPS, location, RPA icon, bty power).	Check ground station for power. Initiate fail safe return to home Attempt to regain control by cycling modes (GPS/ATTI) Monitor video imagery for location Monitor RPA until it lands Recover RPA	Note RPA location, height, wind direction, Direction of travel, Bty remaining, your location Inform other air users if required	In the event of loss of signal to handheld controller the RPA will automatically return home and land. Return to home logics – see note* If control regained return home and land asap. Check for damaged components. Submit Report via European Reporting Portal if required.

NOTE - Return to home logics (Failsafe RTH) - The platform will wait for 3 seconds then travel to the home location. If the platform is below 20m it will climb to 20m (or designated height set by user). If the platform is above 20m it will remain at the same altitude and travel directly to the set home location. At the home location the platform will hover for 15 seconds and then conduct an automatic landing. Props will shut down and stop after landing. If RTH is engaged within 20m of the GCS the platform will land in its current position.

z. Loss of RPA power

Symptom	GUI Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
Low Battery 1st level protection	Slow LED Flashes RED	Inform assistant of intentions Return and land immediately	Ensure path to landing site is clear Call CLEAR	The Pilot should make the decision to either land the platform in its current position or try to return the platform to the landing point. If possible, reduce height to mitigate damage/injury risk.
Critical Battery 2nd level protection .	Fast LED Flashes RED	Inform assistant of intentions Select safe landing site if current site unreachable Apply relevant controls to land RPA.	Ensure path to selected landing site is clear Call CLEAR	RPA will soon descend automatically in its current position. Pilot to land platform at the earliest opportunity. Submit Report via European Reporting Portal if required.
Sudden Un-commanded loss of height.	Altitude indictor will decrease quickly. Loss of RPA telemetry & video	Attempt to arrest descent with throttle Push right joystick forward to move RPA out of any possible vortex wake Inform assistant	Monitor RPA until it land Inform other air users if required Recover RPA	This can be caused by a number of factors Power failure RPA failure Control link failure Vortex wake Ground effects Submit Report via European Reporting Portal

		of intentions Check controls .		

aa. Loss of RPS power

Symptom	GUI Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
RPA not responding to commands	RPA will flash fast YELLOW highlighting controller signal lost.	Attempt to repower controller. Monitor video imagery for location Monitor RPA until it land Recover RPA	Note RPA location, height, wind direction, Direction of travel, Bty remaining, your location Monitor RPA until it land Inform other air users if required	In the event of loss of signal to handheld controller the RPA will automatically return home and land. Return to home logics *– See Note

NOTE - Return to home logics (Failsafe RTH) - The platform will wait for 3 seconds then travel to the home location. If the platform is below 20m it will climb to 20m (or designated height set by user). If the platform is above 20m it will remain at the same altitude and travel directly to the set home location. At the home location the platform will hover for 15 seconds and then conduct an automatic landing. Props will shut down and stop after landing. If RTH is engaged within 20m of the GCS the platform will land in its current position.

bb. Rogue RPA

Symptom	GUI Warning	Action Remote Pilot	Action RPAC-c or AO	Remarks
Uncommand RPA movement	None	Attempt to regain control of RPA Cycle control modes (GPS/Atti) Attempt to stabilize aircraft If control regained then bring RPA back to home position if possible If return to home position not possible then land immediately If no control possible then engage RTH function If failsafe does not engage prepare for crash landing	Note RPA location, height, wind direction, Direction of travel, Bty remaining, your location Use information to identify potential location Monitor RPA until it land Inform other air users if required Inform ATC and other agencies as required. check for control link clash with other 2.4Ghz users	The risk of this occurring can be mitigated by constant monitoring of 2.4ghz frequency and the avoidance of built up areas that may contain multiple 2.4ghz devices such as wifi routers. Submit Report via European Reporting Portal

		Inform assistant of intentions Recover RPA		

cc. Pilot incapacitation

Symptom	GUI Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
RP incapable to carry out duty.	NONE	Before flight Assistant/Observer is briefed on roles and responsibilities including the Failsafe and RTH logics and how to initiate them.	Activate failsafe mode Apply first aid If possible move pilot to safe area Call emergency services if necessary Clear landing area of public and FOD	Give assistant basic flight training on failsafe mode Make assistant aware of emergency contact detail and numbers Return to home logics* – see note

NOTE - Return to home logics (Failsafe RTH) - The platform will wait for 3 seconds then travel to the home location. If the platform is below 20m it will climb to 20m (or designated height set by user). If the platform is above 20m it will remain at the same altitude and travel directly to the set home location. At the home location the platform will hover for 15 seconds and then conduct an automatic landing. Props will shut down and stop after landing. If RTH is engaged within 20m of the GCS the platform will land in its current position.

dd. Air Incursion

Symptom	GUI Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
RP notices another airspace user entering the task area	None	Take action to avoid other airspace user Assess risk of incursion reoccurring. Determine if it is safe to continue with flight and act accordingly. Contact ATC if necessary.	Maintain situational awareness Contact ATC if necessary Relay flight path of other airspace user to pilot to aid avoiding action and enhance situational awareness.	Submit Report via European Reporting Portal NB – Use of the RTH function during this emergency is not advisable.

ee. RPA Fire

Symptom	GUI Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
RPA Fire		If still have control land immediately in a safe area away from public Inform emergency service. Cordon off 30m area	Inform emergency services. Cordon off 30m area If safe to do so use extinguisher	It is important to land the RPA in a safe area that will not be affected by the fire LiPo batteries are highly dangerous and can explode Keep distance until safe to approach Always store batteries in LiPo bag Submit Report via European Reporting Portal

		If safe to do so use extinguisher Consider soak period of 30 minutes to ensure Lipo Batteries are stable		

ff. Lighting Fail – Night Flight (Landing Zone)

Symptom	MGS Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
Lighting failure on LZ lighting	Intermitting lighting on LZ. Partial loss of lighting on LZ. Complete loss of lighting on LZ.	Maintain VLOS with RPA Hover RPA in position to save battery. Once lighting issue resolved Pilot to decide to carry on with flight operations or return to home	Inform other air users and crew of LZ light failure. Deploy back up lighting to LZ.	Back up lighting should be "like for like" where possible. The use of alternative means of lighting (Car lights/glowsticks etc) can be used to aid/enhance situational awareness.

gg. Lighting Fail – Night Flight (RPA)

Symptom	MGS Warning	Action Remote Pilot	Action RPAS-c or AO	Remarks
No lighting on RPA observed	Intermitting lighting on RPA.	Inform AO of loss of lighting	AO to deploy white light to assist pilot with	RTH should be engaged if pilot

	Partial loss of lighting on RPA. Complete loss of lighting on RPA.	If VLOS has been lost engage RTH function, attempt to maintain VLOS with AO assistance. If VLOS has been maintained fly RPA back to LZ and land.	maintaining /acquiring VLOS	loses VLOS at any point.

17 DJI Matrice M300 – UAPS Flight Reference Cards and Emergency Procedures

a. UAPS Spraying – Detachment of UAPS Sprayer During Flight

Symptom	MGS Warning	Action Remote Pilot	Action Spray Operative / COSS	Remarks
UAPS Spray system detaches from aircraft during flight	Visual can be seen	Maintain VLOS with RPA Bring the aircraft slowly in to land backwards (reverse landing) to protect the UAPS system by inducing a skid landing.	Immediately stop spraying COSS warn anyone in the area	If the UAPS becomes detached during flight there are 8 bolts that hold in place to allow for multiple failures

b. UAPS Spraying – Chemical Leak From the Baffle Tank

Symptom	MGS Warning	Action Remote Pilot	Action SO / COSS	Remarks
Chemical leak from the UAPS Sprayer	Visual – can see substance leaking from UAPS	Maintain VLOS with RPA Bring aircraft slowly into land away from any persons	Sprayer Operative (SO) is to approach the UAPS and take relevant NEBOSH PA1 / PA6 precautions and report the incident accordingly Site made safe by COSS	Remote Pilots will not approach the leaking substance unless it is safe to do so as directed by the SO.

18 Application Plan

HSE Health and Safety Executive

APPLICATION PLAN FOR THE AERIAL SPRAYING OF PLANT PROTECTION PRODUCTS ([SPECIFIED "OFF-TRACK" UNWANTED VEGETATION SUCH AS BUDDLEIA] CONTROL WITH GLYPHOSATE) IN ENGLAND AND WALES

Applicant name and address:

Ed Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date: 24 Apr 2022

Dear Sir/Madam

REQUEST FOR APPROVAL OF APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS FROM AN UNMANNED AERIAL PRECISION SPRAYER (UAPS); AND REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN (SUBJECT TO IT GAINING APPROVAL)

I seek approval of the Application Plan below, to aerially apply plant protection products via an unmanned aerial precision sprayer (UAPS drone) at the locations detailed in the Appendices to this letter.

APPLICATION PLAN

I will ensure that spray jobs are conducted in accordance with the following conditions:

- The product to be applied shall be Roundup ProVantage (MAPP 15534), containing the active substance glyphosate, authorised under NANUM (2234) of 2021.

necessary and attached to any Permit issued following consideration of this Application Plan.

- Risks to water are assessed and mitigated appropriately, and in accordance with information collected from the environmental regulator, local water company and/or local authority as appropriate.

- Permission is approved by the landowner and Network Rail to use UAPS. The operating environment is a dangerous one with hazards such as trains, railway maintenance rolling stock and railway infrastructure such as points, live rails and power lines. In order to work and operate in this area, additional safety measures and training are required. To support the UAPS operation there are staff who are dedicated to the safety of those who are on site.

- Designated Take Off and Landing (TOLA) sites of UAPS operations represent the best conditions for the operators from a health and safety perspective. Each TOLA site is accessible by vehicle.

I will ensure that the pilot is aware of, and ensures that spray jobs are conducted in accordance with, the following conditions:

- UAPS are maintained and operated in accordance with the most current flying permissions for Railscape and RUAS in line with permissions and negations as approved from the CAA under UAS 11426.

SUPPORTING DECLARATION

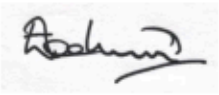
In support of the above Application Plan, I declare that:

- The following range of alternative methods of control have been considered and deemed inappropriate:

  - The existing infrastructure offers several challenges. An array of methods are used to access tunnel portals, bridges and viaducts to achieve the height that is required for the operation. This is all site dependant and can range from scaffolding towers, mobile elevated working platforms (MEWP), ladders or by abseiling. All methods are reliant upon ease of access to the site and site conditions; both of which are not always possible, hence why the plants are able to establish themselves and continue to go

- The information contained herein is true and reflects my best understanding of the circumstances relating to these spray jobs at this time.
- I will advise HSE of any circumstances which may necessitate the review, withdrawal or amendment of the Application Plan or spray jobs permitted under it, in the event that I obtain approval of this Application Plan and permission for those spray jobs from HSE.

Yours faithfully



Ed Lewis

(Signed electronically

19 Aerial Spraying Permit – London

HSE

Health and Safety Executive

Chemicals Regulation Division

Trevor Faxon

Mallard House
Kings Pool
3 Peasholme Green
York YO1 7PX

http://www.hse.gov.uk/

Mr E Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date 11 May 2022

Reference COP 2022/00959

Dear Mr Lewis

RE: YOUR REQUEST FOR APPROVAL OF AN APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS; AND YOUR REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN

APPLICATION PLAN AND PERMIT ENABLING LAWFUL APPLICATION OF AERIAL SPRAYING OF PESTICIDES COP 2022/00959

Thank you for your request for approval of your Application Plan and for permission of spray job[s] dated 24 April 2022.

HSE has approved your Application Plan under the Plant Protection Products (Sustainable Use) Regulations 2012 (as amended)

Appendix A

Land neither in nor within 150m of a protected area - London

Applicant Ref	County	Map refs	Provisional date and time	Amount of product (Roundup ProVantage) to be applied (litres)
	London Primrose Hill Tunnel	GR TQ 27569 842239 GPS 51.542645, -0.161867 W3W Inform. Pretty. Rods	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	London Primrose Hill Tunnel	GR TQ 26518 84059 GPS 51.541260, -0.17703474 W3W Silly. Spot. Transit	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

	London Kensal Green Tunnel	GR TQ 23222 82758 GPS 51.530295, - 0.224987 W3W Tuck. Mini. Mull.	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	London Kensal Green Tunnel	GR TQ 22929 82753 GPS 51.530315, -0.22922337 W3W Sulk. Aims. Guards	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

3

	London London Liverpool Street	GR TQ 33445 82096 GPS 51.522024, - 0.077956617 W3W Rather. Neat. Belts	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

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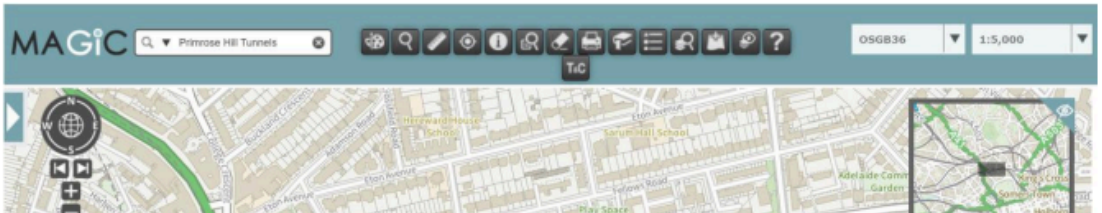

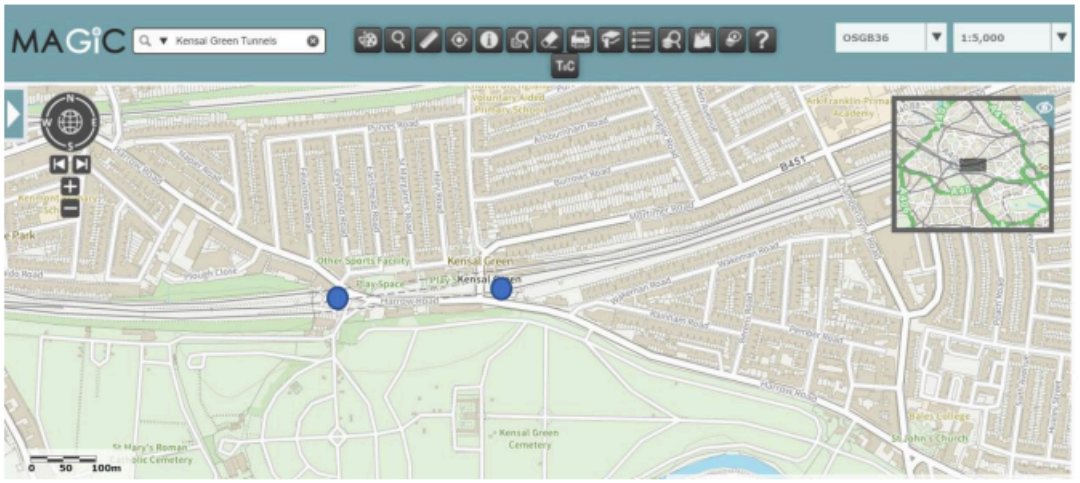
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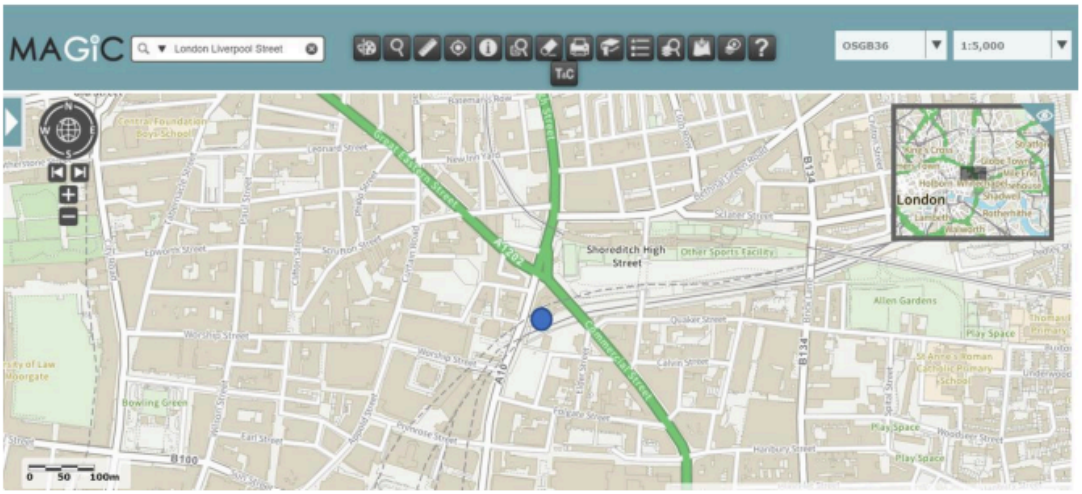


Aerial Spraying Permit – Liverpool

HSE

Health and Safety Executive

Chemicals Regulation Division

Trevor Faxon

Mallard House
Kings Pool
3 Peasholme Green
York YO1 7PX

http://www.hse.gov.uk/

Mr E Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date 11 May 2022

Reference COP 2022/00962

Dear Mr Lewis

RE: YOUR REQUEST FOR APPROVAL OF AN APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS; AND YOUR REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN

APPLICATION PLAN AND PERMIT ENABLING LAWFUL APPLICATION OF AERIAL SPRAYING OF PESTICIDES COP 2022/00962

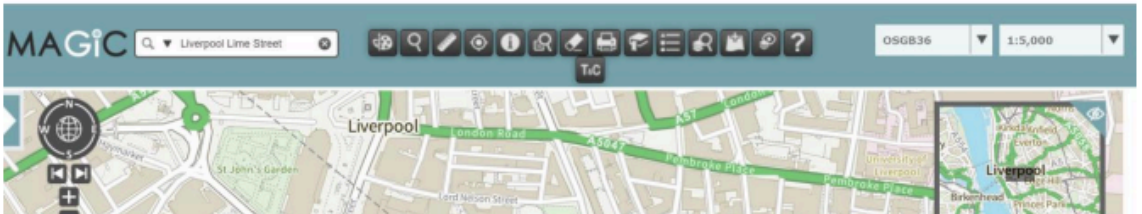
Thank you for your request for approval of your Application Plan and for permission of spray job[s] dated 24 April 2022.

HSE has approved your Application Plan under the Plant Protection Products

Appendix A

Land neither in nor within 150m of a protected area - Liverpool

Applicant Ref	County	Map refs	Provisional date and time	Amount of product (Roundup ProVantage) to be applied (litres)
	Liverpool Lime Street Station Brownlow Hill Portal	GR SJ 35675 90392 GPS 53.406409, -2.9690498 W3W Clubs. Tanks. Garage.	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.094l



Aerial Spraying Permit – Hertfordshire

HSE

Health and Safety Executive

Chemicals Regulation Division

Trevor Faxon

Mallard House
Kings Pool
3 Peasholme Green
York YO1 7PX

http://www.hse.gov.uk/

Mr E Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date 11 May 2022

Reference COP 2022/00963

Dear Mr Lewis

RE: YOUR REQUEST FOR APPROVAL OF AN APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS; AND YOUR REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN

APPLICATION PLAN AND PERMIT ENABLING LAWFUL APPLICATION OF AERIAL SPRAYING OF PESTICIDES COP 2022/00963

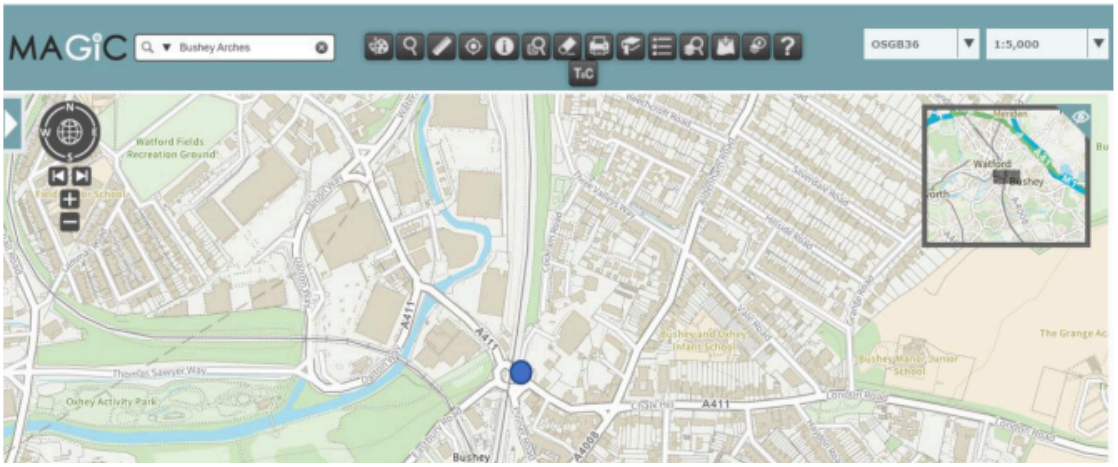
Thank you for your request for approval of your Application Plan and for permission of spray job[s] dated 24 April 2022.

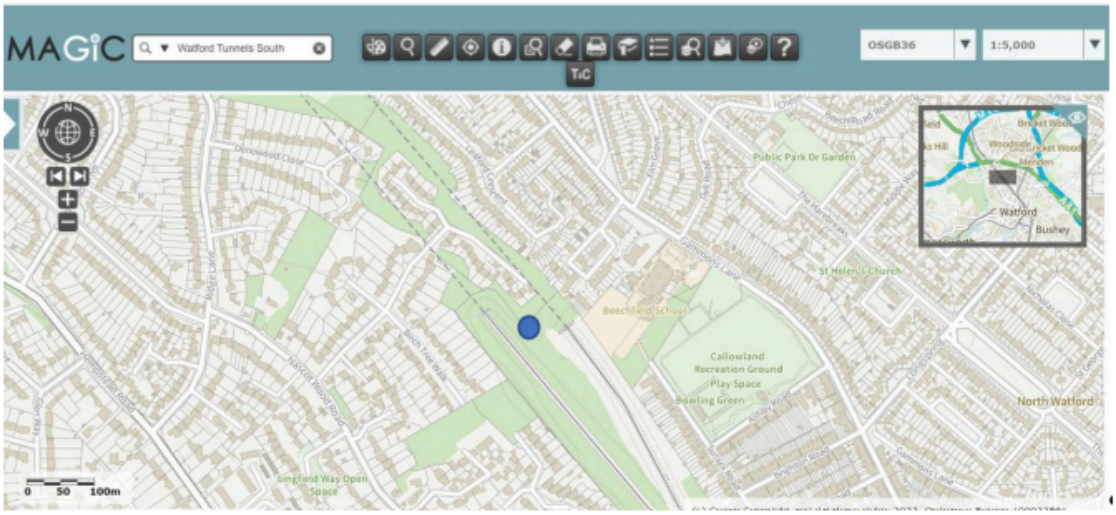
Appendix A

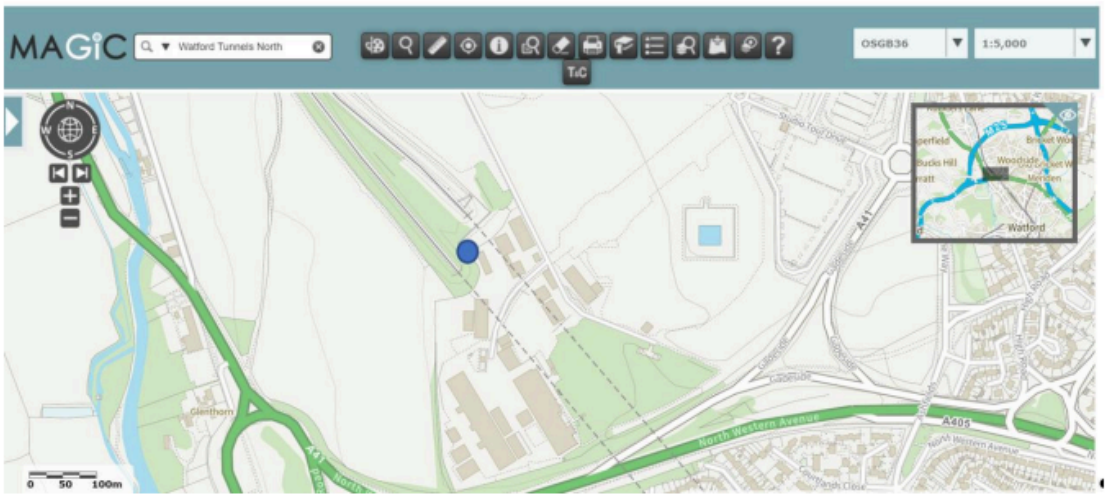
Land neither in nor within 150m of a protected area - Hertfordshire

Applicant Ref	County	Map refs	Provisional date and time	Amount of product (Roundup ProVantage) to be applied (litres)
	Hertfordshire Bushey Viaduct	GR TQ 11879 95470 GPS 51.646967, -0.384602 W3W Charge, Spicy, Swung	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	Hertfordshire Watford Tunnel South	GR TQ 09945 98619 GPS 51.675367,-0.409532 W3W Papers. Fried. Glass	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

	Hertfordshire Watford Tunnel North	GR TQ 08876 99889 GPS 51.687215 ,-0.42641222 W3W Engage. Regards. Cases	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l







Aerial S

HSE

Health and Safety Executive

Chemicals Regulation Division

Trevor Faxon

Mallard House
Kings Pool
3 Peasholme Green
York YO1 7PX

http://www.hse.gov.uk/

Mr E Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date 11 May 2022

Reference COP 2022/00964

Dear Mr Lewis

RE: YOUR REQUEST FOR APPROVAL OF AN APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS; AND YOUR REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN

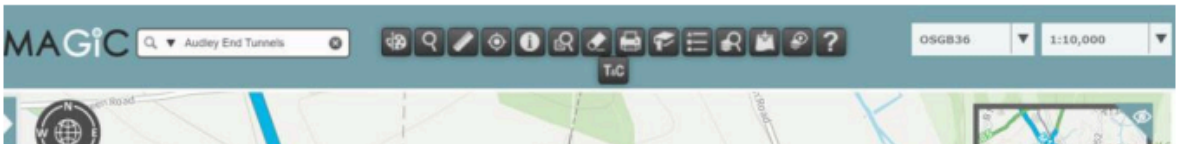
APPLICATION PLAN AND PERMIT ENABLING LAWFUL APPLICATION OF AERIAL SPRAYING OF PESTICIDES COP 2022/00964

Thank you for your request for approval of your Application Plan and for permission of spray job[s] dated 24 April 2022.

Appendix A

Land neither in nor within 150m of a protected area - Essex

Applicant Ref	County	Map refs	Provisional date and time	Amount of product (Roundup ProVantage) to be applied (litres)
	Essex Audley End Tunnel	GR TL 51328 38224 GPS 52.021794, 0.203996 W3W Coupler. Patio. Equipment	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	Essex Audley End Tunnel	GR TL 51268 38655 GPS 52.025686, 0.203348 W3W Winners, Rewriting, Broccoli	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l



Aerial Spraying Permit – Nottinghamshire

HSE

Health and Safety Executive

Chemicals Regulation Division

Trevor Faxon

Mallard House
Kings Pool
3 Peasholme Green
York YO1 7PX

http://www.hse.gov.uk/

Mr E Lewis
15 Totman Crescent
Brook Road Ind Est
Rayleigh
Essex
SS6 7UY

Date 11 May 2022

Reference COP 2022/00968

Dear Mr Lewis

RE: YOUR REQUEST FOR APPROVAL OF AN APPLICATION PLAN TO AERIALLY SPRAY PLANT PROTECTION PRODUCTS; AND YOUR REQUEST FOR PERMISSION TO AERIALLY SPRAY IN ACCORDANCE WITH THAT APPLICATION PLAN

APPLICATION PLAN AND PERMIT ENABLING LAWFUL APPLICATION OF AERIAL SPRAYING OF PESTICIDES COP 2022/00968

Thank you for your request for approval of your Application Plan and for permission of spray job[s] dated 24 April 2022.

Appendix A

Land neither in nor within 150m of a protected area - Nottinghamshire

Applicant Ref	County	Map refs	Provisional date and time	Amount of product (Roundup ProVantage) to be applied (litres)
	Nottinghamshire Tuxford Test Facility OLE Area	GR SK 74779 70395 GPS 53.225344, -0.88136047 W3W Eyelash, Salary, Dads.	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	Nottinghamshire Tuxford Test Facility Bridge Area 1 Marnham Rd	GR SK 75350 70443 GPS 53.225698, -0.87280422 W3W Years. Island. Bins	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

	Nottinghamshire Tuxford Test Facility Bridge Area 2 Marnham Rd	GR SK 76113 70523 GPS 53.226304, -0.86135857 W3W Waffle. Exist. Decoded	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l
	Nottinghamshire Tuxford Test Facility Bridge Area 3 Marnham Rd	GR SK 76348 70548 GPS 53.226497, -0.85782811 W3W Juror. Galaxies. Depending	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000 26 Aug 22 – 1000 27 Sep 22 – 1000 28 Sep 22 – 1000 29 Sep 22 – 1000	0.0945l

	Nottinghamshire Tuxford Test Facility Bridge Area 4 Marnham Rd	GR SK 76854 70561 GPS 53.226539, -0.85025355 W3W Forget. Snuggled. Buckling	9 May 22 – 1000 10 May 22 – 1000 11 May 22 – 1000 21 Jun 22 – 1000 22 Jun 22 – 1000 23 Jun 22 – 1000 26 Jul 22 – 1000 27 Jul 22 – 1000 28 Jul 22 – 1000 24 Aug 22 – 1000 25 Aug 22 – 1000	0.0945l